



Three-Year Diploma Programme

**Diploma in
Food Technology**

Faculty of Engineering and Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering and Technology
Diploma in Food Technology

1. Vision of the Department

To produce world-class food technocrats by inculcating all facets of food.

2. Mission of the Department

M1 To become a recognized focal point for food science and technology education by offering diploma program.

M2 To create an educational ecosystem that fosters entrepreneurship, management, skill development, extension, interdisciplinary research, and development by becoming a centre of excellence in the food processing sector.

M3 To offer continual training to the stakeholders to enhance their skills and be updated on global trends in food research and technology by consultation with the stakeholders.

M4 To carry out Research & Development in frontier areas, and develop innovative technologies in the food processing sector.

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the Diploma Food Technology curriculum enables graduates to attain.

PEO 1	Apply the knowledge of food Science to understand, evaluate and develop food products and preservation methods based on standard practices.
PEO 2	Employ technology to design and develop innovative food processing techniques for solving practical and real-world problems.
PEO 3	Demonstrate professional and ethical competency with effective communication and managerial skills to emerge as a responsible leader in the Food sector.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	Engineering knowledge:	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	Problem analysis:	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	Design/development of solutions:	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PLO 4	Conduct	Use research-based knowledge and research methods

	investigations of complex problems:	including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	Modern tool usage:	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	The engineer and society:	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	Environment and sustainability:	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	Individual and team work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	Communication:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	Project management and finance:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	Life-long learning:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	Capable of implementing efficient and sustainable food processing techniques to ensure the production of safe, high-quality, and nutritious food products.
PSO 2	Possess skills to implement and manage quality control systems, ensuring compliance with safety regulations and conducting risk assessments to produce safe, high-quality food products.

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	20
Semester-2	22
Semester-3	23
Semester-4	24
Semester-5	20
Semester-6	18
Total Credits:	127

Category wise Credit distribution of the programme	
Category	Credit
Major Core	70
Minor Stream	0
Multidisciplinary	29
Ability Enhancement Course	04
Skill Enhancement Courses	06
Value added Courses	18
Total Credits:	127

7. Program Curriculum

Semester 1						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03604113	Physics	3.00	3	-	-
2	03604114	Physics Lab	1.00	-	2	-
3	03604115	Chemistry	3.00	3	-	-
4	03604116	Chemistry Lab	1.00	-	2	-
5	03604117	Mathematics	3.00	3	-	-
6	03604118	Mathematics Lab	1.00	-	2	-
7	03604121	Fundamentals of Microbiology	2.00	2	-	-
8	03604122	Fundamentals of Microbiology Lab	1.00	-	2	-
9	03605101	Environmental Science	0.00	2	-	-
10	03606102	Introduction to IT Systems Lab	2.00	-	4	-
11	03635109	Introduction to Food Technology	2.00	2	-	-
12	03693103	Communication Skills – I	1.00	1	-	-
Total			20.00	16	12	-

Semester 2						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
13	03604173	Engineering Graphics	1.00	1	-	-
14	03604174	Engineering Graphics Lab	2.00	-	4	-
15	03604176	Engineering Workshop Practice Lab	2.00	-	4	-
16	03604177	Fluid Mechanics	2.00	2	-	-
17	03604178	Fluid Mechanics Lab	1.00	-	2	-
18	03604179	Economic Analysis	2.00	2	-	-
19	03635159	Food Chemistry and Nutrition	2.00	2	-	-
20	03635160	Food Chemistry and Nutrition Lab	1.00	-	2	-
21	03635161	Principles of Food Processing and Perservation	2.00	2	-	-
22	03635162	Principles of Food Processing and Perservation Lab	1.00	-	2	-
23	03635163	Computer Programming & Data Structure	1.00	1	-	-
24	03635164	Computer Programming & Data Structure Lab	2.00	-	4	-
25	03635165	Food Microbiology	1.00	1	-	-
26	03635166	Food Microbiology Lab	1.00	-	2	-
27	03693153	Communication Skills – II	1.00	1	-	-
Total			22	12	20	-
Semester 3						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
28	03604219	Thermodynamics & Heat Engines	2.00	2	-	-
29	03604220	Thermodynamics & Heat Engine Lab	1.00	-	2	-
30	03607151	Fundamentals of Electrical and Electronics Engineering	3.00	2	-	1
31	03607152	Fundamentals of Electrical and Electronics Engineering Lab	1.00	-	2	-
32	03635209	Principles of Food Engineering	2.00	2	-	-
33	03635210	Principles of Food Engineering Lab	1.00	-	2	-
34	03635211	Technology of Cereals & Pulses	2.00	2	-	-
35	03635212	Technology of Cereals & Pulses Lab	1.00	-	2	-
36	03635213	Technology of Milk & Milk Products	2.00	2	-	-
37	03635214	Technology of Milk & Milk Products Lab	1.00	-	2	-
38	03635215	Fruits and Vegetable Technology	2.00	2	-	-

39	03635216	Fruits and Vegetable Technology Lab	1.00	-	2	-
40	03635217	Technology of Meat, Fish & Poultry Products	2.00	2	-	-
41	03635218	Technology of Meat, Fish & Poultry Products Lab	1.00	-	2	-
42	03693203	Professional Communication and Critical Thinking	1.00	1	-	-
Total			23	15	14	01
Semester 4						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
43	03635259	Crop Production Technology	2.00	2	-	-
44	03635260	Crop Production Technology Lab	1.00	-	2	-
45	03635261	Food Preservation and Additives	2.00	2	-	-
46	03635262	Food Preservation and Additives Lab	1.00	-	2	-
47	03635263	Nutraceuticals and Functional Foods	2.00	2	-	-
48	03635265	Food Fermentation Technology	2.00	2	-	-
49	03635266	Food Fermentation Technology Lab	1.00	-	2	-
50	03635267	Beverage Manufacturing Technology	2.00	2	-	-
51	03635268	Beverage Manufacturing Technology Lab	1.00	-	2	-
52	03635269	Post Harvest Engineering	2.00	2	-	-
53	03635270	Post Harvest Engineering Lab	1.00	-	2	-
54	03635271	Bakery and Confectionary Technology	2.00	2	-	-
55	03635272	Bakery and Confectionary Technology Lab	1.00	-	2	-
56	03635273	Food Microbiology	2.00	2	-	-
57	03635274	Food Microbiology Lab	1.00	-	2	-
58	03693251	Employability Skills	1.00	1	-	-
Total			24	17	14	0
Semester 5						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
59	03604327	Entrepreneurship & Start Up	1.00	1	-	-
60	03604331	Marketing Management & International	2.00	2	-	-

		Trade				
61	03635311	Food Packaging Technology	1.00	1	-	-
62	03635312	Food Packaging Technology Lab	1.00	-	2	-
63	03635313	Food Analysis & Quality Control	2.00	2	-	-
64	03635314	Food Analysis & Quality Control Lab	1.00	-	2	-
65	03635315	Waste Management in Food Industry	1.00	1	-	-
66	03635316	Waste Management in Food Industry Lab	1.00	-	2	-
67	03635317	Instrumentations and Process Control	2.00	2	-	-
68	03635318	Instrumentations and Process Control Lab	1.00	-	2	-
69	03635319	Technology of Oils and Fats	2.00	2	-	-
70	03635320	Technology of Oils and Fats Lab	1.00	-	2	-
71	03635321	Sensory Evaluation of Food Products	1.00	1	-	-
72	03635322	Sensory Evaluation of Food Products Lab	1.00	-	2	-
73	03635324	Hands on Training	2.00	-	4	-
Total			20	12	16	0
Semester 6						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
74	03635352	In-Plant Training	18	-	36	-
Total			18	-	36	0
Total (06 Semester)			127	72	112	0

8. Detailed Syllabus

- a. **Course Name:** Physics
- b. **Course Code:** 03604113
- c. **Prerequisite:** Knowledge of Science up to 10th standard level.
- d. **Rationale:** The Physics course provides a foundational understanding of the fundamental principles governing the physical universe, equipping students with critical analytical and problem-solving skills applicable to science, engineering, and everyday life.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental principles of mechanics, thermodynamics, electromagnetism, and optics.
CLOBJ 2	Demonstrate the ability to use mathematical methods and computational tools to model physical systems.
CLOBJ 3	Conduct and Analyze Experiments.
CLOBJ 4	Integrate Physics into Interdisciplinary Contexts.

f. Course Learning Outcomes:

CLO 1	Apply fundamental principles of mechanics, thermodynamics, and electromagnetism to solve real-world problems.
CLO 2	Demonstrate an understanding of wave phenomena, optics, and their applications in technology and nature.
CLO 3	Analyze and interpret experimental data to validate physical theories and models.
CLO 4	Develop problem-solving and critical thinking skills through the application of mathematical techniques in physics.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Units of Measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement;	15 %	7

	significant figures. Dimensions of physical quantities.		
2	Kinematics and motion: Motion in a straight line: speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Acceleration, Scalar and vector quantities Force. Inertia, Newtons laws of motion; momentum; impulse, torque, angular momentum Equilibrium of concurrent forces. Static and kinetic friction, laws of friction, rolling friction, lubrication.	22 %	11
3	Work: Energy and Power - Work done by a force, energy, power; kinetic and potential energy; law of conservation of energy	8 %	4
4	Properties of Bulk matter: Elastic behaviour, Stress-strain relationship, Hookes law, Youngs modulus, Pressure due to a fluid column; Pascals law and its applications	9 %	4
5	Optics and sound: Light $\pm$ reflection, refraction, velocity of light; refractive index; scattering of light, diffraction, Convergence and divergence of light, Nature of sound and its propagation, speed of sound, ultrasound; reflection of sound; echo and sonar.	15 %	7
6	Electrostatics and electric current: Electric charges and their conservation. Coulomb s law Electric field, Electric potential, potential difference Conductors and insulators Electric current and resistance, Ohms law	11 %	5
7	Magnetism and electro magnets: Concept of magnetic field, Field lines Field due to a current carrying wire. Field due to current, carrying coil or solenoid. Electromagnets and Permanent magnets. Force on current carrying conductor Fleming left-hand rule. Faraday s Law, Inductance, induced potential differences, induced current.	20 %	10
Total		100%	48

i. Text Book and Reference Book:

- Goldstein, H., Poole, C. P., & Safko, J. L. (2002). *Classical Mechanics* (3rd ed.). Addison-Wesley. ISBN: 978-0201657029.
- Landau, L. D., & Lifshitz, E. M. (1976). *Mechanics: Course of Theoretical Physics, Volume 1* (3rd ed.). Butterworth-Heinemann. ISBN: 978-0750628969.
- Arfken, G. B., Weber, H. J., & Harris, F. E. (2012). *Mathematical Methods for Physicists: A Comprehensive Guide* (7th ed.). Academic Press. ISBN: 978-0123846549.

- a. **Course Name:** Physics lab
- b. **Course Code:** 03604114
- c. **Prerequisite:** Knowledge of Science up to 10th standard level.
- d. **Rationale:** The Physics course provides a foundational understanding of the fundamental principles governing the physical universe, equipping students with critical analytical and problem-solving skills applicable to science, engineering, and everyday life.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental principles of mechanics, thermodynamics, electromagnetism, and optics.
CLOBJ 2	Demonstrate the ability to use mathematical methods and computational tools to model physical systems.
CLOBJ 3	Conduct and Analyze Experiments.
CLOBJ 4	Integrate Physics into Interdisciplinary Contexts.

f. Course Learning Outcomes:

CLO 1	Apply fundamental principles of mechanics, thermodynamics, and electromagnetism to solve real-world problems.
CLO 2	Demonstrate an understanding of wave phenomena, optics, and their applications in technology and nature.
CLO 3	Analyze and interpret experimental data to validate physical theories and models.
CLO 4	Develop problem-solving and critical thinking skills through the application of mathematical techniques in physics.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Measurement of diameter of a small spherical/cylindrical body using Vernier calipers.
2	Measurement of internal diameter and depth of a given beaker/calorimeter using Vernier calipers and its volume.
3	Measurement of diameter of a given wire using screw gauge
4	Measurement of thickness of a given sheet using screw gauge
5	Determination of weight and density of given bodies

6	Determination of refractive index
7	Determination of the surface tension of water by capillary rise method.
8	Determination of the coefficient of viscosity of a given viscous liquid by measuring the terminal velocity of a given spherical body
9	Measurement of resistance, voltage (ac/dc), current (ac) and check continuity of a given circuit using multimeter.

- a. **Course Name:** Chemistry
- b. **Course Code:** 03604115
- c. **Prerequisite:** Knowledge of science up to 10th standard is essential.
- d. **Rationale:** The subject of Chemistry in Diploma Dairy Technology is significant as it provides foundational knowledge of chemical principles essential for understanding milk composition, processing, preservation, and quality control in dairy products.
- e. **Course Learning Objective:**

CLOBJ 1	Understand fundamental concepts in chemistry, including elements, atoms, molecules, and their properties
CLOBJ 2	Learn to calculate molecular masses, and molar masses, and solve problems using the mole concept and chemical formulas
CLOBJ 3	Analyze the types of solutions and their properties, focusing on solubility and colligative properties
CLOBJ 4	Gain foundational knowledge of organic chemistry principles, including nomenclature, methods of preparation, and reactions of hydrocarbons
CLOBJ 5	Explore the role of chemicals in everyday life, including medicines, food additives, and cleansing agents
CLOBJ 6	Develop practical skills in standard solution preparation, titration, pH analysis, and determination of physical properties of compounds

f. Course Learning Outcomes:

CLO 1	Explain the significance of chemistry in various contexts and apply basic principles to describe chemical systems
CLO 2	Perform stoichiometric calculations and determine the empirical and molecular formulas of compound
CLO 3	Analyze solutions and their behaviors, utilizing concepts such as concentration and colligative properties to predict physical changes
CLO 4	Apply IUPAC nomenclature and reaction mechanisms to classify and predict the behavior of organic compounds
CLO 5	Evaluate the applications and impact of chemicals in daily life, particularly in healthcare, food, and hygiene
CLO 6	Conduct laboratory experiments to measure physical and chemical properties of substances, ensuring accurate data collection and interpretation

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weight age	Teaching Hours
1	Some Basic Concepts of Chemistry General Introduction: Importance and scope of chemistry. Concept of elements, atoms and molecules. Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions	15 %	10
2	Solutions Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions	06 %	02
3	Colligative properties Relative lowering of vapour pressure, Raoult's law, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor	12 %	06
4	Organic Chemistry - Some Basic Principles and Techniques General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds	08 %	03
5	Hydrocarbons - Aliphatic Hydrocarbons Alkanes – Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis	08 %	03
6	Hydrocarbons - Alkenes Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition	15 %	10
7	Hydrocarbons - Aldehydes and Ketones Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses	13 %	03
8	Hydrocarbons - Carboxylic Acids Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses	08 %	03
9	Chemistry in Everyday Life - Chemicals in medicines analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines. Chemicals in food – preservatives, artificial	15 %	05

	sweetening agents, elementary idea of antioxidants. Cleansing agents – soaps and detergents, cleansing action.		
Total		100%	45

i. Text Book and Reference Book:

1. "Chemistry: The Central Science" by Theodore L. Brown, H. Eugene LeMay, Bruce E. Bursten, and Catherine J. Matta.
2. "Organic Chemistry" by David R. Klein.
3. "Physical Chemistry" by Peter Atkins and Julio de Paula.
4. "Inorganic Chemistry" by Gary L. Miessler, Donald A. Tarr, and Jeremy J. Berg.

- a. **Course Name:** Chemistry lab
- b. **Course Code:** 03604116
- c. **Prerequisite:** Knowledge of science up to 10th standard is essential.
- d. **Rationale:** The subject of Chemistry in Diploma Dairy Technology is significant as it provides foundational knowledge of chemical principles essential for understanding milk composition, processing, preservation, and quality control in dairy products.
- e. **Course Learning Objective:**

CLOBJ 1	Understand fundamental concepts in chemistry, including elements, atoms, molecules, and their properties
CLOBJ 2	Learn to calculate molecular masses, and molar masses, and solve problems using the mole concept and chemical formulas
CLOBJ 3	Analyze the types of solutions and their properties, focusing on solubility and colligative properties
CLOBJ 4	Gain foundational knowledge of organic chemistry principles, including nomenclature, methods of preparation, and reactions of hydrocarbons
CLOBJ 5	Explore the role of chemicals in everyday life, including medicines, food additives, and cleansing agents
CLOBJ 6	Develop practical skills in standard solution preparation, titration, pH analysis, and determination of physical properties of compounds

f. Course Learning Outcomes:

CLO 1	Explain the significance of chemistry in various contexts and apply basic principles to describe chemical systems
CLO 2	Perform stoichiometric calculations and determine the empirical and molecular formulas of compound
CLO 3	Analyze solutions and their behaviors, utilizing concepts such as concentration and colligative properties to predict physical changes
CLO 4	Apply IUPAC nomenclature and reaction mechanisms to classify and predict the behavior of organic compounds
CLO 5	Evaluate the applications and impact of chemicals in daily life, particularly in healthcare, food, and hygiene
CLO 6	Conduct laboratory experiments to measure physical and chemical properties of substances, ensuring accurate data collection and interpretation

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List

Sr. No.	Experiment List
1	Cutting glass tube and glass rod, bending a glass tube, drawing out a glass jet, boring a cork and using a chemical balance.
2	Preparation of standard solution of oxalic acid.
3	Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.
4	Preparation of standard solution of sodium carbonate.
5	Determination of melting point of an organic compound.
6	Determination of boiling point of an organic compound.
7	Determination of pH of some solutions obtained from fruit juices, solutions of known and varied concentrations of acids, bases and salts using pH paper or universal indicator.
8	Comparing the pH of solutions of strong and weak acid of same concentration.
9	Study the pH change in the titration of a strong acid with a strong base using universal indicator.
10	Study of pH change by common-ion effect in case of weak acids and weak bases.
11	Acidity determination of different samples of the tea leaves.
12	Analysis of fruit and vegetable juices for their acidity.
13	Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of RF values.
14	Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given food stuffs.

- a. **Course Name:** Mathematics
- b. **Course Code:** 03604117
- c. **Prerequisite:** Knowledge of Mathematics up to 10th standard.
- d. **Rationale:** The rationale of Mathematics in a Diploma food technology is to provide students with the essential mathematical tools and problem-solving skills needed to analyze, model, and solve real-world technical problems in their specific field of study.
- e. **Course Learning Objective:**

CLOBJ 1	Develop an understanding of trigonometric functions and their applications in solving problems. Apply trigonometric concepts in real-world and mathematical problems
CLOBJ 2	Understand the algebra of complex numbers and their geometric representation. Apply complex numbers in solving polynomial equations and mathematical problems.
CLOBJ 3	Develop problem-solving skills using differential equations in physical and engineering contexts.
CLOBJ 4	Apply matrices to solve linear equations and transform geometric problems.
CLOBJ 5	Understand vector algebra and its applications in physics and geometry. Analyze vector equations in various physical contexts.
CLOBJ 6	Apply statistical methods to analyze data and draw conclusions. Understand the basic principles of probability and its applications in uncertain scenarios.

f. **Course Learning Outcomes:**

CLO 1	Solve equations using trigonometric identities and functions. Analyze and graph trigonometric functions.
CLO 2	Perform arithmetic operations on complex numbers. Represent complex numbers in polar form and interpret their significance.
CLO 3	Solve first-order and higher-order differential equations. Model real-world problems using differential equations.
CLO 4	Perform operations such as addition, multiplication, and inversion of matrices. Use matrices in computer graphics and network analysis.
CLO 5	Perform vector operations such as addition, scalar multiplication, and dot/cross product. Solve problems involving vector projection and planes.
CLO 6	Summarize data using measures of central tendency and dispersion. Construct and interpret histograms, box plots, and scatter plots.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Trigonometric Functions: Introduction of trigonometric functions, angles, expressing sin and cos, trigonometric equations, introduction to inverse trigonometric functions.	9%	4
2	Complex Numbers and Quadratic Equations: complex numbers; quadratic equations, algebra of complex numbers, quadratic equations, square-root of a complex number.	9%	4
3	Binomial Theorem: Introduction, binomial theorem for positive integral indices, general and middle term, simple applications.	7%	3
4	Limits and derivatives: Introduction, intuitive idea of derivatives, limits, derivatives, derivative of sum, difference, product and quotient of functions, derivatives of polynomial and trigonometric functions.	10%	5
5	Matrices: Introduction of matrices, types and operations of matrices, transpose of matrices, transformation of a matrix, invertible matrices.	7%	4
6	Continuity and Differentiability: Continuity, differentiability, concepts of exponential and logarithmic function, brief introduction of order derivative	7%	3
7	Integrals: Integration as inverse process of differentiation, methods of integration, integration of a variety of functions by substitution, basic properties of definite integrals.	10%	5
8	Differential equations: Definition, order and degree, general and particular solutions of a differential equation.	6%	3
9	Vectors: Vectors and scalars; types of vectors, position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, scalar (dot) product, product of vectors, cross product of vectors.	17%	8
10	Statistics: definition of statistics, mean, mode, median, measures of dispersion, range, mean deviation, variance and standard deviation, analysis of frequency distribution.	9%	4

11	Probability: probability, conditional probability, multiplications theorem on probability, independent events, total probability, random variable and its probability distribution, repeated independent (Bernoulli) trials and Binomial distribution.	10%	5
Total		100%	48

i. Text Book and Reference Book:

1. Mathematics 1 by Deepak singh
2. Diploma engineering Mathematics by B.K Pal

- a. **Course Name:** Mathematics lab
- b. **Course Code:** 03604118
- c. **Prerequisite:** Knowledge of Mathematics up to 10th standard.
- d. **Rationale:** The rationale of Mathematics in a Diploma food technology is to provide students with the essential mathematical tools and problem-solving skills needed to analyze, model, and solve real-world technical problems in their specific field of study.
- e. **Course Learning Objective:**

CLOBJ 1	Develop an understanding of trigonometric functions and their applications in solving problems. Apply trigonometric concepts in real-world and mathematical problems
CLOBJ 2	Understand the algebra of complex numbers and their geometric representation. Apply complex numbers in solving polynomial equations and mathematical problems.
CLOBJ 3	Develop problem-solving skills using differential equations in physical and engineering contexts.
CLOBJ 4	Apply matrices to solve linear equations and transform geometric problems.
CLOBJ 5	Understand vector algebra and its applications in physics and geometry. Analyze vector equations in various physical contexts.
CLOBJ 6	Apply statistical methods to analyze data and draw conclusions. Understand the basic principles of probability and its applications in uncertain scenarios.

f. Course Learning Outcomes:

CLO 1	Solve equations using trigonometric identities and functions. Analyze and graph trigonometric functions.
CLO 2	Perform arithmetic operations on complex numbers. Represent complex numbers in polar form and interpret their significance.
CLO 3	Solve first-order and higher-order differential equations. Model real-world problems using differential equations.
CLO 4	Perform operations such as addition, multiplication, and inversion of matrices. Use matrices in computer graphics and network analysis.
CLO 5	Perform vector operations such as addition, scalar multiplication, and dot/cross product. Solve problems involving vector projection and planes.
CLO 6	Summarize data using measures of central tendency and dispersion. Construct and interpret histograms, box plots, and scatter plots.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List

Sr. No.	Experiment Name
1	Tutorial on trigonometric equations; tutorial on algebra of complex numbers and quadratic
2	Tutorial on derivatives of polynomial and trigonometric functions, operations of matrices;
3	Analysis of frequency distribution
4	Tutorial on integrals and differential equations; solving simple statistical and probability problems using mean, mode, median and probability.

- a. **Course Name:** Fundamentals of Microbiology
- b. **Course Code:** 03604121
- c. **Prerequisite:** Knowledge of Science up to 10th level.
- d. **Rationale:** Fundamentals of Microbiology in Diploma food Technology equips students with essential knowledge of microbial aspects crucial for quality control and safety in dairy production, ensuring proficiency in managing microbial processes vital to the dairy industry.

e. Course Learning Objective:

CLOBJ 1	Understand the foundational principles of microbiology, including the classification, morphology, and physiology of microorganisms relevant to dairy technology.
CLOBJ 2	Demonstrate knowledge of the role of microorganisms in food processes, such as fermentation, spoilage, and pathogenicity, and their impact on product quality and safety.
CLOBJ 3	Develop proficiency in microbiological techniques, including microbial isolation, identification, and enumeration, to assess and control microbial populations in dairy products.
CLOBJ 4	Explore the application of beneficial microorganisms in food fermentations, emphasizing the role of starter cultures and probiotics in enhancing product flavour, texture, and nutritional value.

f. Course Learning Outcomes:

CLO 1	Understanding about history and scope of microbiology
CLO 2	Study the electron microscopy and various microbiological staining methods
CLO 3	Understand the difference between prokaryotes and eukaryotic organisms.
CLO 4	Learn the microbial growth, nutrition and bacterial genetics

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Overview of history and scope of microbiology Discovery of Microorganisms and Microscopy (types, working principles and applications); Theories of Biogenesis and abiogenesis; Contributions of Leeuwenhoek, Pasteur, Tyndal, Joseph Lister, Robert Koch, Edward Jenner and Alexander Fleming; Scope and application of microbiology in fields like Dairy, Food, Pharmaceutical, Industrial, Medical and agriculture	18 %	06
2	Classification of Microbes Microbial classification systems, numerical taxonomy, General properties and principles of microbial classification; Whittaker's five kingdom and Carl Wiese's three domain classification system; Systematics of bacteria and Bergey's manual of systematic bacteriology, Phylogenetic tree	12 %	04
3	Prokaryotic and Eukaryotic microorganisms Structure and functions of prokaryotic cells; Differences between prokaryotes and eukaryotes; Differences between cell wall of Gram positive and Gram-negative bacteria; Structure of Racheal cell wall	15 %	05
4	Microbial growth and nutrition Bacterial growth curve; factors affecting growth of bacteria, direct and indirect methods of measurement of bacterial growth; Bacteriostatic and bactericidal agents; Common nutrient requirements and nutritional types of microorganisms	15 %	05
5	Diversity of Microorganisms	12 %	04
6	Microbial Ecology and Environmental Microbiology Microflora of air, soil and water and Microbes of Extreme environment like Archea	8 %	02
7	Basics of Microbial Genetics and Host-Microbe interactions DNA as the genetic material, Structure of DNA/ RNA, DNA replication; transcription and translation	12%	04
8	Basic concepts of immunology Role of immune system in governing host- microbe interactions, Microbial Commensalism, Colonization, Infection, Disease and Vaccines	08 %	02
Total		100	32

i. Text Book and Reference Book:

1. Applied Dairy Microbiology (Text Book) By Marth, E.H. and Steele,
2. Advanced Dairy Science and Technology (Textbook) By Britz, T.J. and Robinson, R.K
3. Dairy Bacteriology (Text Book) By Su Kumar De

- a. Course Name:** Fundamentals of Microbiology lab
- b. Course Code:** 03604122
- c. Prerequisite:** Knowledge of Science up to 10th std. level.
- d. Rationale:** Fundamentals of Microbiology in Diploma food Technology equips students with essential knowledge of microbial aspects crucial for quality control and safety in dairy production, ensuring proficiency in managing microbial processes vital to the dairy industry.

e. Course Learning Objective:

CLOBJ 1	Understand the foundational principles of microbiology, including the classification, morphology, and physiology of microorganisms relevant to dairy technology.
CLOBJ 2	Demonstrate knowledge of the role of microorganisms in food processes, such as fermentation, spoilage, and pathogenicity, and their impact on product quality and safety.
CLOBJ 3	Develop proficiency in microbiological techniques, including microbial isolation, identification, and enumeration, to assess and control microbial populations in dairy products.
CLOBJ 4	Explore the application of beneficial microorganisms in food fermentations, emphasizing the role of starter cultures and probiotics in enhancing product flavour, texture, and nutritional value.

f. Course Learning Outcomes:

CLO 1	Understanding about history and scope of microbiology
CLO 2	Study the electron microscopy and various microbiological staining methods
CLO 3	Understand the difference between prokaryotes and eukaryotic organisms.
CLO 4	Learn the microbial growth, nutrition and bacterial genetics

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

- a. Course Name:** Environmental Science
- b. Course Code:** 03605101
- c. Prerequisite:** Basic understanding of environmental science principles and their application to dairy industry sustainability.
- d. Rationale:** Environmental Science in Diploma food Technology ensures graduates comprehend ecological implications of dairy practices, promoting sustainable and ethical approaches for responsible environmental stewardship within the dairy industry.

e. Course Learning Objective:

CLOBJ 1	Attain an exhaustive understanding of environmental science concepts, with an emphasis on their applicability to the ecological impact.
CLOBJ 2	Develop the ability to assess and analyse the environmental footprint of dairy operations, identifying potential areas for improvement and sustainable practices.
CLOBJ 3	Understand and adhere to environmental regulations and policies relevant to the dairy sector, ensuring ethical and legal practices in environmental management.
CLOBJ 4	Explore and propose innovative technologies and strategies to minimize environmental impact in dairy production, including waste management.
CLOBJ 5	Cultivate effective communication skills to articulate environmental issues within the dairy industry, fostering awareness, and advocating for responsible and sustainable practices among stakeholders.

f. Course Learning Outcomes:

CLO 1	Understand the various natural resources and its uses
CLO 2	Introduction, structure, and function of an ecosystem
CLO 3	Learn the basics of biodiversity and its conservation
CLO 4	Distinguish the various pollutants and learn the role of an individual in prevention of pollution
CLO 5	Establish an understanding of the function of information technology (IT) in the environment.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	

2	-	-	0	20	20	-	-	-	40
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L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Environmental Health and Quality of Life: Environmental education: Objective and scope, Impact of technology on the environment. Environmental disasters: Case studies, Global environmental awareness to mitigate stress on environment	10 %	04
2	Ecology and Ecosystem: Interdependence of organisms, Structure and function of an ecosystem, Ecological pyramids, Pyramid of number, Pyramid of energy and pyramid of biomass	25 %	07
3	Natural resources and their managements: Water resources: Sources of water, Stress on water resources, The story of Cherapunji. Energy resources: Classification, advantages, limitations and future scope of conventional and non-conventional. Resources	15 %	05
4	Environmental Pollution: Air pollution, Water pollution, Solid waste pollution, Noise pollution, Soil pollution, Radioactive pollution	15 %	05
5	Waste Management: Food processing industry waste and its management, Management of urban waste water, Recycling of organic waste, Recycling of factory effluent	25 %	07
6	Environmental Protection Through Environmental Legislation: Control of environmental pollution through law, Composting of biological waste and Sewage, uses of water disposal effluent treatment, microbial examination	10 %	04
Total		100 %	32

i. Text Book and Reference Book:

1. Environmental Studies: From Crisis to Cure by R. Rajagopalan
2. Environmental Science and Engineering by J. Glynn Henry and Gary W. Heinke
3. Environmental Management in Dairy Industry by P. Sampath Kumar and R. B. Singh.
4. Sustainable Dairy Production by Nico van Belzen.
5. E-course of ICAR. Cited from: www.agrimoon.com

- a. **Course Name:** Introduction to IT Systems Lab
- b. **Course Code:** 03606102
- c. **Prerequisite:** Basic knowledge of mathematics up to 10th standard.
- d. **Rationale:** The rationale of **Introduction to IT Systems Lab** is to provide hands-on experience in using fundamental IT tools, systems, and software, enabling students to develop practical skills essential for managing and troubleshooting technology in real-world applications.
- e. **Course Learning Objective:**

CLOBJ 1	To develop practical skills in operating and configuring basic IT systems and software applications.
CLOBJ 2	To understand the fundamentals of computer hardware, operating systems, and networking concepts.
CLOBJ 3	To gain hands-on experience with system troubleshooting and problem-solving techniques.
CLOBJ 4	To explore security best practices and tools for maintaining safe and efficient IT environments.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficiency in operating and configuring basic IT systems and software tools.
CLO 2	Apply fundamental knowledge of computer hardware, operating systems, and networking in practical scenarios.
CLO 3	Develop troubleshooting skills to identify and resolve common IT system issues.
CLO 4	Implement basic security measures to ensure the integrity and safety of IT systems and data.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Study practical of computer components	5%	01
2	Study practical of different OS installation (Windows, Linux, Ubuntu)	5%	01
3	Write a script for basic OS commands	5%	01
4	Write a script for basic operators in OS	5%	01
5	Study practical of Internal structure and components of storage devices(Hard disk components)	5%	02
6	Study practical of input working devices (Keyboard, Mouse, scanner)	5%	02
7	Study practical of output working devices (Monitor, Printer)	5%	02
8	Write a HTML code to display "hello world"	5%	01
9	Write a HTML code to create a table for student marksheet.	5%	02
10	Write a HTML code to create a simple registration form	5%	01
11	Write a CSS to create user define tag	5%	01
12	Write an HTML code to create static website using CSS	5%	01
13	Study practical of evolution and working of internet	5%	01
14	Study practical of surfing techniques in internet	5%	01
15	Create your Gmail account and use different services provided by Google like Google drive, sharable sheet etc.	5%	03
16	Perform various DOS commands	5%	01
17	Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) Fetch the data of the student who has distinction 2) Fetch the data of students with minimum marks in each subject. Sort the data based on percentage	7%	05
18	Create a presentation of your favorite movie using animation	5%	02
19	Create a word file for your resume	3%	01
20	Create library management database in access with minimum 5 tables in it.	5%	02
Total		100 %	32

i. Text Book and Reference Book:

1. Basic Computer Course Made Simple, Satish Jain; BPB Publication
2. Basic Computer Engineering, Sanjay Silakari and Rajesh K Shukla; Wiley India Pvt. Limited, 2011
3. Computer Fundamentals, P.K. Sinha; BPB Publications

- a. Course Name:** Introduction to Food Technology
- b. Course Code:** 03635109
- c. Prerequisite:** Knowledge of science up to 10th standard level.
- d. Rationale:** The rationale of Introduction to Food Technology is to provide students with foundational knowledge of food science, processing, preservation, and safety, equipping them with the skills to understand and apply technology in the production and improvement of food products for public health and industry advancement.
- e. Course Learning Objective:**

CLOBJ 1	Examine the role of food technology in food production, preservation, and safety.
CLOBJ 2	Identify and describe the key processes involved in food manufacturing and processing.
CLOBJ 3	Analyze the nutritional content and quality attributes of different food products.
CLOBJ 4	Evaluate current trends, challenges, and innovations in the field of food technology.

f. Course Learning Outcomes:

CLO 1	Understand the basic principles of food science and its application in food technology.
CLO 2	Describe common food processing techniques and their impact on food quality and safety.
CLO 3	Apply food safety and quality standards in food production and handling.
CLO 4	Explore emerging trends and innovations in food technology and sustainability.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	-	20	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction: Historical development of food science and technology. Evolution of food processing from prehistoric times till date.	4%	1
2	Introduction to various branches of food science and technology: Introduction to various branches of food science and technology	5%	1
3	Compositional, Nutritional and Technological aspects of foods Cereals and Millets: Introduction, structure, composition and uses and by-products of cereals and coarse cereals.	8%	3
4	Wheat: Structure and composition of wheat, types (hard, soft/strong, weak). Diagrammatic representation of longitudinal structure of wheat grain and process of malting, Gelatinization of starch, types of browning.	8%	3
5	Rice: Composition of rice obtained by different de-husking methods, parboiling of rice- advantages and disadvantages.	6%	2
6	Millets: Varieties, composition and uses of maize, sorghum, barley, rye, oats, triticale, pearl millet and finger millet.	6%	2
7	Pulses: Introduction, common names and scientific names of different pulses.	5%	2
8	Chemical composition of pulses, processing of pulses: soaking, germination, decortications, cooking and fermentation.	6%	2
9	Toxic constituents in pulses and its detoxification processes.: Toxic constituents in pulses and its detoxification processes.	5%	1
10	Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids.	8%	3
11	Refining of oils, types: steam refining, alkali refining, bleaching, steam deodorization, hydrogenation.	10%	4
12	Rancidity: hydrolytic and / rancidity and its prevention. Define -	8%	1

	margarine, butter, hydrogenated vegetable oil, lard		
13	Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.	8%	3
14	Post-harvest changes in fruits and vegetables: Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.	13%	4
Total		100%	32

i. Text Book and Reference Book:

1. S. Prasad and U. Kumar. 2010. Principles of Horticulture. Agrobios, New Delhi.
2. T. Yellamanda Reddy and G.H. Shankar Reddy. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
3. S.S. Singh. Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana.

a. Course Name: Communication Skills-I

b. Course Code: 03693103

c. Prerequisite: Knowledge of English up to 10th standard level.

d. Rationale: The Communication Skills course in diploma Food Technology is of paramount importance as it equips students with the essential abilities to effectively convey technical knowledge collaborate with industry stakeholders, and articulate ideas crucial for success in the dairy technology field.

e. Course Learning Objective:

CLOBJ 1	Develop the ability to express thoughts and ideas clearly and concisely through spoken language.
CLOBJ 2	Improve written communication skills, including composing clear and professional emails, reports, and other written documents.
CLOBJ 3	Explore and employ digital communication tools, platforms, and multimedia aids for professional communication, including virtual meetings, collaboration software, and social media.
CLOBJ 4	Cultivate interpersonal skills, including empathy and conflict resolution, to navigate various communication scenarios effectively.

f. Course Learning Outcomes:

CLO 1	Understand basics of English grammar
CLO 2	Display basic level of communication confidence
CLO 3	Study the basics of communication, types of communication, models of communication and barriers to communication
CLO 4	Distinguish the technical writing, scientific writing and resume writing

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Ice Breaker + Introducing your Friend : This is one activity which will build the bond between the students in the class and work as a team in the task given to them. The students will be asked to introduce their new best friend in the class. This will ensure that the bond being created here will stay strong and also breaks the ice between them.	5%	1

2	Picture Connector :In this class the students will be trained to form a logical connection between a set of pictures which will be shared with This geared towards building creativity and presentation skills.	5%	1
3	Crazy Scientist :The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	5%	1
4	Shopping Role Play : This activity topic gears towards making students do role play based on shopping scenarios. It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it.	5%	1
5	Parts of speech, Active and Passive voice, Tenses.	20%	10
6	Basics of communication : Introduction ,meaning, definition, Process of communication. Types of communication : Formal, Informal, Verbal/Non verbal and Written barriers to effective communication. 7 Cs of effective communication: (considerate, concrete concise, clear, complete, correct and courteous). Technical Communication	12%	5
7	Soft Skills for Professional Excellence Introduction : Soft skills and hard skills, Importance of soft skills	12%	2
8	Students are trained to let go of inhibitions and come forward and speak openly on passionate topics.The students will be divided into teams and made to share their ideas and views on the topics.	5%	1
9	Extempore :To change the average speakers in the class to some of the best Orator.This will be done by making the students give variety of impromptu speeches in front of the class.	5%	1
10	Letter Writing :Types of letters-Inquiry letter,Order letter,Complaint letter,Adjustment,Request letter, Recommendation letter.Format of letters	12%	2
11	Reading Comprehension :Dabbawalahs, A Snake in the grass, Internet – Dr. Jagdish Joshi	14%	5
Total		100%	32

i. Text Book and Reference Book:

1. Ajmani, J. C. Good English: Getting it Right. New Delhi: Rupa Publications, 2012.
2. Adair, John. Effective Communication. London: Pan Macmillan Ltd., 2003.
3. Brown, Michele & Gyles Brandreth. How to Interview and be Interviewed. London: Sheldon Press, 1994.
4. Fitikides, T. J. Common Mistakes in English. London: Orient Longman, 1984.

Semester 2

- a. **Course Name:** Engineering Graphics
- b. **Course Code:** 03604173
- c. **Prerequisite:** Zeal to Learn Subject
- d. **Rationale:** It equips students with the ability to visualize, communicate, and interpret technical designs, essential for creating and understanding engineering drawings, which are a universal language in the industry.
- e. **Course Learning Objective:**

CLOBJ 1	To develop students' competency in using drawing equipment, understanding types, and applying them effectively in technical drawing tasks.
CLOBJ 2	To guide students in following standard practices for drawing layouts, ensuring accurate scaling and proper dimensional representation according to given engineering scenarios.
CLOBJ 3	To enable students to grasp various types of projections, including orthographic and isometric, and apply these methods to translate 3D objects into 2D drawings.
CLOBJ 4	To teach students the step-by-step process of geometric constructions and the drawing of engineering curves such as conics and cycloids, which are critical in machine design and manufacturing processes.

f. Course Learning Outcomes:

CLO 1	Demonstrate proficiency in selecting and using various drawing equipment, instruments, and materials effectively.
CLO 2	Develop and implement standard practices for planning, layout, and scaling in technical drawings.
CLO 3	Accurately construct geometric figures, including angles, polygons, and curves, using appropriate methods.
CLO 4	Apply principles of orthographic and isometric projections to convert pictorial views into accurate technical representations.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Drawing equipments, instruments and materials. Equipments types, specifications, method to use them, applications. Instruments-types, specifications, methods to use them and applications. Pencils-grades, applications, types of points and applications. Other materials-types and applications.	4%	1
2	Planning, Layout and Scalling of Drawing Follow and apply standard practice as per bureau of I.S. for planning and layout, Choose appropriate scale factor for the drawing as per given situation	4%	1
3	Lines, Lettering and dimensioning Different types of lines. Vertical capital and lower case letters. Inclined capital and lower case letters. Numerals and Greek alphabets. Dimensioning methods. Aligned method. Unilateral with chain, parallel, progressive and combined dimensioning	4%	1
4	Geometric Construction Geometric construction related with line like bisecting a line, to draw perpendicular with a given line, divide a line, etc. Geometric construction related with angle like bisect an angle, trisect an angle, etc.	7%	1
5	Construct polygon. Triangle, Square / Rectangle, Pentagon with special method. d: Hexagon with special method. To draw tangents. Geometric construction related with circle & arc	22%	1
6	Engineering Curves Conic sections: Concept and understanding of focus, directrix, vertex and eccentricity and drawing of conic sections.Using various methods, understand construction of : Ellipse. Parabola. Hyperbola.	25%	1

	Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid) Involute. Involute of a circle, Involute of a polygon, Spiral (Archimedean spiral only).		
7	Projection Of Points, Lines And Planes Reference planes, orthographic projections. Concept of quadrant. 1st angle and 3rd angle projection and their symbols. Projection of points. Projection of lines – determination of true length and inclinations for following cases. Line parallel to one or both the plane. Line perpendicular to one of the plane. Line inclined to one plane and parallel to another. Line inclined to both the planes. Projection of Planes: Types of planes, Projection of planes parallel to one of the reference planes, Projection of plane inclined to one reference plane and perpendicular to another, Projection of planes inclined to both reference planes.	22%	1
8	Orthographic Projections Types of projections- orthographic, perspective, isometric and oblique: concept and applications. Various term associated	12%	3
Total		100%	16

i. Text Book and Reference Book:

1. B.L. Theraja and A.K. Theraja. 2005. A Textbook of Electrical Technology, Vol. II. S. Chand & Company Ltd., New Delhi.
2. Engineering Drawing” by Basant Agrawal and C M Agrawal
3. Vincent Del Toro. 2000. Electrical Engineering Fundamentals. Prentice-Hall India Private Ltd., New Delhi.

a. **Course Name:** Engineering Graphics Lab

b. **Course Code:** 03609102

c. **Prerequisite:** Zeal to Learn Subject

d. **Rationale:** It equips students with the ability to visualize, communicate, and interpret technical designs, essential for creating and understanding engineering drawings, which are a universal language in the industry.

e. Course Learning Objective:

CLOBJ 1	To develop students' competency in using drawing equipment, understanding types, and applying them effectively in technical drawing tasks.
CLOBJ 2	To guide students in following standard practices for drawing layouts, ensuring accurate scaling and proper dimensional representation according to given engineering scenarios.
CLOBJ 3	To enable students to grasp various types of projections, including orthographic and isometric, and apply these methods to translate 3D objects into 2D drawings.
CLOBJ 4	To teach students the step-by-step process of geometric constructions and the drawing of engineering curves such as conics and cycloids, which are critical in machine design and manufacturing processes.

f. Course Learning Outcomes:

CLO 1	Demonstrate proficiency in selecting and using various drawing equipment, instruments, and materials effectively.
CLO 2	Develop and implement standard practices for planning, layout, and scaling in technical drawings.
CLO 3	Accurately construct geometric figures, including angles, polygons, and curves, using appropriate methods.
CLO 4	Apply principles of orthographic and isometric projections to convert pictorial views into accurate technical representations.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Introduction of drawing scales
2	Principles of orthographic projections
3	References planes
4	Points and lines in space and traces of lines and planes
5	Auxiliary planes and true shapes of oblique plain surface
6	True length and inclination of lines
7	Projections of solids: Change of position method, alteration of ground lines; 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 with dimensions from models and isometric drawings of objects and machine components;
11	Preparation of sectional drawings of simple machine parts;
12	Drawing of riveted joints and thread fasteners;
13	Demonstration on computer graphics and computer aided drafting use of standard software;
14	Sectional drawings of engineering machines; Computer graphics for food engineering applications; Interpretation of sectional views of food equipment and components; Practice in the use of basic and drawing commands on AutoCAD;
15	Generating simple 2-D drawings with dimensioning using AutoCAD;
16	Small Projects using CAD/CAM.

- a. **Course Name:** Engineering Workshop Practice Lab
- b. **Course Code:** 03604176
- c. **Prerequisite:** Learn about fundamental of mechanical and electrical engineering.
- d. **Rationale:** Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops
- e. **Course Learning Objective:**

CLOBJ 1	To familiarize students with different hand tools, materials, and techniques used in carpentry, smithy, and fitting jobs, enabling them to create simple joints and components.
CLOBJ 2	To provide hands-on experience in performing welding, soldering, and plumbing operations, focusing on safety and accuracy during construction and repair tasks.
CLOBJ 3	To develop competency in using electrical tools, cables, switches, and protective devices through practical demonstration and application in real-world wiring setups.
CLOBJ 4	To equip students with the knowledge to interpret electrical symbols and diagrams, allowing them to effectively plan and execute various domestic and industrial wiring projects.

f. Course Learning Outcomes:

CLO 1	Demonstrate proficiency in basic carpentry, smithy, and fitting techniques.
CLO 2	Utilize various welding, soldering, and plumbing tools effectively and safely.
CLO 3	Identify and operate electrical installation tools and measuring instruments.
CLO 4	Apply knowledge of domestic wiring systems and protective devices in practical scenarios.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	To A Perform a Job in Carpentry Shop. Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc., Types of woods and their applications., Types of carpentry hardware 's and their uses., Demonstration of carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, etc., Preparation of wooden joints., Safety precautions.	3 %	1
2	To A Perform a Job in Tim Smithy. Concept and conversions of SWG and other gauges in use., Use of wire gauge., Types of sheet metal joints and applications., Types, sketch, specification, material, applications and methods of using tin smithy tools-hammers, stakes, scissors/snips, etc., Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining., Preparation of tin smithy job., Safety precautions	3 %	1
3	To Perform a Job on Fitting Practice. Sketch, specification and applications of fitting work holding tools-bench vise, Vblock with clamp and C-clamp., Sketch, specification , material ,applications and methods of using fitting marking and measuring tools-marking table, surface plate, angle plate, universal cribbing block, try-square, scribe, divider, centre punch, letter punch, callipers, Vernier calliper, etc., Types, sketch, specification , material , applications and methods of using of fitting cutting tools hacksaw, chisels, twist drill, taps, files, dies., Types, sketch, specification, material, applications and methods of using of fitting finishing tools-files, reamers., Sketch, specification and applications of miscellaneous tools-hammer, spanners, screw drivers sliding screw wrench., Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping., Preparation of simple and male- female joints., Safety precautions.	6 %	2
4	To Perform a Job on Soldering	7 %	2
5	To Perform a Job on Welding. Demonstration of differentwelding tools / machines.,Demonstration	7 %	2

	onArcWelding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding., One simple job involving butt and lap joint., Safety precautions.		
6	To Perform a Job on plumbing. Types, specification, material and applications of pipes., Types, specification, material and applications of pipe fittings., Types, specifications, material, applications and demonstration of pipe fitting tools., Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling, etc., Types and application of various spanners such as flat, fix, ring, box, adjustable, etc., Preparation of pipe fitting jobs., Safety precautions	7 %	2
7	To Perform a Job on Sheet Metal Practice.	7 %	2
8	Identify Different symbol used in electrical installation and prepare sheet. Demonstration of electrical symbol used in domestic or industrial wiring., Demonstration of electrical wiring tools and accessories., Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter., Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Techometer, Tester etc	7 %	2
9	Identify the different tools used in electrical installation. Demonstration of electrical wiring tools and accessories.	7 %	2
10	Demonstration of measuring instrument Voltmeter, Ammeter, Wattmeter. Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter.	6 %	2
11	Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Techometer, Tester etc.	7 %	2
12	Demonstration of different cables used in electrical installation. Single core cable, multicore cable, single strand wire, multi strand wire, shielded wire	10 %	3
13	Demonstration of different switches used in electrical installation. Demonstration of different switches like Toggle switch, Rotary switches, Push button switch etc	3 %	2
14	Demonstration of protective devices: fuse, MCB, ELCB. Demonstration of protective devices like fuse, MCB, ELCB.	6 %	2

15	Identify different types of domestic wirings. Demonstration on one lamp controlled by one Switch., Demonstration on Staircase wiring., Demonstration on connection of Tube light Wiring., Demonstration on different earthing used in electrical installation.	3 %	1
Total		100%	32

i. Text Book and Reference Book:

1. Mechanical workshop practice By K.C. John
2. A Textbook of Electrical Workshop Practices By Dr. Umesh Rathore | S.K. Kataria & Sons
3. A Course in Workshop Technology By Raghuwamsi B S | Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982
4. Workshop Practice Manual By K. Venkat Reddy | BS Publications
5. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House
6. Comprehensive Workshop Technology By S.K. Garg | Laxmi publications

a. Course Name: Fluid Mechanics

b. Course Code: 03604177

c. Prerequisite: Knowledge of Mathematics up to 10th level.

d. Rationale: The aim of Fluid Mechanics subject is to provide students with the principles and concepts governing the behaviour of fluids in motion and at rest, enabling them to understand and analyze fluid-related processes in various engineering applications, such as transportation, energy systems, and environmental engineering.

e. Course Learning Objective:

CLOBJ 1	1 Understand the physical properties of fluids and analyze the stability and behavior of submerged and floating bodies.
CLOBJ 2	Grasp the principles of fluid flow patterns, velocity fields, and apply the continuity equation in various fluid flow problems.
CLOBJ 3	Apply Bernoulli's theorem and principles of laminar and turbulent flow in pipes to analyze fluid behavior under dynamic conditions.
CLOBJ 4	Design and evaluate open channel flows using standard formulas like Manning's and Chezy's for practical engineering applications.

f. Course Learning Outcomes:

CLO 1	Calculate pressure forces on surfaces, determine buoyancy, meta-centric height, and evaluate the stability of submerged and floating bodies in static fluid conditions.
CLO 2	Analyze fluid motion using the Eulerian and Lagrangian approaches, construct flow nets, and apply these concepts to solve practical fluid flow problems.
CLO 3	Use Bernoulli's equation and principles of laminar and turbulent flow to compute fluid discharge, velocity, and energy losses in pipe networks and through devices like orifices and weirs.
CLO 4	Design and analyze open channel flows by applying formulas like Chezy's and Manning's, accounting for velocity and pressure profiles, and understanding hydraulic losses.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme		
L	T	P	C	Internal Evaluation	ESE	Total

				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	T	W
1	Introduction Units and dimensions, Properties of fluids.	2	6
2	Static pressure of liquids: Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid. Compressible and non compressible fluids. Surface tension, capillarity	4	12
3	Pressure measuring devices simple, differential, micro, inclined manometer, mechanical gauges, Piezometer.	3	9
4	Fluid flow: Classification, steady uniform and non uniform flow, Laminar and turbulent, continuity equation, Bernolli's theorem and its applications	4	12
5	Flow through pipes: Loss of head, determination of pipe diameter. Determination of discharge, friction factor, critical velocity, Flow through orifices, mouthpieces, notches and weirs, Vena ontracta, hydraulic coefficients, discharge losses, Time for emptying a tank. Loss of head due to contraction, enlargement at entrance and exit of pipe. External and internal mouthpieces, types of notches, rectangular and triangular notches, rectangular weirs	5	16
6	Flow measurement: Venturimeters, pitot tube, Rota meter. Water level point gauge, hook gauge.	4	13
7	Dimensional analysis: Buckingham"s theorem application to fluid flow phenomena. Froude Number, Reynolds number. Weber number and hydraulic similitude.	5	16
8	Pumps: Classification, reciprocating, centrifugal pump. Pressure variation, work efficiency. Pump selection and sizing.	5	16
Total		32	100%

i. Text Book and Reference Book:

1. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines
By Khurmi R .S. | S. Chand & Company Limited, New Delhi, Pub. Year 1970
2. Hydraulics and Fluid Mechanics

By Modi P.N. and Seth S.M. | Standard Book House, Delhi, Pub. Year 1973

3. Open Channel Hydraulics

By Chow V.T. | McGraw Hill Book Co., New Delhi, Pub. Year 1983

4. Fluid Mechanics and Hydraulics

By Jagdish Lal | Metropolitan Book Co.Pvt. Ltd., New Delhi, Pub. Year 1985

- a. Course Name: Fluid Mechanics Lab**
- b. Course Code:** 03604178
- c. Prerequisite:** A basic understanding of Physics (specifically mechanics) to grasp fundamental principles like forces and pressure.
- d. Rationale:** Fluid Mechanics and Open Channel Hydraulics is an essential course for civil and mechanical engineering students, particularly for those focusing on hydraulics, water resource management, and infrastructure design. Understanding fluid behavior in both confined (pipes) and unconfined (open channels) environments is crucial for designing efficient systems for water distribution, flood control, and irrigation.

e. Course Learning Objective:

CLOBJ 1	1 Understand the physical properties of fluids and analyze the stability and behavior of submerged and floating bodies.
CLOBJ 2	Grasp the principles of fluid flow patterns, velocity fields, and apply the continuity equation in various fluid flow problems.
CLOBJ 3	Apply Bernoulli's theorem and principles of laminar and turbulent flow in pipes to analyze fluid behavior under dynamic conditions.
CLOBJ 4	Design and evaluate open channel flows using standard formulas like Manning's and Chezy's for practical engineering applications.

f. Course Learning Outcomes:

CLO 1	Calculate pressure forces on surfaces, determine buoyancy, meta-centric height, and evaluate the stability of submerged and floating bodies in static fluid conditions.
CLO 2	Analyze fluid motion using the Eulerian and Lagrangian approaches, construct flow nets, and apply these concepts to solve practical fluid flow problems.
CLO 3	Use Bernoulli's equation and principles of laminar and turbulent flow to compute fluid discharge, velocity, and energy losses in pipe networks and through devices like orifices and weirs.
CLO 4	Design and analyze open channel flows by applying formulas like Chezy's and Manning's, accounting for velocity and pressure profiles, and understanding hydraulic losses.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Experiment List
1	Study of various types of pipes and pipe fittings.
2	Study of different types of valves
3	Study of reciprocating pump
4	Determination of frictional coefficient of given pipe.
5	Determination of minor head loss
6	Study the construction and working principle of centrifugal pump.
7	Study and measurement of flow of liquid by V- notch

- a. **Course Name:** Economic Analysis
- b. **Course Code:** 03604179
- c. **Prerequisite:** Zeal to learn
- d. **Rationale:** The rationale of Economic Analysis is to equip students with the tools and techniques needed to evaluate the financial viability, efficiency, and sustainability of projects, helping them make informed decisions by analyzing cost, benefits, risks, and economic factors in various industries and business operations.

e. Course Learning Objective:

CLOBJ 1	To understand key economic concepts and principles used in evaluating projects and business decisions.
CLOBJ 2	To learn how to apply cost-benefit analysis, break-even analysis, and other financial evaluation techniques.
CLOBJ 3	To develop the ability to assess the economic feasibility and sustainability of different business strategies.
CLOBJ 4	To explore how external economic factors, such as inflation, interest rates, and market conditions, impact decision-making and profitability.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to apply economic principles to evaluate the feasibility and profitability of business projects.
CLO 2	Analyze and interpret financial data using various economic tools, such as cost-benefit analysis and financial ratios.
CLO 3	Assess the impact of economic variables and market conditions on business decisions and outcomes.
CLO 4	Make informed decisions based on economic evaluations, contributing to the efficient allocation of resources in a business or project.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basic concepts-wants Basic concepts-wants, goods, wealth, utility, consumption, demand and supply	5 %	15
2	Consumer behaviour. Consumer behaviour-law of diminishing marginal utility and equi- marginal utility, cardinal and ordinal utility approach for consumer's behavior.	6 %	20
3	Theory of demand Theory of demand-law of demand, demand schedule, demand function, determinates of demand, individual consumer demand and market demand, demand forecasting, elasticity of demand, price elasticity, income elasticity and cross elasticity, Consumer's surplus.	8 %	25
4	Theory of production Theory of production- concepts of firm and industry, basic factors of production and their role, production function for a single product, nature of production function, laws of returns.	8 %	25
5	Concepts of costs Concepts of costs-fixed and variable costs, short run and long run costs.	5 %	15
Total		100%	32

i. Text Book and Reference Book:

1. Principles of Economics" by N. Gregory Mankiw
2. Microeconomics: A Modern Approach
3. Intermediate Microeconomics: A Modern Approach" by Hal R. Varian

- a. **Course Name:** Food Chemistry and Nutrition
- b. **Course Code:** 03635159
- c. **Prerequisite:** Knowledge of English up to 10th level.
- d. **Rationale:** The Communication Skills course in diploma Food Technology is of paramount importance as it equips students with the essential abilities to effectively convey technical knowledge collaborate with industry stakeholders, and articulate ideas crucial for success in the dairy technology field.
- e. **Course Learning Objective:**

CLOBJ 1	Understand about the Scope and development of food chemistry.
CLOBJ 2	Elaborate the role and type of water in foods, functional properties of water, water activity and sorption isotherm.
CLOBJ 3	Discover the basic knowledge of Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibers.
CLOBJ 4	Learn Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein.
CLOBJ 5	Explain Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, and its thermal decomposition.

f. **Course Learning Outcomes:**

CLO 1	Explore the scope and development of food chemistry.
CLO 2	Investigate the role and types of water in foods, focusing on functional properties, water activity, and sorption isotherms.
CLO 3	Acquire basic knowledge about carbohydrates, including their changes during cooking, modification, and dietary fiber.
CLO 4	Examine the impact of processing on proteins in foods, covering physical, chemical, and nutritional changes.
CLO 5	Understand the role and use of lipids/fat, including crystallization, consistency, chemical aspects, lipolysis, auto-oxidation, and thermal decomposition.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Water:Water binding and chemical reaction mediated by water. Food proteins: Classification and physico-chemical and structural properties.	12%	2
2	Lipids:Definition, classification of lipids, Unsaponifiable matter contents in various fats and oils, classification and chemical composition.	15%	2
3	Simple sugars: mono and disaccharides, Properties, Caramelization, Maillard reaction; Sugar alcohols; Oligosaccharides: structure, nomenclature, occurrence, uses in foods.	15%	4
4	Polysaccharides: Starch- Structure, Properties, Functional role in food system, Modified starches, Resistant starch, Starch hydrolysates, Applications in food industry.	15%	5
5	Pectins, Gums &Hydrocolloid, Fiber – Cellulose and hemicellulose; Food sources, functional role and uses in foods.	15%	4
6	Digestion and absorption of carbohydrates, lactose intolerance: glycemic and non-glycemic carbohydrates, blood glucose.	15%	2
7	Energy balance; body weight and body composition; healthimplications; obesity, BMR and BMI calculations	12%	4
Total		100%	32

i. Text Book and Reference Book:

1. **Food Chemistry"** by Owen R. Fennema
2. **Food Science"** by Norman N. Potter and Joseph H. Hotchkiss
3. **Principles of Food Chemistry"** by John M. DeMan
4. **Nutrition and Physical Degeneration"** by Weston A. Price

- a. Course Name:** Food Chemistry and Nutrition Lab
- b. Course Code:** 03635160
- c. Prerequisite:** Knowledge of science up to 10th science level.
- d. Rationale:** Food Chemistry of Macronutrients subject provides essential insights into the physicochemical properties and transformations of carbohydrates, proteins, and lipids, laying the foundation for designing and optimizing food processes and formulations to meet nutritional and sensory requirements.

e. Course Learning Objective:

CLOBJ 1	Understand about the Scope and development of food chemistry.
CLOBJ 2	Elaborate the role and type of water in foods, functional properties of water, water activity and sorption isotherm.
CLOBJ 3	Discover the basic knowledge of Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibers.
CLOBJ 4	Learn Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein.
CLOBJ 5	Explain Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, and its thermal decomposition.

f. Course Learning Outcomes:

CLO 1	Explore the scope and development of food chemistry.
CLO 2	Investigate the role and types of water in foods, focusing on functional properties, water activity, and sorption isotherms.
CLO 3	Acquire basic knowledge about carbohydrates, including their changes during cooking, modification, and dietary fiber.
CLO 4	Examine the impact of processing on proteins in foods, covering physical, chemical, and nutritional changes.
CLO 5	Understand the role and use of lipids/fat, including crystallization, consistency, chemical aspects, lipolysis, auto-oxidation, and thermal decomposition.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Determination of the order of hydrolysis of an ester/carbohydrate and measurement of activation energy.
2	Determination of the calories from food.
3	Measurement of pH and buffering of different foods.
4	To study the gel formation and gel stability of milk proteins.
5	Determination of moisture content.

- a. Course Name:** Principles of Food Processing and Preservation
- b. Course Code:** 03635161
- c. Prerequisite:** Knowledge of biology up to 10th level.
- d. Rationale:** The study of food processing and preservation aims to extend shelf life, enhance safety, and maintain nutritional and sensory quality by preventing spoilage and microbial contamination.
- e. Course Learning Objective:**

CLOBJ 1	To understand the fundamental principles and techniques involved in food preservation and processing.
CLOBJ 2	To analyze the effects of various processing methods on food safety, quality, and shelf life.
CLOBJ 3	To explore the role of food preservation in preventing spoilage and maintaining nutritional value.
CLOBJ 4	To apply knowledge of preservation techniques to develop innovative and sustainable food processing solutions.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of key food processing and preservation techniques and their scientific basis.
CLO 2	Evaluate the impact of processing methods on food quality, safety, and shelf life.
CLO 3	Apply preservation strategies to minimize spoilage and ensure the nutritional and sensory attributes of food.
CLO 4	Design and propose sustainable food processing solutions for real-world applications in the food industry.
CLO 5	Demonstrate an understanding of key food processing and preservation techniques and their scientific basis.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Importance and significance of microbes in food science;	10%	3
2	Microbial spoilage of foods Factors affecting kinds, numbers, growth and survival of microorganisms in foods; Intrinsic factors; pH, water activity, nutrients etc., Extrinsic factors: Relative humidity, temperature, gaseous atmosphere; Chemical changes caused by microorganisms: Changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances;	20%	7
3	Contamination of foods; Sources of contamination, Genera of bacteria, Maintenance of anaerobic conditions; Asepsis, removal of microorganisms; Intermediate moisture foods; Microbiology of milk and milk products; Microbiology of fruits and vegetables, Microbiology of cereal and cereal products, Microbiology of meat and meat products, Microbiology of fish and other sea foods; Microbiology of poultry and eggs; Microbiology of sugar and sugar products; Microbiology of salts and spices, Microbiology of canned foods	30%	9
4	Shelf life: Calculation of shelf life, Shelf-life requirements, deteriorative reactions, accelerated testing; Simulations of product: Package environment interaction, shelf life simulation for moisture, oxygen, and light sensitive products;	20%	6
5	Food borne intoxications and infections types of food involved, toxicity and symptoms, chemical properties, environmental conditions; Food borne viruses: Polio, hepatitis A & E, noroviruses, rota viruses, prion diseases, types of food involved, toxicity and symptoms, chemical properties, environmental conditions.	20%	7
Total		100%	32

i. Text Book and Reference Book:

1. "Food Processing and Preservation" by P. J. Fellows.
2. "Food Processing Technology: Principles and Practice" by P. J. Fellows.
3. "Introduction to Food Engineering" by R. Paul Singh and Dennis R. Heldman.
4. "Handbook of Food Preservation" edited by M. Shafiur Rahman.

- a. Course Name:** Principles of Food Processing and Preservation Lab
- b. Course Code:** 03635162
- c. Rationale:** The study of food processing and preservation aims to extend shelf life, enhance safety, and maintain nutritional and sensory quality by preventing spoilage and microbial contamination.
- d. Course Learning Objective:**

CLOBJ 1	To understand the fundamental principles and techniques involved in food preservation and processing.
CLOBJ 2	To analyze the effects of various processing methods on food safety, quality, and shelf life.
CLOBJ 3	To explore the role of food preservation in preventing spoilage and maintaining nutritional value.
CLOBJ 4	To apply knowledge of preservation techniques to develop innovative and sustainable food processing solutions.

e. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of key food processing and preservation techniques and their scientific basis.
CLO 2	Evaluate the impact of processing methods on food quality, safety, and shelf life.
CLO 3	Apply preservation strategies to minimize spoilage and ensure the nutritional and sensory attributes of food.
CLO 4	Design and propose sustainable food processing solutions for real-world applications in the food industry.
CLO 5	Demonstrate an understanding of key food processing and preservation techniques and their scientific basis.

f. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	1	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

g. Course Content:

Sr. No.	Content
1	Demonstration of various machineries used in processing
2	Demonstration of effect of blanching on quality of foods
3	Preservation of food by heat treatment- canning
4	Preservation of food by high concentration of sugar i.e., preparation of jam
5	Preservation of food by using acidulants i.e., pickling by acid, vinegar or acetic acid
6	Drying of pineapple slices, apple slices in cabinet drier

- a. **Course Name:** Computer Programming and Data Structures
- b. **Course Code:** 03635163
- c. **Prerequisite:** Knowledge of Computer and Mathematics up to 12th science level.
- d. **Rationale:** Computer Programming and Data Structures in B Tech Food Technology is essential for students to acquire fundamental skills in coding and algorithmic thinking, enabling them to develop efficient and innovative solutions for data management and programming challenges in the food technology domain.

e. Course Learning Objective:

CLOBJ 1	comprehensive understanding of computer technology.
CLOBJ 2	understanding of computer programming and data structures.
CLOBJ 3	Acquire foundational knowledge in Computer Programming and Data Structures by understanding the structure of a C program, simple data types etc.
CLOBJ 4	Develop a comprehensive understanding of high-level programming languages.

f. Course Learning Outcomes:

CLO 1	Understand the computer technology; Processor, memory, secondary storage, display devices and other peripheral devices
CLO 2	Study the types of systems software, applications software and programming language; Algorithms and flow-charts:
CLO 3	Assess the basic knowledge of Structure of a C program
CLO 4	Explain the high-level languages.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction and historical background: Review of computer technology; Processor, memory, secondary storage, display devices and other peripheral devices; Basic computer organization, future trends; Brief review of present-day applications, programming;	13%	2
2	Introduction to systems software, applications software and programming language; Algorithms and flow-charts: Input- processing-output model of a computer program; Role of the compiler and the integrated development environment;	13%	3
3	Introduction to C: Structure of a C program, simple data types, declarations, operators and expressions; The assignment statement; Library functions; Control Structures: Conditional and iterative execution of statements	28%	4
4	Importance of documentation; Nesting of control structures and the use of indentation to indicate nesting levels; Labels and the “go to” statement; Arrays; Single and multi-dimensional arrays: Character strings and string functions; Functions: Scope rules; Argument passing by reference and by value; Storage classes; Use of function prototypes; Structures, unions and user-defined types; Operations on files: Concept of standard input and output files; Formatting of data on input and output; Use of include files;	20%	3
5	Introduction to high level languages; Primary data types and user defined data types, variables, typecasting, operators, building and evaluating expressions, standard library functions, managing input and output, decision making, branching, looping, arrays, user defined functions, passing arguments and returning values, recursion, scope and visibility of a variable, string functions, structures and union, pointers, stacks, push/pop operations, queues, insertion and deletion operations, linked lists.	26%	4
Total		100%	16

i. Text Book and Reference Book:

1. Mark Allen Weiss. 2014. Data Structures and Algorithm Analysis in C++, 4th Ed. Pearson Education, Boston, USA.
2. Svetlin Nakov & Co. 2013. Fundamentals of Computer Programming with c#. Sofia, Bulgaria.
3. F. Balagurusamy. 2008. Object Oriented Programming with C++, 4th Ed. Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Structure and Interpretation of computer programs (SICP), by Harold Abelson, Gerald Jay Sussman, Julie Sussman. MIT Press.

- a. **Course Name:** Computer Programming and Data Structures lab
- b. **Course Code:** 03635164
- c. **Prerequisite:** Knowledge of Computer and Mathematics up to 10th level.
- d. **Rationale:** Computer Programming and Data Structures in B Tech Food Technology is essential for students to acquire fundamental skills in coding and algorithmic thinking, enabling them to develop efficient and innovative solutions for data management and programming challenges in the food technology domain.

e. Course Learning Objective:

CLOBJ 1	To Understand computer technology.
CLOBJ 2	To Understand computer programming and data structures.
CLOBJ 3	To Acquire foundational knowledge in Computer Programming and Data Structures by understanding the structure of a C program, simple data types etc.
CLOBJ 4	To Develop a comprehensive understanding of high-level programming languages.

f. Course Learning Outcomes:

CLO 1	Understand the computer technology; Processor, memory, secondary storage, display devices and other peripheral devices
CLO 2	Study the types of systems software, applications software and programming language; Algorithms and flow-charts:
CLO 3	Assess the basic knowledge of Structure of a C program
CLO 4	Explain the high-level languages.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Familiarizing with Turbo C IDE;
2	Building an executable version of C program;
3	Debugging a C program;
4	Developing and executing simple programs;
5	Creating programs using decision making statements such as if, go to and switch;
6	Developing program using loop statements while, do and for;
7	Using nested control structures; Familiarizing with one and two dimensional arrays;
8	Using string functions; Developing structures and union;
9	Creating user defined functions; Using local, global and external variables;
10	Using pointers; Implementing stacks;
11	Implementing push/ pop functions; Creating queues;
12	Developing linked lists in C language;
13	Insertion/deletion in data structures.

i. Text Book and Reference Book:

5. Mark Allen Weiss. 2014. Data Structures and Algorithm Analysis in C++, 4th Ed. Pearson Education, Boston, USA.
6. Svetlin Nakov & Co. 2013. Fundamentals of Computer Programming with c#. Sofia, Bulgaria.
7. F. Balagurusamy. 2008. Object Oriented Programming with C++, 4th Ed. Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. Structure and Interpretation of computer programs (SICP), by Harold Abelson, Gerald Jay Sussman, Julie Sussman. MIT Press.

- a. **Course Name:** Food Microbiology
- b. **Course Code:** 03635165
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** Food Microbiology aims to understand the role of microorganisms in food safety, spoilage, preservation, and production to ensure quality and public health.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the role of microorganisms in food spoilage, fermentation, and preservation.
CLOBJ 2	To identify and analyze the factors influencing microbial growth in food systems.
CLOBJ 3	To explore the methods for detecting, controlling, and preventing foodborne pathogens and contaminants.
CLOBJ 4	To examine the beneficial applications of microorganisms in food production and biotechnology.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of the role of microorganisms in food spoilage, fermentation, and preservation.
CLO 2	Analyze and evaluate factors affecting microbial growth and survival in various food systems.
CLO 3	Apply techniques to detect and control foodborne pathogens and ensure food safety.
CLO 4	Develop an understanding of the beneficial applications of microorganisms in food biotechnology and product development.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Importance and significance of microbes in food science Introduction to food microbiology, Microbial spoilage of foods, Factors affecting the growth of microorganisms in foods; Intrinsic factors; pH, water activity, nutrients etc., Extrinsic factors: Relative humidity, temperature, gaseous atmosphere; Chemical changes caused by microorganisms: Changes in nitrogenous organic compounds, non- nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances.	30%	8
2	General characteristics and bacterial growth curve: General characteristics of bacteria, fungi, virus, protozoa and algae; Bacterial growth curve; Shelf life of food, Classification of food based on perishability; Sources and prevention of contamination; Causes of food spoilage	25%	9
3	Microbiology of foods: Microbiology of milk and milk products; Microbiology of fruits and vegetables, Microbiology of cereal and cereal products, Microbiology of meat and meat products, Microbiology of poultry and eggs; Microbiology of canned foods	20%	7
4	Simulations of product : Food borne intoxications and infections, types of food involved, toxicity and symptoms, chemical properties, environmental condition; Food borne viruses: Polio, hepatitis A& E, noroviruses, rotavirus, types of food involved, toxicity and symptoms, chemical properties, environmental conditions	25%	8
Total		100%	32

i. Text Book and Reference Book:

- Modern Food Microbiology" by James M. Jay, Martin J. Loessner, and David A. Golden.
- "Food Microbiology: Fundamentals and Frontiers" by Michael P. Doyle, Larry R. Beuchat, and Thomas J. Montville.
- "Fundamental Food Microbiology" by Bibek Ray and Arun Bhunia.
- "Principles of Food Sanitation" by Norman G. Marriott and Robert B. Gravani.

- a. Course Name:** Food Microbiology Lab
- b. Course Code:** 03635166
- c. Prerequisite:** Knowledge of science up to 10th level.
- d. Rationale:** Food Microbiology aims to understand the role of microorganisms in food safety, spoilage, preservation, and production to ensure quality and public health.
- e. Course Learning Objective:**

CLOBJ 1	Understand the role of microorganisms in food spoilage, fermentation, and preservation.
CLOBJ 2	To identify and analyze the factors influencing microbial growth in food systems.
CLOBJ 3	To explore the methods for detecting, controlling, and preventing foodborne pathogens and contaminants.
CLOBJ 4	To examine the beneficial applications of microorganisms in food production and biotechnology.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of the role of microorganisms in food spoilage, fermentation, and preservation.
CLO 2	Analyze and evaluate factors affecting microbial growth and survival in various food systems.
CLO 3	Apply techniques to detect and control foodborne pathogens and ensure food safety.
CLO 4	Develop an understanding of the beneficial applications of microorganisms in food biotechnology and product development.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	To study different parts of a compound microscope
2	Study of equipment`s in a microbiology lab
3	Staining of bacteria: Gram staining
4	Microbial examination of vegetables and fruits
5	Microbial examination of cereal and cereal products
6	Microbial examination of milk and milk products
7	Demonstration of available rapid methods and diagnostic kits used in identification of microorganisms
8	Visit to food processing unit or any other organization dealing with advanced methods in food microbiology

- a. **Course Name:** Communication Skills - II
- b. **Course Code:** 03693153
- c. **Prerequisite:** Knowledge of English Language.
- d. **Rationale:** The rationale of the Communication Skills subject is to develop students' ability to effectively convey ideas, thoughts, and information through verbal, non-verbal, and written forms, fostering interpersonal and professional competence.
- e. **Course Learning Objective:**

CLOBJ 1	To enhance the ability to communicate effectively using verbal, non-verbal, and written modes.
CLOBJ 2	To develop skills for active listening, clear articulation, and confident public speaking.
CLOBJ 3	To foster proficiency in professional communication, including report writing and correspondence.
CLOBJ 4	To cultivate interpersonal skills for effective collaboration and adaptability in multicultural environments.

f. Course Learning Outcomes:

CLO 1	Demonstrate proficiency in verbal and non-verbal communication for effective interpersonal and professional interactions.
CLO 2	Develop well-structured written communication, including reports, emails, and formal documents.
CLO 3	Exhibit active listening and critical thinking skills in group discussions and presentations.
CLO 4	Apply effective communication strategies in diverse cultural and professional contexts.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	1	1	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Listening Process and Practice - Introduction, importance of good Listening Skills, difference between listening and hearing, types of listening, Barriers to effective Listening, traits of a good listener.	26%	8
2	With audio aids, Students will be able to listen to dialogues, improve in gathering information and to summarize the content. To listen and understand day-to-day conversations and to solve questions based on audio files.	22%	7
3	Synonyms, Antonyms, Homophones, Homonyms, Homographs, Phrasal verbs, idioms & phrases, One word substitution.	15%	1
4	Sounds: Consonant, Vowel, Diphthongs, transcription of words(IPA) weak forms, syllable division, word stress, intonation and voice.	15%	6
5	To enable students to eliminate stage fright and engage in conversation with others.	5%	2
6	Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems.	5%	1
7	Classroom activity which helps students to express their feelings and experiences in English. Encouraging students to overcome stage fear.	5%	1
8	Classroom Activity to encourage Communication and Convincing Skills.	5%	1
9	Classroom activity to encourage Communication and Convincing Skills.	5%	1
10	Enhance the skill of writing by completing the paragraph in appropriate and sensible form.	5%	3
11	Self Awareness, Sympathy, Empathy, Emotional Intelligence.	5%	4
12	A Day's Wait- Ernest Hemingway, My Lost Dollar - Stephen Leacock.	10%	2
Total		100%	32

i. Text Book and Reference Book:

- 1. Technical Communication : Principles And Practice** Sangeetha Sharma, Meenakshi Raman; Oxford University Press
- 2. Effective Technical Communication** Dr. Bharti Kukreja, Dr. Anupama Jain; S.K. Kataria & Sons; 1st

Semester 3

- a. **Course Name:** Thermodynamics & Heat Engines
- b. **Course Code:** 03604219
- c. **Prerequisite:** Knowledge of Mathematics up to 10th level.
- d. **Rationale:** The rationale of Thermodynamics & Heat Engines is to understand the fundamental principles governing energy transformation, heat transfer, and the performance of heat engines, enabling the design and optimization of systems for energy efficiency and sustainable operation.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the fundamental laws of thermodynamics and their applications in heat engines.
CLOBJ 2	To analyze energy conversion processes and determine efficiency in various thermodynamic cycles.
CLOBJ 3	To apply thermodynamic principles to the design and optimization of heat engines.
CLOBJ 4	To develop problem-solving skills for analyzing real-world thermodynamic systems and processes.

f. Course Learning Outcomes:

CLO 1	Demonstrate a thorough understanding of the fundamental laws of thermodynamics and their applications in heat engines.
CLO 2	Analyze and evaluate energy conversion processes, including the efficiency of thermodynamic cycles such as Carnot and Rankine.
CLO 3	Apply thermodynamic principles to the design, analysis, and optimization of heat engines and energy systems.
CLO 4	Solve complex problems involving heat transfer, work, and energy efficiency in thermodynamic systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	2	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Importance and applications of thermodynamics in Dairy/Food processing	6%	2
2	Thermodynamic systems, properties, state, processes, cycles, energy, The Zeroth Law of Thermodynamics	19 %	6
3	Equation of state, Compression and expansion of gases. The first Law of Thermodynamics: Internal energy, enthalpy. Analysis of non-flow and flow processes	12 %	4
4	The second Law of Thermodynamics : Thermodynamic temperature scale, Carnot cycle, heat engine, entropy, reversibility, availability	25 %	8
5	Thermodynamic temperature scale, Carnot cycle, heat engine, entropy, reversibility, availability: Otto, Diesel, dual cycles and their efficiencies, Plotting the air cycles on p-V, T-S, p-h diagram etc	19 %	6
6	Heat Engines : Concepts, Classification, Working of two stroke and four stroke cycle S.I. engines and C.I. engines. Parts of I.C. engine, Performance of IC engines	19 %	6
Total		100%	32

i. Text Book and Reference Book:

1. "Fundamentals of Thermodynamics" by Richard E. Sonntag and Claus Borgnakke.
2. "Thermodynamics: An Engineering Approach" by Yunus A. Çengel and Michael A. Boles.
3. "Introduction to Heat Transfer" by Frank P. Incropera and David P. DeWitt.
4. "Engineering Thermodynamics" by P.K. Nag.

- a. Course Name:** Thermodynamics & Heat Engine Lab
- b. Course Code:** 03604220
- c. Prerequisite:** Basic knowledge of science studied upto 10th.
- d. Rationale:** The rationale of Thermodynamics & Heat Engines is to understand the fundamental principles governing energy transformation, heat transfer, and the performance of heat engines, enabling the design and optimization of systems for energy efficiency and sustainable operation.
- e. Course Learning Objective:**

CLOBJ 1	To understand the fundamental laws of thermodynamics and their applications in heat engines.
CLOBJ 2	To analyze energy conversion processes and determine efficiency in various thermodynamic cycles.
CLOBJ 3	To apply thermodynamic principles to the design and optimization of heat engines.
CLOBJ 4	To develop problem-solving skills for analyzing real-world thermodynamic systems and processes.

f. Course Learning Outcomes:

CLO 1	Demonstrate a thorough understanding of the fundamental laws of thermodynamics and their applications in heat engines.
CLO 2	Analyze and evaluate energy conversion processes, including the efficiency of thermodynamic cycles such as Carnot and Rankine.
CLO 3	Apply thermodynamic principles to the design, analysis, and optimization of heat engines and energy systems.
CLO 4	Solve complex problems involving heat transfer, work, and energy efficiency in thermodynamic systems.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. NO.	Experiment List
1	A visit to dairy/ food processing plant showing the thermodynamics

	applications/ devices
2	Study of 2-stroke and 4-strokes IC engines working
3	Study of 2-stroke and 4-strokes IC engines working
4	Study of S.I. and C.I. engines working
5	Study of S.I. and C.I. engines working
6	Study of modern fuel injection systems of I.C. engines
7	Study of modern fuel injection systems of I.C. engines
8	Study of diesel fuel supply system (pump and fuel injector) of I.C. engine
9	Study of diesel fuel supply system (pump and fuel injector) of I.C. engine
10	Study of fuel supply system of a petrol engine.
11	Study of fuel supply system of a petrol engine
12	Study of cooling system of an I.C. engine (air cooling and water cooling).
13	Study of cooling system of an I.C. engine (air cooling and water cooling).
14	Study of lubrication system of I.C. engine
15	Study of Solar water heater and biogas plants and appliances
16	Study of Solar water heater and biogas plants and appliances Printed

- a. Course Name:** Fundamentals of Electrical and Electronics Engineering
- b. Course Code:** 03607151
- c. Prerequisite:** Knowledge of Physics and Mathematics up to 10th Standard Level.
- d. Rationale:**
Students after studying this course will be able to understand the basics of analog electronics, various electronics components and develop skills to use simple electronic instruments needed for computer- based working environment.
- e. Course Learning Objective:**

CLOBJ 1	To understand the basic concepts of electrical circuits, components, and their applications in engineering.
CLOBJ 2	To learn the principles of electronics, including semiconductor devices and their role in electronic circuits.
CLOBJ 3	To analyze and solve electrical circuits using techniques like Ohm's law, Kirchhoff's laws, and network theorems.
CLOBJ 4	To gain hands-on experience with electrical and electronic components, tools, and measurement devices.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to analyze and solve electrical circuits using basic circuit laws and theorems.
CLO 2	Understand the operation and application of fundamental electronic devices like diodes, transistors, and operational amplifiers.
CLO 3	Apply principles of electrical and electronic engineering to design and test simple circuits.
CLO 4	Develop proficiency in using instruments and tools for measuring and testing electrical and electronic components.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Overview of Electronic Components & Signals :Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current source, independent/dependent voltage current sources.	13.33 %	4
2	Introduction of Semiconductor Components :P-N junction diode, V-I Characteristics of P-N junction Diode, Zener Diode, Classification of Transistor, Transistor construction, Types of transistors (NPN & PNP)	20 %	6
3	Overview of Digital Electronics :Number systems, Base Conversion -BINARY -DECIMAL -HEX -OCTAL, Complements - 2' and 10's Complement -1's and 9's Complement, Binary addition, subtraction, multiplication and division Logic Gates -Basic Gates (AND, OR, Not), Universal Gates (NAND and NOR Gate), Complementary Gates-(EX-OR, EX-NOR), De-Morgan's Theorems, Adder and Subtractor, Multiplexer and De-multiplexer.	13.33 %	4
4	Electric Circuit :Generation of electricity, Different terms related to electric circuit, Concept of AC and DC, Concept of 1-phase and 3-phase supply, Electrical circuit elements – Resistor Inductor and Capacitor, Resistor in series and parallel, Ohm's law and its limitations, Factors affecting the value of resistance	20 %	8
5	Magnetic Circuit : Terms Related to magnetic circuit, Terms Related to AC circuit, Faraday's Law, Fleming's law, Lenz's Law, Hysteresis loop (B/H Curve), Types of Induced EMF, Comparison between Electric and Magnetic Circuit	26.67%	8
6	Transformer and Machines: General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations of motors.	6.67 %	2
Total		100%	16

i. Text Book and Reference Book:

1. Electrical Engineering: Principles and Applications" by Allan R. Hambley.

2. "Fundamentals of Electrical Engineering and Electronics" by B.L. Theraja and A.K. Theraja.
3. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
4. "Principles of Electrical Engineering" by V.K. Mehta and Rohit Mehta.

- a. **Course Name:** Fundamentals of Electrical and Electronics Engineering Lab
- b. **Course Code:** 03607152
- c. **Prerequisite:** Knowledge of Physics and Mathematics up to 10th Standard Level.
- d. **Rationale:**

Students after studying this course will be able to understand the basics of analog electronics, various electronics components and develop skills to use simple electronic instruments needed for computer- based working environment.

- e. **Course Learning Objective:**

CLOBJ 1	To understand the basic concepts of electrical circuits, components, and their applications in engineering.
CLOBJ 2	To learn the principles of electronics, including semiconductor devices and their role in electronic circuits.
CLOBJ 3	To analyze and solve electrical circuits using techniques like Ohm's law, Kirchhoff's laws, and network theorems.
CLOBJ 4	To gain hands-on experience with electrical and electronic components, tools, and measurement devices.

- f. **Course Learning Outcomes:**

CLO 1	Demonstrate the ability to analyze and solve electrical circuits using basic circuit laws and theorems.
CLO 2	Understand the operation and application of fundamental electronic devices like diodes, transistors, and operational amplifiers.
CLO 3	Apply principles of electrical and electronic engineering to design and test simple circuits.
CLO 4	Develop proficiency in using instruments and tools for measuring and testing electrical and electronic components.

- g. **Teaching & Examination Scheme:**

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

- h. **Course Content:**

Sr. No.	Content
1	Determine the permeability of magnetic material by plotting its B-H curve.
2	Measure voltage, current and power in 1-phase circuit with resistive load.
3	Measure voltage, current and power in R-L series circuit.
4	Determine the transformation ratio (K) of 1-phase transformer.
5	Connect single phase transformer and measure input and output quantities.
6	Identify various active and passive electronic components.
7	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.
8	Use multimeter to measure the value of given resistor. Determine the value of given resistor using digital multimeter to confirm with colour code.
9	Test the performance of PN-junction diode.
10	Test the half wave rectifier using CRO.
11	Test the Bridge rectifier and capacitor filter using CRO.
12	Test the performance of Zener diode.
13	Identify the pins of IC 741.
14	Test the performance of CE NPN transistor.
15	Test the performance of transistor amplifier circuit.

- a. **Course Name:** Principles of Food Engineering
- b. **Course Code:** 03635209
- c. **Prerequisite:** Knowledge of Mathematics up to 10th level.
- d. **Rationale:** The rationale of **Principles of Food Engineering** is to apply engineering principles and techniques to the design, optimization, and operation of food processing systems, ensuring the efficient transformation of raw materials into safe, high-quality food products while addressing issues related to energy consumption, sustainability, and food safety.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the fundamental engineering principles applied to food processing, including mass and energy balances.
CLOBJ 2	To analyze the physical, chemical, and biological changes that occur during food processing.
CLOBJ 3	To apply engineering techniques in the design and optimization of food processing systems and equipment.
CLOBJ 4	To evaluate the role of food engineering in improving food quality, safety, and sustainability.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of key food engineering concepts, including thermodynamics, heat transfer, and fluid mechanics as applied to food processes.
CLO 2	Analyze the effects of processing techniques on food quality, safety, and nutritional value.
CLO 3	Design and optimize food processing systems using engineering principles to improve efficiency and product quality.
CLO 4	Apply food engineering knowledge to address challenges in sustainability, energy use, and food safety in the food industry.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to units and dimensions, mass balances, energy balances, thermal balances. scope and importance of food process engineering- preliminary operations – cleaning, grading, sorting, washing, cutting – equipment's used.	25%	10
2	Processing Methods: Blanching- pasteurization – sterilization- extrusion cooking- micro wave processing – Concepts and equipment used.	25%	8
3	Flow of fluids:viscosity, viscometry and rheology, Reynolds number, mechanical energy balance	25%	8
4	Heat transfer, conduction, convection, overall heat transfer coefficient and heat exchangers, unsteady-state heat transfer, thermal processing of foods	25%	6
Total		100%	32

i. Text Book and Reference Book:

1. Introduction to Food Engineering" by R. Paul Singh and Dennis R. Heldman
2. Fundamentals of Food Process Engineering" by Romeo T. Toledo
3. Food Engineering Fundamentals" by Theodora P. Tsarouhas

- a. **Course Name:** Principles of Food Engineering lab
- b. **Course Code:** 03635210
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The rationale of **Principles of Food Engineering** is to apply engineering principles and techniques to the design, optimization, and operation of food processing systems, ensuring the efficient transformation of raw materials into safe, high-quality food products while addressing issues related to energy consumption, sustainability, and food safety.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the fundamental engineering principles applied to food processing, including mass and energy balances.
CLOBJ 2	To analyze the physical, chemical, and biological changes that occur during food processing.
CLOBJ 3	To apply engineering techniques in the design and optimization of food processing systems and equipment.
CLOBJ 4	To evaluate the role of food engineering in improving food quality, safety, and sustainability.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of key food engineering concepts, including thermodynamics, heat transfer, and fluid mechanics as applied to food processes.
CLO 2	Analyze the effects of processing techniques on food quality, safety, and nutritional value.
CLO 3	Design and optimize food processing systems using engineering principles to improve efficiency and product quality.
CLO 4	Apply food engineering knowledge to address challenges in sustainability, energy use, and food safety in the food industry.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	1	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Experiment on water activity determination of food materials
2	Experiment on moisture content determination of food materials
3	Experiment on extrusion.
4	Experiment on pretreatment of food materials
5	Experiment on microwave cooking

i. Text Book and Reference Book:

1. Introduction to Food Engineering" by R. Paul Singh and Dennis R. Heldman
2. Fundamentals of Food Process Engineering" by Romeo T. Toledo
3. Food Engineering Fundamentals" by Theodora P. Tsarouhas

- a. **Course Name:** Technology of Cereals & Pulses
- b. **Course Code:** 03635211
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The course in Processing Technology of Cereals equips students with essential knowledge and skills to master the intricate processes involved in converting raw cereals into a diverse range of food products, crucial for meeting global demands in the food technology industry.
- e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding on the classification of different grains, understanding their characteristics and categorization.
CLOBJ 2	Understand the various processing methods and machinery employed in the milling of cereals, gaining practical insights into the cereal processing industry.
CLOBJ 3	Acquire knowledge on the production of value-added products derived from a variety of cereal grains, exploring diverse applications in the food industry.
CLOBJ 4	Comprehend the processes involved in the utilization of by-products from cereal and millet processing.

f. Course Learning Outcomes:

CLO 1	Appraise information about the classification of various grains.
CLO 2	Exposed to various processing methods and machinery used in milling of cereals.
CLO 3	Learn value added products from all cereal grains.
CLO 4	Understand about by-product processing of cereal and millets.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	2	3	20	-	20	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value;	16.67 %	5
2	Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling; Rice bran stabilization and its methods.	16.67 %	6
3	Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking.	20.00 %	6
4	Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches;	13.33 %	4
5	Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets.	16.67 %	6
6	By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.	16.67 %	5
Total		100%	32

i. Text Book and Reference Book:

1. Amalendu Chakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
2. Khalil Khan and Peter R. Shewry. 2009. Wheat: Chemistry and Technology, 4th Ed., AACC International, Inc., St. Paul, MN, USA.
3. Colin Wrigley. 2004. Encyclopedia of Grain Science. Academic Press, London, UK.
4. Elaine T. Champagne. 2004. Rice: Chemistry and Technology, 3rd Ed., AACC International, Inc., St. Paul, MN, USA.

- a. **Course Name:** Technology of Cereals & Pulses lab
- b. **Course Code:** 03635212
- c. **Prerequisite:** Knowledge of Chemistry and Mathematics up to 10th level.
- d. **Rationale:** The course in Processing Technology of Cereals equips students with essential knowledge and skills to master the intricate processes involved in converting raw cereals into a diverse range of food products, crucial for meeting global demands in the food technology industry.
- e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding on the classification of different grains, understanding their characteristics and categorization.
CLOBJ 2	Understand the various processing methods and machinery employed in the milling of cereals, gaining practical insights into the cereal processing industry.
CLOBJ 3	Acquire knowledge on the production of value-added products derived from a variety of cereal grains, exploring diverse applications in the food industry.
CLOBJ 4	Comprehend the processes involved in the utilization of by-products from cereal and millet processing.

f. Course Learning Outcomes:

CLO 1	Appraise information about the classification of various grains.
CLO 2	Exposed to various processing methods and machinery used in milling of cereals.
CLO 3	Learn value added products from all cereal grains.
CLO 4	Understand about by-product processing of cereal and millets.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Preparation of cereals-based food products
2	Preparation of idli and dosa
3	Demonstration of equipment used in dal milling
4	Study of dal milling process
5	Drying of cereals and pulses

- a. **Course Name:** Technology of Milk & Milk Products
- b. **Course Code:** 03635213
- c. **Prerequisite:** Basic knowledge of milk and milk products studied upto 10th
- d. **Rationale:** Understanding human nutrition in B. Tech Dairy Technology as it equips students with the knowledge to optimize dairy product development, ensuring the creation of nutritious and health-promoting dairy products for consumers.

e. Course Learning Objective:

CLOBJ 1	Demonstrate Proficiency in Dairy Processing Techniques
CLOBJ 2	Analyze and Optimize Dairy Product Quality
CLOBJ 3	Apply Quality Control Measures and Compliance Standards
CLOBJ 4	Innovate and Develop New Dairy Products

f. Course Learning Outcomes:

CLO 1	Evaluate the diverse composition and types of milk and milk products.
CLO 2	Summarize the various products derived from milk and outline their processing methods.
CLO 3	Describe the technology involved in the production of various frozen milk products.
CLO 4	Explain the different methods employed in the processing of milk.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	2	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Classification of dairy products; Butter: Definition, composition; processing and production steps, overrun, butter making machines, quality testing of table butter, butter-defects, causes and their prevention, packaging and storage;	16.67 %	05

2	Butter oil and ghee: Definition, composition, processing, equipment, quality tests	16.67 %	05
3	Paneer and Cheese: Definition, composition, types, processing steps, process flow diagram, equipment, quality defects, causes and prevention, packaging and storage	16.67 %	05
4	Ice cream and frozen desserts: Definition, composition, types, processing steps and flow diagram, equipment, quality testing, defects causes and prevention, packaging and storage.	16.67 %	06
5	Condensed and Dried milk: Definition, composition, role of milk constituents in condensed milk, manufacture of condensed milk, types of standards for dried milk, manufacture of SMP and WMP using roller and spray drying, instantization, recent developments in drying, quality testing, defects, causes and prevention, packaging and storage;	16.67 %	06
6	Traditional Indian Dairy Products: Definitions, compositions, processing, packaging, storage, equipment and quality testing; By- products of dairy industry and their utilization.	16.67 %	05
Total		100%	32

i. Text Book and Reference Book:

1. Adnan Y. Tamime. 2009. Milk Processing and Quality Management. Blackwell Publishing Ltd., UK.
2. Kanekanian. 2014. Milk and Dairy Products as Functional Foods. John Wiley & Sons, Ltd., UK.
3. Pieter Walstra, Jan T.M. Wouters, Tom J. Geurts. 2006. Dairy Science and Technology, 2nd Ed. CRC Press, Boca Raton, FL, USA.
4. Sukumar De. 2005. Outlines of Dairy Technology. Oxford University Press, New Delhi.

- a. Course Name:** Technology of Milk & Milk Products lab
- b. Course Code:** 03635214
- c. Prerequisite:** Basic knowledge of milk and milk products studied upto 10th
- d. Rationale:** Understanding human nutrition in B. Tech Dairy Technology as it equips students with the knowledge to optimize dairy product development, ensuring the creation of nutritious and health-promoting dairy products for consumers.

e. Course Learning Objective:

CLOBJ 1	Demonstrate Proficiency in Dairy Processing Techniques
CLOBJ 2	Analyze and Optimize Dairy Product Quality
CLOBJ 3	Apply Quality Control Measures and Compliance Standards
CLOBJ 4	Innovate and Develop New Dairy Products

f. Course Learning Outcomes:

CLO 1	Evaluate the diverse composition and types of milk and milk products.
CLO 2	Summarize the various products derived from milk and outline their processing methods.
CLO 3	Describe the technology involved in the production of various frozen milk products.
CLO 4	Explain the different methods employed in the processing of milk.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Preparation of khoa from cow, buffalo and concentrated milk
2	Preparation of burfi and Peda
3	Preparation of paneer from cow, buffalo and mixed milk
4	Preparation of channa and rasogolla from cow and buffalo milk and mixed milk.
5	Preparation of Sandesh

6	Preparation of rabri
7	Preparation of khoa from cow, buffalo and concentrated milk
8	Preparation of burfi and Peda

i. Text Book and Reference Book:

5. Adnan Y. Tamime. 2009. Milk Processing and Quality Management. Blackwell Publishing Ltd., UK.
6. Kanekanian. 2014. Milk and Dairy Products as Functional Foods. John Wiley & Sons, Ltd., UK.
7. Pieter Walstra, Jan T.M. Wouters, Tom J. Geurts. 2006. Dairy Science and Technology, 2nd Ed. CRC Press, Boca Raton, FL, USA.
8. Sukumar De. 2005. Outlines of Dairy Technology. Oxford University Press, New Delhi.

- a. **Course Name:** Fruits and Vegetable Technology
- b. **Course Code:** 03635215
- c. **Prerequisite:** Knowledge of chemistry and Mathematics up to 10th level.
- d. **Rationale:** The course in Processing Technology of Fruits and Vegetables in diploma Food Technology is significant for imparting students with the specialized knowledge and practical skills necessary to optimize and innovate fruit and vegetable processing methods, ensuring quality, safety, and market competitiveness in the food industry.

e. Course Learning Objective:

CLOBJ 1	Develop a comprehensive understanding of the physical, chemical, and biological characteristics of various fruits and vegetables.
CLOBJ 2	Learn principles and techniques of post-harvest handling to minimize losses and maintain the quality of fruits and vegetables during storage and transportation.
CLOBJ 3	Acquire knowledge of various processing technologies for fruits and vegetables, including cleaning, sorting, grading, blanching, canning, freezing, drying, and juicing.
CLOBJ 4	Understand packaging materials, techniques, and storage conditions suitable for different processed fruit and vegetable products to extend shelf life.

f. Course Learning Outcomes:

CLO 1	Demonstrate a comprehensive understanding of various processing methods employed in the food industry for fruits and vegetables.
CLO 2	Acquire the skills needed to implement quality assurance protocols in fruit and vegetable processing.
CLO 3	Learn basic sciences of Minimal processing of fruits and vegetables.
CLO 4	Showcase the ability to develop innovative products from fruits and vegetables.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India;	20%	6
2	Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables; Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables;	20%	7
3	Minimal processing of fruits and vegetables; Blanching operations and equipment; Canning: Definition, processing steps, and equipment, cans and containers, quality assurance and defects in canned products;	20%	6
4	FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products; FSSAI specifications;	20%	6
5	Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and marmalades, candies, Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, lather, dehydrated, wafers and papads, soup powders; Production of pectin and vinegar; Commercial processing technology of selected fruits and vegetables for production of various value added processed products.	20%	7
Total		100%	32

i. Text Book and Reference Book:

1. U.D. Chavan and J.V. Patil. 2013. Industrial Processing of Fruits and Vegetables. Astral International Pvt. Ltd., New Delhi.
2. S. Rajarathnam and R.S. Ramteke. 2011. Advances in Preservation and Processing Technologies of Fruits and Vegetables. New India Publishing Agency, New Delhi.
3. Y.H. Hui. 2006. Handbook of Fruits and Fruit Processing. Blackwell Publishing Ltd., Oxford, UK.
4. W.V. Cruess. 2004. Commercial Fruit and Vegetable Products. Agrobios India, Jodhpur

- a. **Course Name:** Fruits and Vegetable Technology lab
- b. **Course Code:** 03635216
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The course in Processing Technology of Fruits and Vegetables in diploma Food Technology is significant for imparting students with the specialized knowledge and practical skills necessary to optimize and innovate fruit and vegetable processing methods, ensuring quality, safety, and market competitiveness in the food industry.

e. Course Learning Objective:

CLOBJ 1	Develop a comprehensive understanding of the physical, chemical, and biological characteristics of various fruits and vegetables.
CLOBJ 2	Learn principles and techniques of post-harvest handling to minimize losses and maintain the quality of fruits and vegetables during storage and transportation.
CLOBJ 3	Acquire knowledge of various processing technologies for fruits and vegetables, including cleaning, sorting, grading, blanching, canning, freezing, drying, and juicing.
CLOBJ 4	Understand packaging materials, techniques, and storage conditions suitable for different processed fruit and vegetable products to extend shelf life.

f. Course Learning Outcomes:

CLO 1	Demonstrate a comprehensive understanding of various processing methods employed in the food industry for fruits and vegetables.
CLO 2	Acquire the skills needed to implement quality assurance protocols in fruit and vegetable processing.
CLO 3	Learn basic sciences of Minimal processing of fruits and vegetables.
CLO 4	Showcase the ability to develop innovative products from fruits and vegetables.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Examination of fresh fruits and vegetables for processing
2	Pre– Packaging of Fresh fruits and vegetables, modified atmosphere packaging, controlled atmosphere packaging.
3	Canning of fruits and vegetables.
4	Preparation and analysis of syrups and Brines
5	Experimental dehydration of fruits and vegetables.
6	Thermal process evaluation for low and high acid canned foods
7	Freezing of fruits and vegetables
8	Visit to a fruits and vegetables processing industry.

- a. **Course Name:** Technology of Meat, Fish & Poultry Products
- b. **Course Code:** 03635217
- c. **Prerequisite:** Knowledge of chemistry and Mathematics up to 10th level.
- d. **Rationale:** The course in Processing of Meat and Poultry Products in diploma Food Technology is significant for equipping students with specialized knowledge and skills essential for the efficient and hygienic processing of meat and poultry, ensuring quality, safety, and compliance with industry standards in the food production sector.
- e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the physical, chemical, and microbiological characteristics of different meat and poultry products.
CLOBJ 2	Learn techniques for evaluating and selecting quality carcasses based on factors such as size, fat content, and meat colour.
CLOBJ 3	Acquire knowledge of various processing technologies, including cutting, grinding, curing, smoking, marinating, and cooking for meat and poultry products.
CLOBJ 4	Implement quality control measures throughout the processing chain to ensure the safety, nutritional value, and sensory attributes of meat and poultry products.

f. Course Learning Outcomes:

CLO 1	Understand the Sources and importance of meat and poultry
CLO 2	Increase the basic knowledge of Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives.
CLO 3	Explain in detail regarding Eggs: Structure, composition, quality characteristics, processing, preservation of eggs
CLO 4	Able to develop new and innovative meat and poultry products, considering factors such as flavour profiles, texture, packaging, and market trends to meet consumer demands and preferences.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Sources and importance of meat and poultry; Status of Meat and poultry industry in India;	10%	5
2	Pre- slaughter operations and slaughtering operations for animals and poultry; Evaluation of animal carcasses; Factors affecting post-mortem changes, properties and shelf life of meat; Mechanical deboning, grading and aging; Eating and cooking quality of meat;	30%	9
3	Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives; Meat tenderization; Meat emulsions; Meat cutting and handling; Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation; Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation; Preparation, preservation and equipment for manufacture of meat sausages and their quality evaluation; Abattoir design and layout;	30%	9
4	Eggs: Structure, composition, quality characteristics, processing, preservation of eggs; Processing and preservation of poultry meat and chicken patties; Meat plant sanitation and safety; By-products of meat, poultry and eggs and their utilization; Safety standards in meat industry: HACCP/ISO/MFPO/FSSAI/Kosher/Halal	30%	9
Total		100%	32

i. Text Book and Reference Book:

1. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing House Pvt. Ltd., New Delhi.
2. B.D. Sharma and Kinshuki Sharma. 2011. Outlines of Meat Science and Technology. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
3. Fidel Toldrá, Y. H. Hui, Iciar Astiasarán, Wai-Kit Nip, Joseph G. Sebranek, Expedito-Tadeu F. Silveira, Louise H. Stahnke, Régine Talon. 2007. Handbook of Fermented Meat and Poultry. Blackwell Publishing Professional, Ames, Iowa, USA.
4. Joseph Kerry, John Kerry and David Ledward. 2005. Meat Processing-Improving Quality. Woodhead Publishing Ltd., Cambridge, England.

- a. **Course Name:** Technology of Meat, Fish & Poultry Products lab
- b. **Course Code:** 03635218
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The course in Processing of Meat and Poultry Products in diploma Food Technology is significant for equipping students with specialized knowledge and skills essential for the efficient and hygienic processing of meat and poultry, ensuring quality, safety, and compliance with industry standards in the food production sector.
- e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of the physical, chemical, and microbiological characteristics of different meat and poultry products.
CLOBJ 2	Learn techniques for evaluating and selecting quality carcasses based on factors such as size, fat content, and meat colour.
CLOBJ 3	Acquire knowledge of various processing technologies, including cutting, grinding, curing, smoking, marinating, and cooking for meat and poultry products.
CLOBJ 4	Implement quality control measures throughout the processing chain to ensure the safety, nutritional value, and sensory attributes of meat and poultry products.

f. Course Learning Outcomes:

CLO 1	Understand the Sources and importance of meat and poultry
CLO 2	Increase the basic knowledge of Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives.
CLO 3	Explain in detail regarding Eggs: Structure, composition, quality characteristics, processing, preservation of eggs
CLO 4	Able to develop new and innovative meat and poultry products, considering factors such as flavour profiles, texture, packaging, and market trends to meet consumer demands and preferences.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

5. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing House Pvt. Ltd., New Delhi.
6. B.D. Sharma and Kinshuki Sharma. 2011. Outlines of Meat Science and Technology. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
7. Fidel Toldrá, Y. H. Hui, Iciar Astiasarán, Wai-Kit Nip, Joseph G. Sebranek, Expedito-Tadeu F. Silveira, Louise H. Stahnke, Régine Talon. 2007. Handbook of Fermented Meat and Poultry. Blackwell Publishing Professional, Ames, Iowa, USA.
8. Joseph Kerry, John Kerry and David Ledward. 2005. Meat Processing-Improving Quality. Woodhead Publishing Ltd., Cambridge, England.

i. Experiment List:

Sr. NO.	Experiment List
1	1. Demonstration of slaughtering and different cuts in meat at a slaughter house.
2	2. Preparation of different types of meat products and their quality evaluation
3	3. Cutting of meat and preparation of sausages.
4	4. Calculation of shape and size index of egg.
5	5. Determination of specific gravity of eggs.
6	6. Candling and grading of eggs
7	7. Preservation of whole egg
8	8. Visit to slaughter houses and abattoir

- a. **Course Name:** Professional Communication and Critical Thinking
- b. **Course Code:** 03693203
- c. **Prerequisite:** Zeal to learn
- d. **Rationale:** The course in Professional Communication and Critical Thinking in B Tech Food Technology is pivotal for equipping students with effective communication abilities and fostering personal development, essential for successful collaboration, leadership, and professional growth in the food industry.

e. Course Learning Objective:

CLOBJ 1	Develop the ability to articulate ideas clearly and concisely in both written and verbal communication.
CLOBJ 2	Cultivate the ability to build and maintain positive relationships with peers, colleagues, and superiors.
CLOBJ 3	Develop a professional online presence, including effective use of email, social media, and other digital communication tools.
CLOBJ 4	Explore techniques for building self-confidence and overcoming public speaking anxiety.

f. Course Learning Outcomes:

CLO 1	Speak and participate in oral organizational communication
CLO 2	Use of technology to facilitate efficient interpersonal communication
CLO 3	Effective use of verbal & non-verbal communication for delivering a business presentation
CLO 4	Understand soft skills required for professional growth

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	1	-	1	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Story Mason :Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	5%	1
2	Determiners, Articles, and Interrogatives: This session will enable students to understand proper usage of Determiners and Articles. It will also enhance their daily speaking conversational/ communication skills. Preparation of verbal section in company's aptitude exam.	10%	6
3	Subject-Verb Agreement: This will enable students to understand the formation of sentence with the usage of subject-verb agreement.	10%	3
4	Reading-Skill Building :Types of Reading – reading for different purposes An Astrologer's Day-Malgudi Days Enhance reading skills by collecting information, know the importance of reading.	10%	2
5	Reading Comprehension :Learn to solve the reading comprehension questions in an easy manner and also in less amount of time Introduction, Factual & Inferential comprehension, Reasons for Poor Comprehension Able to solve reading comprehension in less amount of Time by practicing.	10%	2
6	Mafia the art of Observation and Convincing The interesting activity is targeted toward improving observation and convincing skills. A team activity in which every single Individual is a very important person of his team to win.	5%	1
7	Direct and Indirect Speech: This session will enable students to understand proper usage of narration.	10%	3
8	Industry Expectation: In this class the students will be made to understand what will be the world after their college life will be, how they should prepare themselves from that competitive world with full of challenges for them.	5%	1
9	Reflection of an object into a mirror and water. It is obtained by inverting an object laterally (mirror) & vertically (water).	10%	3
10	Sentence Correction: It will also enhance their daily speaking conversational/communication skills. Preparation of verbal section in company's aptitude exam.	5%	2
11	Play Teacher: Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	5%	1
12	Professional Writing : Email and report.	5%	3
13	Group Discussion: It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	10%	3
Total		100%	32

i. Text Book and Reference Book:

1. Mamatha Bhatnagar and Nitin Bhatnagar. 2011. Effective Communication and So" Skills. Person Education.
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication Principles and Practice
3. Harold Wallace and Ann Masters. Personality Development. Cengage Publishers.
4. Andrea J. Rutherford. Basic Communication Skills for Technology. Pearson Education.

Semester 4

- a. **Course Name:** Crop Production Technology
- b. **Course Code:** 03635259
- c. **Prerequisite:** Knowledge of Biology up to 10th level.
- d. **Rationale:** Crop Production Technology subject is significant as it equips students with essential knowledge and skills in the cultivation and management of crops, fostering an understanding of agricultural practices crucial for ensuring a sustainable and quality supply of raw materials for food processing industries.

e. Course Learning Objective:

CLOBJ 1	Distinguish the production technology of various types of fruits and vegetables.
CLOBJ 2	Interpret the effect of different weather parameters on crop growth and development
CLOBJ 3	Calculate the maturity index, yield potential, cost of cultivation, etc.
CLOBJ 4	Solve the sowing time for major varieties.

f. Course Learning Outcomes:

CLO 1	Differentiate between the production techniques for various fruits and vegetables.
CLO 2	Comprehend the impact of diverse weather parameters on crop growth and development.
CLO 3	Calculate maturity index, yield potential, and cost of cultivation.
CLO 4	Determine optimal sowing times for major crop varieties.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Classification of crops; Effect of different weather parameters on crop growth and development.	6 %	2
2	Principles of tillage; Soil-water-plant relationship, crop rotation.	3 %	1
3	Cropping systems, relay cropping, and mixed cropping.	6 %	2
4	Crop production technology for major cereal crops viz., paddy, wheat, maize, pearl millet, sorghum, etc.;	9 %	3
5	Major varieties, sowing time, method of sowing, spacing, inter- culturing, fertilizer, and water requirement.	9 %	3
6	Time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc.;	9 %	3
7	Crop production technology for major oilseed crops viz., groundnut, sesame, rapeseed, mustard, castor, etc.:	9 %	3
8	Crop production technology for major pulse crops viz., pigeon pea, cowpea, gram, green gram, black gram, etc.:	6 %	2
9	Crop production technology for major spices and cash crops viz., cumin, coriander, fennel, ginger, garlic, sugarcane, etc.	6 %	3
10	Horticulture: Scope of horticultural crops. Soil and climatic requirements for fruits and vegetables, nursery raising and management;	10 %	3
11	Crop production technology for major fruit crops viz., mango, banana, sapota, aonla, pomegranate, guava, etc.:	6 %	2
12	Crop production technology for major vegetable crops viz., potato, onion, tomato, chili.	9 %	3
13	Crop production technology for other green and leafy vegetables:	3 %	2
Total		100%	32

i. Text Book and Reference Book:

1. Principles of Agronomy" by Reddy T. Yellamanda, G. H. Shankar, and S. R. Anantha Singh
2. S. Prasad and U. Kumar. 2010. Principles of Horticulture. Agrobios, New Delhi.
3. T. Yellamanda Reddy and G.H. Shankar Reddy. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
4. S.S. Singh. Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana.

- a. **Course Name:** Crop Production Technology lab
- b. **Course Code:** 03635260
- c. **Prerequisite:** Knowledge of Biology up to 10th level.
- d. **Rationale:** Crop Production Technology subject is significant as it equips students with essential knowledge and skills in the cultivation and management of crops, fostering an understanding of agricultural practices crucial for ensuring a sustainable and quality supply of raw materials for food processing industries.

e. Course Learning Objective:

CLOBJ 1	Distinguish the production technology of various types of fruits and vegetables.
CLOBJ 2	Interpret the effect of different weather parameters on crop growth and development
CLOBJ 3	Calculate the maturity index, yield potential, cost of cultivation, etc.
CLOBJ 4	Solve the sowing time for major varieties.

f. Course Learning Outcomes:

CLO 1	Differentiate between the production techniques for various fruits and vegetables.
CLO 2	Comprehend the impact of diverse weather parameters on crop growth and development.
CLO 3	Calculate maturity index, yield potential, and cost of cultivation.
CLO 4	Determine optimal sowing times for major crop varieties.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

5. T. Yellamanda Reddy and G.H. Shankar Reddy. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
6. S.S. Singh. Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana.

7. S. Prasad and U. Kumar. 2010. Principles of Horticulture. Agrobios, New Delhi
8. Principles of Agronomy" by Reddy T. Yellamanda, G. H. Shankar, and S. R. Anantha Singh

i. Course Content:

Sr. NO.	Experiment List
1	Introduction to different equipment utilized in a weather observatory
2	Identification of seeds of different agricultural crops and their varieties
3	Identification of different weeds and methods of their control
4	Study of water requirement of different crops
5	Judging maturity time for harvesting of the crop
6	Identification and description of important fruit and vegetable crops.
7	Study of different garden tools
8	Practices of pruning and training in some important fruit crops

- a. Course Name:** Food Preservation and Additives
- b. Course Code:** 03635261
- c. Prerequisite:** Knowledge of Chemistry and Mathematics up to 10th level.
- d. Rationale:** The subject of Food Additives and Preservatives is integral for diploma in Food Technology students as it acquaints them with essential knowledge of substances added to foods to enhance their safety, flavor, texture, and shelf life.
- e. Course Learning Objective:**

CLOBJ 1	Understand the role of food additives.
CLOBJ 2	Explain the purpose, Outline methodologies and Discuss regulatory frameworks and guidelines concerning the use and safety evaluation of food additives.
CLOBJ 3	Differentiate between different types of food additives based on their chemical properties and functions.
CLOBJ 4	Evaluate the feasibility and potential impact of implementing novel additive-based strategies in food production.
CLOBJ 5	Construct informed arguments advocating for or against the use of additives based on scientific evidence and societal needs.

f. Course Learning Outcomes:

CLO 1	Develop the additives in maintaining or improving food quality
CLO 2	Explain applications of food additives and how to study the toxicity of food additives
CLO 3	Develop the properties, levels of addition and toxicity data of various food additives
CLO 4	Identify and design newer products, with better quality using additives which are economical and safe
CLO 5	Analyze the importance of additives in maintaining or improving food quality

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Intentional and unintentional food additives, their toxicology and safety evaluation; Naturally occurring food additives	25%	8
2	Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), pigments and their importance and utilization as food color; Processing of natural and artificial food colorants	25%	8
3	Food preservatives and their chemical action. Role and mode of action of salts, chelating agents, stabilizers and thickeners; Humectants/polyhydric alcohol, anti- caking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners	25%	8
4	Production of enzymes, leavening agents, fat substitutes, flavor and taste enhancers in food processing; Acidity regulators; Emulsifiers.	25%	8
Total		100%	32

i. Text Book and Reference Book:

1. Branen AL, Davidson PM & Salminen S. (2001). Food Additives. 2nd Ed. Marcel Dekker.
2. George AB. (1996). Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. George AB. (2004). Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4. Madhavi DL, Deshpande SS & Salunkhe DK. (1996). Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker.
5. Morton ID & Macleod AJ. (1990). Food Flavours. Part A, B & C. Elsevier.
6. Nakai S & Modler HW. (2000). Food Proteins: Processing Applications. Wiley VCH.
7. Stephen AM. (2006). Food Polysaccharides and Their Applications. Marcel Dekker

- a. Course Name:** Food Additives and Preservatives lab
- b. Course Code:** 03635262
- c. Prerequisite:** Knowledge of science up to 10th level.
- d. Rationale:** The subject of Food Additives and Preservatives is integral for Diploma in Food Technology students as it acquaints them with essential knowledge of substances added to foods to enhance their safety, flavor, texture, and shelf life.
- e. Course Learning Objective:**

CLOBJ 1	Understand the role of food additives. Analyze different categories. Evaluate the impact.
CLOBJ 2	Explain the purpose, Outline methodologies and Discuss regulatory frameworks and guidelines concerning the use and safety evaluation of food additives.
CLOBJ 3	Differentiate between different types of food additives based on their chemical properties and functions.
CLOBJ 4	Evaluate the feasibility and potential impact of implementing novel additive-based strategies in food production.
CLOBJ 5	Construct informed arguments advocating for or against the use of additives based on scientific evidence and societal needs.

f. Course Learning Outcomes:

CLO 1	Develop the additives in maintaining or improving food quality
CLO 2	Explain applications of food additives and how to study the toxicity of food additives
CLO 3	Develop the properties, levels of addition and toxicity data of various food additives
CLO 4	Identify and design newer products, with better quality using additives which are economical and safe
CLO 5	Analyze the importance of additives in maintaining or improving food quality

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	2	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content

Sr. NO.	Experiment List
1	Methods of Sampling
2	Concept of shelf life of different foods.
3	To study the concept of Asepsis and sterilization
4	Determination of pH of different foods using pH meter
5	Study quality characteristics of foods preserved by drying/dehydration/ freezing
6	To perform pasteurization of fluids using different methods.
7	To perform blanching of different plant foods.

- a. **Course Name:** Nutraceuticals and Functional Foods
- b. **Course Code:** 03635263
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The rationale of Nutraceuticals and Functional Foods is to explore the health-promoting properties of bioactive food components and their role in preventing diseases, enhancing nutrition, and improving overall well-being, bridging the gap between nutrition and medicine.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the concepts, definitions, and classifications of nutraceuticals and functional foods.
CLOBJ 2	To explore the bioactive compounds in foods and their role in promoting health and preventing diseases.
CLOBJ 3	To analyze the scientific evidence supporting the health benefits of functional foods and nutraceuticals.
CLOBJ 4	To examine the regulatory, safety, and market aspects of developing and promoting nutraceuticals and functional foods.
CLOBJ 5	To understand the concepts, definitions, and classifications of nutraceuticals and functional foods.

f. Course Learning Outcomes:

CLO 1	Demonstrate a clear understanding of the principles, classifications, and applications of nutraceuticals and functional foods.
CLO 2	Identify and evaluate bioactive compounds in foods and their potential health benefits in disease prevention.
CLO 3	Assess the scientific evidence and mechanisms underlying the efficacy of nutraceuticals and functional foods.
CLO 4	Understand the regulatory, safety, and marketing challenges associated with the development and commercialization of nutraceutical products.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basic definition, function, classification and dietary sources of foods, nutrition and dietetics Concept of malnutrition, health, immunity by food and functions of food. Classification of macronutrients and micronutrients. Definition and classification of functional foods and nutraceuticals; Assessment of safety and efficacy of functional foods and ingredients; Legal requirements and stability testing	20%	7
2	Definition, Definition, classification and role of nutraceuticals. Introduction to chemistry of prebiotics and probiotics as functional foods. Effect of nutraceuticals on health and prevention of diseases. Beneficiary microbes and their metabolism for improving health	20%	7
3	Nutraceuticals :Sources, types and bioavailability of probiotics, prebiotics, bioactive peptides, bioactive lipids, phytochemicals, bioactive vitamins and minerals. Functional foods for immune, intestinal, bone and brain health. Functional foods for cancer, diabetes, cardiovascular disorders, osteoporosis, other inflammatory conditions, and obesity.	20%	7
4	Nutritional principals of adaptation during special circumstances of weather, professions and diseases. Nutrition for industrial Nutritional principals of adaptation during special circumstances of weather, professions and diseases. Nutrition for industrial	20%	7
5	Nutrition for high physical work. Nutrition in space Nutrition for high physical work. Nutrition for extreme weather conditions. Sports nutrition. Introduction to novel foods, functional foods and organic foods. Principles of convenience foods. Beneficial and harmful effects of genetically modified food. Textured and nano foods	20%	6
Total		100%	32

i. Text Book and Reference Book:

1. Handbook of Nutraceuticals and Functional Foods" by Robert E.C. Wildman
2. Nutraceuticals: Efficacy, Safety, and Toxicity" by Ramesh C. Gupta
3. Functional Foods: Principles and Technology" by M. Naushad Khan and Javed A. Khan
4. Functional Foods and Nutraceuticals" by Rotimi Aluko

- a. **Course Name: Food Fermentation Technology**
- b. **Course Code: 03635265**
- c. **Prerequisite:** Knowledge of science up to 10th level
- d. **Rationale:** The rationale of **Food Fermentation Technology** is to understand the principles and applications of microbial fermentation processes in the production of diverse food products, enhancing their safety, flavor, texture, and nutritional value while exploring sustainable food processing solutions.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the scientific principles underlying microbial fermentation processes in food production.
CLOBJ 2	To explore the role of microorganisms in the development of fermented foods and beverages.
CLOBJ 3	To learn about the industrial processes and technologies used in large-scale food fermentation.
CLOBJ 4	To analyze the impact of fermentation on food safety, quality, and nutritional enhancement.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate an understanding of the principles and processes involved in food fermentation.
CLO 2	Identify and evaluate the role of microorganisms in the production and quality of fermented foods and beverages.
CLO 3	Apply knowledge of fermentation technology to design and optimize industrial fermentation processes.
CLO 4	Analyze the effects of fermentation on food safety, sensory properties, and nutritional value.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	Preparation of inoculum for large scale propagation: Microbiology in fermentation :Industrially important cultures, Media- composition, Types of Raw Material, Inoculums Development for industrial fermentations, Criteria for transfer of Inoculums.	20%	7
2	Microbial enzymes :Microbial Production of enzymes: Fundamentals and Techniques	16%	5
3	Design of a fermentor :Body construction: construction material, Temperature controls, Aeration and agitation systems, Stirrer glands and bearings, Baffles, Valves and steam traps, Pressure-control valves	16%	5
4	Sterilization: Calculation of del factor, Calculation of holding time at constant temperature, Scale up of batch sterilization	16%	5
5	Aeration & Agitation: Oxygen requirement, Oxygen supply	16%	5
6	Alcoholic Beverages: Definition, Types, wines, whisky, Champagne, etc. Industrial process for wine production.	16%	5
Total		100%	32

i. Text Book and Reference Book:

1. "Fundamentals of Food Fermentation" by Ronald W. Hutkins.
2. "Microbiology and Technology of Fermented Foods" by Robert W. Hutkins.
3. "Industrial Microbiology and Biotechnology" by Michael J. Waites, Neil L. Morgan, John S. Rockey, and Gary Higton.
4. "Handbook of Fermented Functional Foods" by Edward R. Farnworth.

- a. **Course Name: Food Fermentation Technology lab**
- b. **Course Code: 03635266**
- c. **Prerequisite:** Knowledge of science up to 10th level
- d. **Rationale:** The rationale of **Food Fermentation Technology** is to understand the principles and applications of microbial fermentation processes in the production of diverse food products, enhancing their safety, flavor, texture, and nutritional value while exploring sustainable food processing solutions.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the scientific principles underlying microbial fermentation processes in food production.
CLOBJ 2	To explore the role of microorganisms in the development of fermented foods and beverages.
CLOBJ 3	To learn about the industrial processes and technologies used in large-scale food fermentation.
CLOBJ 4	To analyze the impact of fermentation on food safety, quality, and nutritional enhancement.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate an understanding of the principles and processes involved in food fermentation.
CLO 2	Identify and evaluate the role of microorganisms in the production and quality of fermented foods and beverages.
CLO 3	Apply knowledge of fermentation technology to design and optimize industrial fermentation processes.
CLO 4	Analyze the effects of fermentation on food safety, sensory properties, and nutritional value.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	0	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	To determine the type of gas produced by yeast during fermentation
2	To prepare cabbage based traditionally fermented food: Sauerkraut.
3	To study the effect of agitation on microbial growth in batch fermentation
4	To study the sugar utilization patterns by microorganisms
5	To screen starch hydrolytic microorganisms from given sample.
6	To study given culture for its starter activity
7	To prepare fermented vegetable pickle

- a. **Course Name: Beverage Manufacturing Technology**
- b. **Course Code: 03635267**
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The rationale of **Beverage Manufacturing Technology** is to understand the scientific, technological, and engineering principles involved in the production, processing, and quality assurance of beverages, enabling the development of safe, high-quality, and innovative products for diverse consumer needs.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and processes involved in the production of various alcoholic and non-alcoholic beverages.
CLOBJ 2	To learn about the raw materials, formulation, and equipment used in beverage manufacturing.
CLOBJ 3	To explore techniques for ensuring quality control, safety, and shelf life in beverage production.
CLOBJ 4	To study advancements in packaging, preservation, and sustainability in the beverage industry.

e. **Course Learning Outcomes:**

CLO 1	Demonstrate an understanding of the key processes involved in the production of various types of beverages.
CLO 2	Apply knowledge of raw materials, formulations, and production techniques to design and develop beverage products.
CLO 3	Analyze and implement quality control measures to ensure safety, consistency, and shelf life in beverage manufacturing.
CLO 4	Evaluate the impact of packaging, preservation methods, and sustainability practices on beverage production and distribution.

f. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

g. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	status of beverage industry in India and globally. Types of bottled water – mineral water, spring water, flavored water, carbonated water. Packaged drinking water – manufacturing process, raw and processed water, water treatment. Quality standards of bottled and packaged water	20%	7
2	Carbonated and non-carbonated beverages: beverage ingredients and their functions – sweeteners, bulking agents, acidulants, flavourings, preservatives.	16%	5
3	Concentrated beverages: ingredients, processing techniques, and standards. Carbonated beverages - ingredients, processing techniques, and standards. Fruit- and vegetable-based beverages – ingredients, processing techniques, and standards	16%	5
4	Synthetic beverages: ingredients, processing techniques, and standards. Beverages used in the sports industry – types, ingredients, processing techniques, and standards	16%	5
5.	Distillation and Distilled Liquors: whisky, rum, gin, vodka, brandy	16%	5
6	Fermentation and Fermented Alcohols: wine, ciders, sake. Carbonated Alcohols – beer, champagne.	16%	5
Total		100%	32

h. Text Book and Reference Book:

1. "The Technology of Wine Making" by M. E. J. McIntyre.
2. "Technology of Fruit and Vegetable Processing" by A. Y. Tamime.
3. "Handbook of Beverage Production" by Zeki Berk.
4. "Brewing: Science and Practice" by D. G. H. Smith.

- a. **Course Name:** Beverage Manufacturing Technology lab
- b. **Course Code:** 03635268
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The rationale of **Beverage Manufacturing Technology** is to understand the scientific, technological, and engineering principles involved in the production, processing, and quality assurance of beverages, enabling the development of safe, high-quality, and innovative products for diverse consumer needs.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and processes involved in the production of various alcoholic and non-alcoholic beverages.
CLOBJ 2	To learn about the raw materials, formulation, and equipment used in beverage manufacturing.
CLOBJ 3	To explore techniques for ensuring quality control, safety, and shelf life in beverage production.
CLOBJ 4	To study advancements in packaging, preservation, and sustainability in the beverage industry.

i. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of the key processes involved in the production of various types of beverages.
CLO 2	Apply knowledge of raw materials, formulations, and production techniques to design and develop beverage products.
CLO 3	Analyze and implement quality control measures to ensure safety, consistency, and shelf life in beverage manufacturing.
CLO 4	Evaluate the impact of packaging, preservation methods, and sustainability practices on beverage production and distribution.

j. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	0	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

e. Experiment List:

Sr. NO.	Experiment List
1.	Preparation of Non-Carbonated Beverages
2.	Preparation and Evaluation of Wine.
3.	Estimation of Sulphur Dioxide in Beverages
4.	Estimation of Ascorbic Acid Content of Commercial Juices
5.	Estimation of Phenolic Content in Beverages
6.	Analysis of Mineral Content of Bottled Water
7.	Analysis of Nutrient Content in Sports Drinks

- a. **Course Name: Post Harvest Engineering**
- b. **Course Code: 03635269**
- c. **Prerequisite:** Knowledge of maths up to 10th standard.
- d. **Rationale:** The rationale of **Post-Harvest Engineering** is to apply engineering principles to optimize the handling, processing, storage, and transportation of harvested crops, minimizing losses, maintaining quality, and ensuring the efficient use of resources to meet food supply and sustainability goals.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and technologies involved in the handling, storage, and processing of agricultural produce after harvest.
CLOBJ 2	To study methods for minimizing post-harvest losses and maintaining the quality of food products.
CLOBJ 3	To learn about the design and operation of equipment used in post-harvest processing and storage.
CLOBJ 4	To explore sustainable practices and innovations in post-harvest management for improved efficiency and reduced waste.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of post-harvest handling, storage, and processing techniques to reduce losses and maintain product quality.
CLO 2	Analyze the principles and applications of equipment used in post-harvest operations for various crops.
CLO 3	Apply sustainable practices and innovative technologies to enhance the efficiency of post-harvest systems.
CLO 4	Evaluate and implement strategies to improve the shelf life, safety, and marketability of agricultural produce.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Overview of post harvest technology: Concept and science, production and post harvest losses, reasons for losses, importance of loss reduction; Water activity, water binding and its effect on enzymatic and non-enzymatic reactions and food texture, control of water activity and moisture; Post Harvest Handling operations	20%	6
2	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; Sorting and grading: 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; Separation: Magnetic separator, destoners, electrostatic separators, pneumatic separator; 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	20%	6
3	Grain drying theory, grain dryers; Liquid dryers; Parboiling: process, changes during parboiling, parboiling methods, advantages and disadvantages of parboiling with respect to milling, nutritional and cooking quality of grain, significance of glass transition temperature; Milling: milling, polishing, grinding, milling equipments, dehuskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers, machine efficiency and power requirement; Materials handling: Introduction to different conveying equipments used for handling of grains, fruits and vegetables; 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	30%	11
4	Bucket elevator :Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt	30%	9

	speed, pickup and bucket discharge, buckets types; Pneumatic conveying system: Capacity and power requirement, types, air/product separators; Gravity conveyor design considerations, capacity and power requirement		
Total		100%	32

i. Text Book and Reference Book:

1. Postharvest Technology of Horticultural Crops" by Adel A. Kader.
2. "Engineering Properties of Foods" by M.A. Rao, Syed S.H. Rizvi, and Ashim K. Datta.
3. "Postharvest: An Introduction to the Physiology and Handling of Fruits and Vegetables" by R. Wills, T. Lee, D. Graham, and W. McGlasson.
4. "Principles and Practices of Postharvest Handling and Processing of Fruits and Vegetables" by A.K. Thompson.

- a. **Course Name: Post Harvest Engineering lab**
- b. **Course Code: 03635270**
- c. **Prerequisite:** Knowledge of maths up to 10th standard.
- d. **Rationale:** The rationale of **Post-Harvest Engineering** is to apply engineering principles to optimize the handling, processing, storage, and transportation of harvested crops, minimizing losses, maintaining quality, and ensuring the efficient use of resources to meet food supply and sustainability goals.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and technologies involved in the handling, storage, and processing of agricultural produce after harvest.
CLOBJ 2	To study methods for minimizing post-harvest losses and maintaining the quality of food products.
CLOBJ 3	To learn about the design and operation of equipment used in post-harvest processing and storage.
CLOBJ 4	To explore sustainable practices and innovations in post-harvest management for improved efficiency and reduced waste.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of post-harvest handling, storage, and processing techniques to reduce losses and maintain product quality.
CLO 2	Analyze the principles and applications of equipment used in post-harvest operations for various crops.
CLO 3	Apply sustainable practices and innovative technologies to enhance the efficiency of post-harvest systems.
CLO 4	Evaluate and implement strategies to improve the shelf life, safety, and marketability of agricultural produce.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	0	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Study of cleaners for grains; Study of washers for fruits and vegetables
2	Study of graders for grains; Study of graders for fruits and vegetables
3	Study of decorticators; Study of a maize/ sunflower sheller
4	Study of crop dryers; Study of a RF/MW/tray dryer
5	Study of a RF/MW/tray dryer; Study of hot air dryer and modelling drying kinetics
6	Study of vacuum dryer and modelling drying kinetics
7	Study of working principle of spray dryer and spray drying process
8	Study of drum dryer and liquid food dehydration using drum drying
9	Study of fluidized bed dryer and drying process
10	Study of freeze dryer and freeze drying process
11	Study of rice milling machines
12	Study of pulse milling machines
13	Study of different components of flour mill
14	Study of different materials handling equipment

a. Course Name: Bakery and Confectionary Technology

b. Course Code: 03635271

c. Prerequisite: Knowledge of science up to 10th level.

d. Rationale: The rationale of **Bakery and Confectionary Technology** is to equip students with knowledge of the science, techniques, and equipment involved in the production of bakery and confectionery products, focusing on quality, innovation, and meeting consumer demands while ensuring food safety and sustainability.

e. Course Learning Objective:

CLOBJ 1	To understand the raw materials, ingredients, and their functional properties in bakery and confectionery products.
CLOBJ 2	To study the processes, techniques, and equipment used in the production of bakery and confectionery items.
CLOBJ 3	To explore methods for ensuring quality control, safety, and shelf life in bakery and confectionery manufacturing.
CLOBJ 4	To develop skills for innovation and product development in the bakery and confectionery industry.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of raw materials, ingredients, and their functional roles in bakery and confectionery products.
CLO 2	Apply appropriate techniques and processes for the production of high-quality bakery and confectionery items.
CLO 3	Implement quality control measures and ensure food safety and shelf life in bakery and confectionery manufacturing.
CLO 4	Develop innovative and sustainable products to meet consumer demands in the bakery and confectionery industry.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Materials for BakingWheat varieties, wheat milling, by products of wheat milling, desirable qualities of white wheat flour, grades of white wheat flour, Yeast, leaveners and shortenings, Types of yeast, properties, leavening agents their role and types, role of shortening and forms used in bakery, Emulsifiers and antioxidants, sweeteners and malt syrup, Role of emulsifiers and antioxidants and their types, kinds of sweeteners used in bakery, Methods of manufacture of syrups and their properties, Ingredients from milk and eggs: Introduction, role and types, Other ingredients: Vegetables and nuts, spices, flavours and colours.	35%	10
2	Bread Formulation and ProcessingIngredients, details of manufacturing steps like fermentation, proofing, baking, packing, Defects in bread: Details of different defects like physical, microbiological etc, their causes and prevention	17%	6
3	Cake Formulation and ProcessingIngredients, details of manufacturing steps, types of cakes, defects-their causes and prevention.	13%	4
4	Products Leavened with ChemicalsIntroduction method of manufacture of biscuit, types of biscuit and manufacturing details of cookies and crackers.	16%	5
5	Chocolate ConfectioneryCocoa processing, details of confectionery manufacture.	12%	4
6	Sugar ConfectioneryIntroduction of raw materials like cane sugar, liquid glucose etc, classification of sugar confectionery, Processing of hard-boiled candy.	7%	4
Total		100%	32

i. Text Book and Reference Book:

1. NIIR Board of Consultants & Engineers. 2014. The Complete Technology Book on Bakery Products (Baking Science with Formulation & Production), 3rd Ed. NIIR, New Delhi.
2. Peter P. Grewling. 2013. Chocolates & Confections, 2nd Ed. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
3. E.J. Pyler and L.A. Gorton. 2009. Baking Science & Technology, Vol. II: Formulation & Production, 4 th Ed. Sosland Publishing Company, Kansas City, MO, USA.
4. E.J. Pyler and L.A. Gorton. 2008. Baking Science & Technology, Vol. I: Fundamentals & Ingredients, 4th Ed. Sosland Publishing Company, Kansas City, MO, USA.
5. Y.H. Hui. 2007. Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.

- a. **Course Name: Bakery and Confectionary Technology Lab**
- b. **Course Code: 03635272**
- c. **Prerequisite:** Knowledge of science up to 10th level.
- d. **Rationale:** The rationale of **Bakery and Confectionary Technology** is to equip students with knowledge of the science, techniques, and equipment involved in the production of bakery and confectionery products, focusing on quality, innovation, and meeting consumer demands while ensuring food safety and sustainability.

e. Course Learning Objective:

CLOBJ 1	To understand the raw materials, ingredients, and their functional properties in bakery and confectionery products.
CLOBJ 2	To study the processes, techniques, and equipment used in the production of bakery and confectionery items.
CLOBJ 3	To explore methods for ensuring quality control, safety, and shelf life in bakery and confectionery manufacturing.
CLOBJ 4	To develop skills for innovation and product development in the bakery and confectionery industry.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of raw materials, ingredients, and their functional roles in bakery and confectionery products.
CLO 2	Apply appropriate techniques and processes for the production of high-quality bakery and confectionery items.
CLO 3	Implement quality control measures and ensure food safety and shelf life in bakery and confectionery manufacturing.
CLO 4	Develop innovative and sustainable products to meet consumer demands in the bakery and confectionery industry.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Introduction to bakery equipment's
2	Determination of ash content of the given sample of white wheat flour.
3	Estimation of water absorption power and gluten content of the given flour
4	Determination of alcoholic acidity of the given sample of wheat flour
5	Determination of sedimentation value of white wheat flour
6	Determination of yeast quality by its dough rising capacity
7	Preparation of plain biscuit in laboratory
8	Preparation of egg less cake
9	Preparation of bread by straight dough method
10	Preparation of brown bread

a. Course Name: Food Microbiology

b. Course Code: 03635273

c. Prerequisite: Knowledge of science up to 10th standard.

d. Rationale: The rationale of **Food Microbiology** is to study the role of microorganisms in food systems, focusing on their impact on food safety, spoilage, fermentation, and preservation, to ensure the production of safe, high-quality, and nutritious food products.

e. Course Learning Objective:

CLOBJ 1	Recognize and characterize various microbial hazards commonly associated with food, including bacteria, viruses, fungi, and parasites
CLOBJ 2	Acquire knowledge about specific foodborne pathogens
CLOBJ 3	Develop proficiency in laboratory techniques used to isolate, enumerate, and identify microorganisms present in food samples
CLOBJ 4	learn to critically evaluate food safety practices and control measures
CLOBJ 5	Apply principles of food microbiology to implement quality assurance programs in food production, processing, and distribution.

f. Course Learning Outcomes:

CLO 1	Understanding about Importance and significance of microbes in food science.
CLO 2	Study the Microbial spoilage of foods Factors affecting kinds, numbers, growth and survival of microorganisms in foods.
CLO 3	Acquire the basic knowledge of Contamination of foods; Sources of contamination, microbiology of milk, meat, egg, sugar, spice, and other food products.
CLO 4	Learn Shelf-life requirements and calculation of the shelf-life.
CLO5	Explain Food borne intoxications and infections types of food involved, toxicity and symptoms.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Importance and significance of microbes in food science;	10%	3
2	Microbial spoilage of foods Factors affecting kinds, numbers, growth and survival of microorganisms in foods; Intrinsic factors; pH, water activity, nutrients etc., Extrinsic factors: Relative humidity, temperature, gaseous atmosphere; Chemical changes caused by microorganisms: Changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances;	20%	7
3	Contamination of foods; Sources of contamination, Genera of bacteria, Maintenance of anaerobic conditions; Asepsis, removal of microorganisms; Intermediate moisture foods; Microbiology of milk and milk products; Microbiology of fruits and vegetables, Microbiology of cereal and cereal products, Microbiology of meat and meat products, Microbiology of fish and other sea foods; Microbiology of poultry and eggs; Microbiology of sugar and sugar products; Microbiology of salts and spices, Microbiology of canned foods	30%	9
4	Shelf life: Calculation of shelf life, Shelf-life requirements, deteriorative reactions, accelerated testing; Simulations of product: Package environment interaction, shelf life simulation for moisture, oxygen, and light sensitive products;	20%	6
5	Food borne intoxications and infections types of food involved, toxicity and symptoms, chemical properties, environmental conditions; Food borne viruses: Polio, hepatitis A & E, noroviruses, rota viruses, prion diseases, types of food involved, toxicity and symptoms, chemical properties, environmental conditions.	20%	7
Total		100%	32

i. Text Book and Reference Book:

1. Martin R. Adams and Maurice O. Moss. 2008. Food Microbiology, 3rd Ed., 2e Royal Society of Chemistry, Cambridge, UK.
2. James M. Jay. 2000. Modern Food Microbiology, 6th Ed. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.

3. George J. Banwart. 1989. Basic Food Microbiology, 2nd Ed. Chapman & Hall, New York, USA.
4. William C. Frazier and & Dennis C. Westhoff. 1987. Food Microbiology, 4th Ed. Tata McGrawHill Education, New Delhi.

- a. Course Name:** Food Microbiology lab
- b. Course Code:** 03635274
- c. Prerequisite:** Knowledge of science up to 10th standard.
- d. Rationale:** The rationale of **Food Microbiology** is to study the role of microorganisms in food systems, focusing on their impact on food safety, spoilage, fermentation, and preservation, to ensure the production of safe, high-quality, and nutritious food products.
- e. Course Learning Objective:**

CLOBJ 1	Recognize and characterize various microbial hazards commonly associated with food, including bacteria, viruses, fungi, and parasites
CLOBJ 2	Acquire knowledge about specific foodborne pathogens
CLOBJ 3	Develop proficiency in laboratory techniques used to isolate, enumerate, and identify microorganisms present in food samples
CLOBJ 4	learn to critically evaluate food safety practices and control measures
CLOBJ 5	Apply principles of food microbiology to implement quality assurance programs in food production, processing, and distribution.

f. Course Learning Outcomes:

CLO 1	Understanding about Importance and significance of microbes in food science.
CLO 2	Study the Microbial spoilage of foods Factors affecting kinds, numbers, growth and survival of microorganisms in foods.
CLO 3	Acquire the basic knowledge of Contamination of foods; Sources of contamination, microbiology of milk, meat, egg, sugar, spice, and other food products.
CLO 4	Learn Shelf-life requirements and calculation of the shelf-life.
CLO5	Explain Food borne intoxications and infections types of food involved, toxicity and symptoms.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. No.	Experiment List
1	Isolation of bacteria and molds from foods;
2	Microbial examination of cereal and cereal products: Identification, isolation and confirmation;
3	Microbial examination of vegetable and fruits: Identification, isolation and confirmation;
4	Microbial examination of meat and meat products: Identification, isolation and confirmation;
5	Microbial examination of fish and other sea foods: Identification, isolation and confirmation;
6	Microbial examination of eggs and poultry: Identification, isolation and confirmation;
7	Microbial examination of milk and milk products: Identification, isolation and confirmation;
8	Microbial examination of sugar, salts and spices:
9	Microbial examination of canned products: Identification, isolation and confirmation;
10	Determination and enumeration of pathogenic and indicator organisms in foods (Coliform/ Enterococcus);
11	Thermal death time determination;
12	Detection of Salmonella from food sample;
13	Detection of coliforms from water by MPN method;
14	Detection of <i>Staphylococcus aureus</i> from food sample.

- a. Course Name:** Employability Skills
- b. Course Code:** 03693251
- c. Prerequisite:** Zeal to learn
- d. Rationale:** Acquiring soft skills, life skills & aptitude skills are crucial for organizational communication as well as for employability respectively.
- e. Course Learning Objective:**

CLOBJ 1	Articulate compelling arguments, employing critical thinking and logical reasoning in various contexts, and demonstrate effective communication to persuade and convey ideas convincingly.
CLOBJ 2	Develop the ability to set clear goals, maintain focus on the present task, and communicate work with completeness, precision, and clarity in accessible language.
CLOBJ 3	Foster analytical reasoning skills and problem-solving abilities, enabling students to approach challenges with a systematic and critical mindset.
CLOBJ 4	Acquire and express emotional intelligence, demonstrating an understanding of etiquette, thereby contributing to the development of higher IQ and effective interpersonal relationships.
CLOBJ 5	Exhibit proficiency in team building and collaboration, while also gaining insights into future-oriented planning and guidance.
CLOBJ 6	Develop proficiency in abstract reasoning, coding, decoding, and effective communication in both verbal and non-verbal forms, contributing to enhanced problem-solving and interpersonal skills.

f. Course Learning Outcomes:

CLO 1	Learn about soft skills and activity-based sessions to increase students' reasoning and persuasion.
CLO 2	Organize goal setting, attention towards present the work, complete, precise and easy to understand language.
CLO 3	Understand the critical thinking, logical reasoning and their problem-solving ability
CLO 4	Express analytical reasoning, learning of etiquette, emotional intelligence to build higher IQ.
CLO 5	Demonstration of team building & team work, future guidance.
CLO 6	Focuses on abstract reasoning, Coding & Decoding (Verbal & non-verbal) Communication.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	0	1	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Who gets the heart? Introductory session for the students about soft-skills and an activity-based session intended to improve students' reasoning and convincing skill.	5 %	2
2	Goal Setting Students will learn to set their short term & long-term goal.	5 %	2
3	Attention to details Students will able to capture every minute detail and present the work in a clear, complete, precise and easy to understand language.	7 %	2
4	Critical thinking students will be able to think out-of-the-box to solve various problems and to assess the effectiveness of the opposing argument to test the validity of the proposition	5 %	2
5	Logical reasoning Students will able to think logically when it comes to their problem-solving ability	6 %	2
6	Data arrangement (Analytical reasoning) To help students to acquire skill in analytical reasoning & Implementation of some tricks to do the same.	5 %	3
7	Workplace Etiquette. Students will learn about Dress Etiquette, Cubical Etiquette, and Telephone Etiquette.	5 %	2
8	Emotional Intelligence Student will be able to build high IQ after analysing their IQ.	5 %	2
9	Advanced Listening skills Demonstrate ability to listen more than two minutes audio clips & solve questions based on it.	10 %	2
10	Team-Building & Team work To help students to understand importance of team building & how to work along with team.	10 %	2
11	Abstract Reasoning Students will learn how to measure their abstract reasoning ability & how we can improve the same to reason logically. Generally, abstract reasoning tests measure non-verbal	10 %	2

	abilities		
12	Coding & Decoding (Verbal & non-verbal) Students will learn to improve verbal & non-verbal ability to understand how to crack basic puzzles.	5 %	2
13	Future Guidance (Opportunities after successful completion of dairy technology course)	5 %	1
14	Personal Interview with Resume Session based on Personal Interview (Basics), Personal Interview (Advanced), Mock session	15 %	4
Total		100 %	32

i. Text Book and Reference Book:

1. Communication Skills by Kumar S and Lata P | New Delhi Oxford University Press
2. Business Correspondence and Report Writing By SHARMA, R. AND MOHAN, K.
3. Practical English Usage by MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student by F.T. WOOD
5. On Writing Well by William Zinsser | Harper Paperbacks, 2006 | 30th anniversary edition
6. Quantitative Aptitude for Competitive Examinations by Dr. R.S. Aggarwal

Semester 5

- a. **Course Name:** Entrepreneurship and Start Up
- b. **Course Code:** 03604327
- c. **Prerequisite:** Knowledge of 10th level.
- d. **Rationale:** Entrepreneurship and Start Up in Diploma food Technology empowers students to drive advancements in dairy processes while fostering a mindset for entrepreneurial ventures in the dynamic dairy industry.

e. Course Learning Objective:

CLOBJ 1	Develop a comprehensive understanding of innovative technologies and methodologies in dairy processing.
CLOBJ 2	Acquire the skills necessary to identify and assess opportunities for entrepreneurial ventures within the dairy industry, including market analysis, business planning, and financial management.
CLOBJ 3	Foster a creative and innovative mindset by engaging in hands-on projects and case studies that encourage students to explore novel solutions to challenges in dairy technology, thereby promoting a culture of continuous improvement.
CLOBJ 4	Cultivate effective communication and collaboration skills to work within interdisciplinary teams.

f. Course Learning Outcomes:

CLO 1	Study the concept of entrepreneurship development, globalization and the emerging business/ entrepreneurial environment.
CLO 2	Acquire the knowledge of SWOT analysis and recognize the policies of Export and Import relevant to dairy sector.
CLO 3	Classification of assessment related to entrepreneurial skills and also observation of industrial consultancy.
CLO 4	Recruitment and training of manpower and compose the feasibility reports.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	0	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Innovation and Entrepreneurship: Definition, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, covers the various stages of setting up and growing an entrepreneurial firm.	13 %	2
2	Design Thinking: Design Thinking, Design-Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Double diamond theory.	13 %	2
3	Ideation: Ideation, Opportunity Identification, factors determining competitive advantage, Market segment, market structure, Idea validation.	14 %	2
4	Value Proposition: Value proposition, Business Model Canvas, Lean Canvas Model, developing an Effective Business Model.	24 %	4
5	Testing, Validation, and Commercialization: Testing, Validation, and Commercialization; covers the concepts of Minimum viable Product (MVP)	18 %	3
6	Technological Innovation and Entrepreneurship: Technological Innovation and Entrepreneurship; focusses on technology as a key driver of successful start-up and sustainable ramp up.	18 %	3
Total		100 %	16

i. Text Book and Reference Book:

1. Dairy Processing and Quality Assurance by Ramesh C. Chandan and Arun Kilara
2. Entrepreneurship: Theory, Process, and Practice by Donald F. Kuratko and Jeffrey S. Hornsby
3. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries
4. Innovation and Entrepreneurship: Practice and Principles by Peter F. Drucker
5. Dairy Science and Technology by P. Walstra, T. J. Geurts, A. Noman, A. Jellema, and M. A. J. S. van Boekel

- a. Course Name:** Marketing management and International Trade
- b. Course Code:** 03604331
- c. Prerequisite:** Knowledge of Mathematics up to 10th level.
- d. Rationale:** Marketing Management and International Trade in Diploma food Technology equips students with vital skills to navigate global dairy markets, fostering expertise in strategic marketing and trade practices crucial for industry competitiveness and sustainable growth.

e. Course Learning Objective:

CLOBJ 1	Develop the ability to analyse global dairy markets, including consumer behaviour, market trends, and competitive landscapes, to inform strategic decision-making.
CLOBJ 2	Acquire skills in formulating effective marketing strategies tailored to diverse dairy products, considering cultural, economic, and regulatory variations in international markets
CLOBJ 3	Learn about international trade rules, agreements, and frameworks affecting dairy commerce to navigate trade barriers and restrictions.
CLOBJ 4	Understand and apply brand management principles specific to the dairy industry, including brand positioning, product differentiation, and brand equity enhancement strategies

f. Course Learning Outcomes:

CLO 1	Understand marketing, market structure, and customer buying habits.
CLO 2	Study the market measurement- present and future demand, marketing planning processes.
CLO 3	Learn the organization of product policy, planning and advertising
CLO 4	Decide composition & new plan for direction of Indian exports.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Concept of marketing: Functions of marketing; concepts of marketing management; scope of marketing management; marketing management. Process; concepts of marketing- mix, elements of marketing- mix.	16	5
2	Market Structure and Consumer Buying Behaviour Concept of market structure, marketing environment, micro and macro environments. Consumers buying behaviour, consumerism.	16	5
3	Marketing Opportunities Analysis Marketing research and marketing information systems; Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning. Allocation and marketing resources. Marketing Planning Process.	16	5
4	Product policy and planning Product-mix; product line; product life cycle. New product development process. Product brand, packaging, services decisions. Marketing channel decisions. Retailing, wholesaling and distribution. Pricing Decisions. Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry. Promotion-mix decisions.	17	5
5	Advertising How advertising works; Deciding advertising objectives, advertising budget and advertising message; Media Planning; Personal Selling, Publicity; Sales Promotion. Food and Dairy Products Marketing. International Marketing and International Trade. Salient features of International Marketing	17	5
6	Composition & direction of Indian exports: Trends in International Dairy Trade, International marketing environment; Deciding which & how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization; World Trade Organization (WTO)	18	7
Total		100 %	32

i. Text Book and Reference Book:

- 1) Global Marketing Management by Warren J. Keegan and Mark C. Green
- 2) International Marketing by Cateora, Gilly, and Graham
- 3) Export/Import Procedures and Documentation by Donna L. Bade

a. Course Name: Food Packaging Technology

b. Course Code: 03635311

c. Prerequisite: Knowledge of basic food science upto 10th std.

d. Rationale: Food Packaging Technology and Equipment is a crucial subject because it delves into the intricate methods and tools used to preserve, protect, and deliver food products to consumers. Understanding this field is essential as it ensures the safety, shelf life, and quality of food items, integrating knowledge of materials, machinery, and regulations.

e. Course Learning Objective:

CLOBJ 1	Identify and classify various types of packaging materials commonly used in the food industry.
CLOBJ 2	Formulate creative and sustainable packaging solutions.
CLOBJ 3	Investigate how package properties impact food conversion processes and packaging techniques.
CLOBJ 4	Utilize standardized methods to measure chemical properties (e.g., barrier properties, material composition) of packaging materials.
CLOBJ 5	Examine the design principles behind laminates and their application in enhancing packaging functionality.
CLOBJ 6	Apply knowledge of production, shaping, and printing techniques to optimize packaging design and functionality.

f. Course Learning Outcomes:

CLO 1	Describe the role and function of packaging materials used for a range of consumer food needs and wants.
CLO 2	Design solutions to packaging problems.
CLO 3	Relate the properties of food packages to conversion technologies, processing and packaging technologies and user requirements including safety, convenience and environmental issues.
CLO 4	Measure and evaluate the chemical, physical and mechanical properties of packages and packaging.
CLO 5	Analyse the principles and practices of laminates, active packaging materials and edible films.
CLO 6	Describe the technology involved in the production, shaping and printing of

	various packaging materials and packages.
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g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to subject, Packaging situations in world and India, need of packaging, plastic consumption/use in world, India etc. package requirements, package functions, hazards acting on package during transportation, storage and atmospheric package, labelling laws	20.00 %	6
2	classification packages, paper as package material its manufacture, types, advantages, corrugated and paper board boxes etc. Glass as package material, manufacture, advantages, disadvantages, metal as package material- manufacture, advantages, disadvantages, aluminium as package material, Its advantages and disadvantages, plastic as package material, classification of polymers, properties, uses and chemistry of each plastic such as polyethylene, polypropylene, polystyrene, polycarbonate, PVC, PVDC, cellulose acetate, nylon etc.	23.33 %	7
3	Lamination, Coating and Aseptic packaging: Lamination, need of lamination, types, properties, advantages & disadvantages of each type. coating on paper & films, types of coatings, need of coating, methods of coatings, Biodegradable and edible packaging, aseptic packaging- need, advantages, process, comparison of conventional & aseptic packaging. system of aseptic packaging and materials used in aseptic packaging machineries used in packing foods. Permeability – theoretical consideration permeability of gases and vapours, permeability of	20.00 %	7

	multilayer packages, permeability in relation to products.		
4	Packaging of specific foods with its properties like bread, biscuits coffee, milk powder, carbonated beverages snack foods	20.00 %	6
5	Mechanical and functional tests on package Various mechanical functional testes perform in laboratories on package boxes andpackage materials	16.67 %	6
Total		100%	32

i. Text Book and Reference Book:

1. Gordon L. Robertson. 2010. Food Packaging and Shelf Life – A Practical Guide. CRC Press,
2. Boca Raton, FL, USA.
3. Jung H. Han. 2007. Packaging for Nonthermal Processing of Food. Blackwell Publishing Ltd., Oxford, UK.
4. Jung H. Han. 2005. Innovations in Food Packaging. Elsevier Science & Technology Books,
5. UK.
6. Richard Coles, Berek McDowell and Mark J. Kirwan. 2003. Food Packaging Technology.
7. Blackwell Publishing Ltd., Oxford, UK

- a. **Course Name: Food Packaging Technology lab**
- b. **Course Code: 03635312**
- c. **Prerequisite:** Knowledge of basic food science upto 10th std.
- d. **Rationale:** Food Packaging Technology and Equipment is a crucial subject because it delves into the intricate methods and tools used to preserve, protect, and deliver food products to consumers. Understanding this field is essential as it ensures the safety, shelf life, and quality of food items, integrating knowledge of materials, machinery, and regulations.
- e. **Course Learning Objective:**

CLOBJ 1	Identify and classify various types of packaging materials commonly used in the food industry.
CLOBJ 2	Formulate creative and sustainable packaging solutions.
CLOBJ 3	Investigate how package properties impact food conversion processes and packaging techniques.
CLOBJ 4	Utilize standardized methods to measure chemical properties (e.g., barrier properties, material composition) of packaging materials.
CLOBJ 5	Examine the design principles behind laminates and their application in enhancing packaging functionality.
CLOBJ 6	Apply knowledge of production, shaping, and printing techniques to optimize packaging design and functionality.

f. Course Learning Outcomes:

CLO 1	Describe the role and function of packaging materials used for a range of consumer food needs and wants.
CLO 2	Design solutions to packaging problems.
CLO 3	Relate the properties of food packages to conversion technologies, processing and packaging technologies and user requirements including safety, convenience and environmental issues.
CLO 4	Measure and evaluate the chemical, physical and mechanical properties of packages and packaging.
CLO 5	Analyse the principles and practices of laminates, active packaging materials and edible films.
CLO 6	Describe the technology involved in the production, shaping and printing of

	various packaging materials and packages.
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g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Identification of packaging materials
2	Measurement of thickness of packaging films, papers and boards
3	Measurement of water absorption of paper, paper boards
4	Measurement of bursting strength of paper of paper boards
5	Measurement tear resistance of papers
6	Measurement of puncture resistance of paper and paperboard
7	Measurement of tensile strength of paper of paper boards
8	Determination of gas transmission rate of package films
9	Determination of WVTR of films
10	Determination of coating on package materials
11	Tests for identification of plastic films
12	Prepackaging practices followed for packing of fruits and vegetables
13	visit to packaging industry

- a. **Course Name:** Food Analysis & Quality Control
- b. **Course Code:** 03635313
- c. **Prerequisite:** Knowledge of Chemistry up to 10th level.
- d. **Rationale:** The rationale of **Food Analysis and Quality Control** is to understand the principles, techniques, and standards used to evaluate the composition, quality, and safety of food products, ensuring compliance with regulatory requirements and consumer expectations.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and methods used in the chemical, physical, and microbiological analysis of food.
CLOBJ 2	To learn about the quality parameters and standards governing food products.
CLOBJ 3	To study the techniques and instruments used for detecting food adulteration and contaminants.
CLOBJ 4	To explore methods for ensuring food safety and compliance with regulatory frameworks.
CLOBJ 5	To develop skills for applying quality control techniques to maintain the consistency and reliability of food products.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate knowledge of analytical techniques used for determining the composition and quality of food products.
CLO 2	Identify and evaluate food contaminants, adulterants, and their impact on food safety and quality.
CLO 3	Apply regulatory standards and guidelines to ensure compliance in food production and processing.
CLO 4	Utilize modern instruments and methods for food analysis and quality assurance.
CLO 5	Develop and implement effective quality control measures to maintain product consistency and consumer trust.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1.	Food quality & its role in food industry & of quality	6%	2

	control ,factors affecting quality control		
2	Quality attributes dominant and hidden attributes	6%	3
3	Color-role of color in quality spectra, different types of color measure	6%	3
4	Viscosity-Types of fluids ,different viscometers to measure viscosity	6%	3
5	methods used to measure consistency or product difference between viscosity & consistency	12%	3
6	Minerals: Functions, sources, factors affecting absorption Defects- classification, genetic, physiological defects, structural and off colors Entomological defects, holes ,cars ,lesions, off coloring ,curled leaves, pathological defects, mechanical defects, extraneous or foreign material defect	10%	3
7	Measurement of defects-Improving visibility by dilution ,white background,color difference ,standardization of conditions,reference standards,counts and measures,isolation of defects by floatation,elution,electronic sorting,internal defects	5%	2
8	Texture-Classification,role ,firmness,yielding,quality,juiciness, Chewiness,fibrousness,griviness,mealiness,stickness, measurement of texture, Kinesthetic characteristics by compression,mechanical thumb ,puncture tester. Succulometer,shearing by tenbrometer,texturemeter,meaturometer,fibrometer.moisture content by barbender moisture tester ,alcohol insoluble solids,color	11%	3
9	Flavor-Definition and its role in food quality,Taste,classification and taste qualities, relative intensity ,reaction time ,effect of disease,temperature,taste medium on taste,Basic taste and interaction of taste,Odours-definition,classification,mechanisms,oilfactory abnormalities,odor testing,techniques,thresholds ,odor intensities	9%	3
10	Factors influencing the food qualities ;soil field practices,harvesting practices,packaging ,transportation ,storage conditions,,processing conditions of finished products	13%	4
11	Recording and reporting of quality	16%	3
Total		100%	32

i. Text Book and Reference Book:

1. Food Analysis" by S. Suzanne Nielsen.
2. "Handbook of Food Quality Assurance and Control" by S. S. Deshpande and M. S. Raghunath.

3. "Food Quality Assurance: Principles and Practices" by R. C. Haug and H. A. McEvily.
4. "Introduction to Food Analysis" by R. G. M. Olsson and M. D. King.

- a. **Course Name:** Food Analysis & Quality Control lab
- b. **Course Code:** 03635314
- c. **Prerequisite:** Knowledge of Chemistry up to 10th level.
- d. **Rationale:** The rationale of **Food Analysis and Quality Control** is to understand the principles, techniques, and standards used to evaluate the composition, quality, and safety of food products, ensuring compliance with regulatory requirements and consumer expectations.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the principles and methods used in the chemical, physical, and microbiological analysis of food.
CLOBJ 2	To learn about the quality parameters and standards governing food products.
CLOBJ 3	To study the techniques and instruments used for detecting food adulteration and contaminants.
CLOBJ 4	To explore methods for ensuring food safety and compliance with regulatory frameworks.
CLOBJ 5	To develop skills for applying quality control techniques to maintain the consistency and reliability of food products.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate knowledge of analytical techniques used for determining the composition and quality of food products.
CLO 2	Identify and evaluate food contaminants, adulterants, and their impact on food safety and quality.
CLO 3	Apply regulatory standards and guidelines to ensure compliance in food production and processing.
CLO 4	Utilize modern instruments and methods for food analysis and quality assurance.
CLO 5	Develop and implement effective quality control measures to maintain product consistency and consumer trust.

g. **Teaching & Examination Scheme:**

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Quality attributes of various food products
2	Quality evaluation of product for colors
3	Quality evaluation of product for size and shape
4	Determination of viscosity of food products
5	Determination of textural quality profile
6	Determination of color using lovibond tintometer
7	Testing of supertester for testing evaluation
8	Simple difference test for sensory evaluation
9	Directional difference test for sensory evaluation
10	Measurement of insect damage
11	Evaluation of food products as per standards
12	Descriptive testing for sensory evaluation of food products
13	Consumer study for food quality
14	Visit to fruit and vegetable market for quality assessment

a. Course Name: Waste Management in Food Industry

b. Course Code: 03635315

c. Prerequisite: Knowledge of food equipment's studied up to 10th std.

d. Rationale: The rationale of **Waste Management in the Food Industry** is to implement sustainable practices for minimizing, reusing, and recycling food waste, reducing environmental impact, conserving resources, and ensuring economic efficiency while maintaining food safety and quality standards in production processes.

e. Course Learning Objective:

CLOBJ 1	To understand the types of waste generated in the food industry and their environmental impact.
CLOBJ 2	To explore sustainable practices for minimizing food waste and optimizing resource utilization.
CLOBJ 3	To learn about recycling, waste treatment, and disposal methods suitable for food industry by-products.
CLOBJ 4	To analyze the regulatory and economic aspects of waste management and their implications for food industry operations.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of the types, sources, and environmental impact of waste in the food industry.
CLO 2	Apply sustainable practices to minimize food waste and improve resource efficiency in food production.
CLO 3	Evaluate and implement waste recycling, treatment, and disposal methods to ensure environmental compliance.
CLO 4	Assess the regulatory and economic considerations of waste management to improve the overall sustainability of food industry operations.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry.	13 %	5
2	Waste disposal methods – Physical, Chemical and Biological; Economical aspects of waste treatment and disposal	12%	2
3	ISO 14001 standards, necessity of food waste utilization	10%	3
4	Environmental legislation, treatment according to established standards and directives	10%	6
5	Biological composting, drying and incineration	12%	3
6	Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.	13%	3
7	Treatment methods for liquid wastes from food process industries primary, secondary and tertiary treatment Design of Activated Sludge Process Rotating Biological Contactors, Trickling Filters, UASB, Biogas Plant., Bio filters and Bio clarifiers Ion exchange treatment of waste water, Recovery of useful materials from effluents by different methods. Wastewater treatment of Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry	30%	8
Total		100%	32

i. Text Book and Reference Book:

1. "Waste Management in the Food Industry" by R. W. Field and M. L. Timmons.
2. "Handbook of Waste Management and Co-Product Recovery in Food Processing" by S. M. J. Jafari and M. N. R. Ashrafi.
3. "Sustainable Food Processing and Waste Management" by Vijay H. Borkar and V. R. Jadhav.

- a. **Course Name: Waste Management in Food Industry lab**
- b. **Course Code: 03635316**
- c. **Prerequisite:** Knowledge of food equipment's studied up to 10th std.
- d. **Rationale:** The rationale of **Waste Management in the Food Industry** is to implement sustainable practices for minimizing, reusing, and recycling food waste, reducing environmental impact, conserving resources, and ensuring economic efficiency while maintaining food safety and quality standards in production processes.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the types of waste generated in the food industry and their environmental impact.
CLOBJ 2	To explore sustainable practices for minimizing food waste and optimizing resource utilization.
CLOBJ 3	To learn about recycling, waste treatment, and disposal methods suitable for food industry by-products.
CLOBJ 4	To analyze the regulatory and economic aspects of waste management and their implications for food industry operations.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate an understanding of the types, sources, and environmental impact of waste in the food industry.
CLO 2	Apply sustainable practices to minimize food waste and improve resource efficiency in food production.
CLO 3	Evaluate and implement waste recycling, treatment, and disposal methods to ensure environmental compliance.
CLO 4	Assess the regulatory and economic considerations of waste management to improve the overall sustainability of food industry operations.

g. **Teaching & Examination Scheme:**

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List :

Sr. NO.	Experiment List
1	Identification of useful products from agricultural waste and food processing waste
2	Estimation of COD, BOD, TOD, TDS, sludge value, Fat, oil and grease
3	Extraction of banana fiber
4	Extraction of leaf proteins
5	Alcohol production from molasses.
6	Use of crop residues for the production of cellulose.
7	Use of mango kernels for starch manufacture.
8	Extraction of protein from oil cake. Soap formation from free fatty acids
9	Extraction of oil from wheat germ. Rice bran utilization for edible grade oil extraction. Protein extraction from deoiled rice bran. Extraction of oil from corn germ.
10	Preparation of beverages from whey. Preparation of toffee/pinni from ghee

a. Course Name: Instrumentations and Process Control

b. Course Code: 03635317

c. Prerequisite: Knowledge of general maths studied upto 10th std.

d. Rationale: The rationale of **Instrumentations and Process Control** is to understand and apply the principles of measurement, automation, and control systems in food processing, ensuring efficient, consistent, and safe production processes while optimizing quality, energy usage, and resource management.

e. Course Learning Objective:

CLOBJ 1	To understand the principles and techniques of instrumentation used in food processing.
CLOBJ 2	To learn about the various types of sensors and control systems used for monitoring and controlling food production processes.
CLOBJ 3	To explore the integration of automation and control systems in optimizing food manufacturing efficiency and product quality.
CLOBJ 4	To develop the ability to design, implement, and troubleshoot process control systems in food technology applications.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of the key instruments and sensors used in food processing for measurement and control.
CLO 2	Apply control system principles to optimize food production processes and improve product consistency and quality.
CLO 3	Analyze and troubleshoot process control systems to ensure the efficiency and safety of food manufacturing operations.
CLO 4	Design and implement automation systems in food technology to enhance process control and resource management.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Instruments and measurement system: Instruments and measurement system	16.67%	5
2	Classification and selection of instruments: Classification and selection of instruments Classification and selection of instruments: Classification and selection of instruments	16.67%	5
3	Characteristics of instruments and measurement systems -Characteristics of instruments and measurement systems: Characteristics of instruments and measurement systems	16.67%	5
4	Induction type indicating instruments: Induction type indicating instruments Induction type indicating instruments: Induction type indicating instruments	16.67%	6
5	Transducers: Transducers Transducers: Transducers	16.67%	6
6	Process control: Process control Process control: Process control	16.67%	5
Total		100%	32

i. Text Book and Reference Book:

1. "Food Process Engineering and Technology" by Zeki Berk.
2. "Process Control: A Practical Approach" by Myke King.
3. "Instrumentation and Control Systems" by W. Bolton.
4. "Food Engineering: Integrated Approaches" by Christophe P. Champagne, E. S. N. Murthy, and Michael D. M. Thomas.

- a. Course Name: Instrumentations and Process Control lab**
- b. Course Code: 03635318**
- c. Prerequisite:** Knowledge of general maths studied upto 10th std.
- d. Rationale:** The rationale of **Instrumentations and Process Control** is to understand and apply the principles of measurement, automation, and control systems in food processing, ensuring efficient, consistent, and safe production processes while optimizing quality, energy usage, and resource management.
- e. Course Learning Objective:**

CLOBJ 1	To understand the principles and techniques of instrumentation used in food processing.
CLOBJ 2	To learn about the various types of sensors and control systems used for monitoring and controlling food production processes.
CLOBJ 3	To explore the integration of automation and control systems in optimizing food manufacturing efficiency and product quality.
CLOBJ 4	To develop the ability to design, implement, and troubleshoot process control systems in food technology applications.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of the key instruments and sensors used in food processing for measurement and control.
CLO 2	Apply control system principles to optimize food production processes and improve product consistency and quality.
CLO 3	Analyze and troubleshoot process control systems to ensure the efficiency and safety of food manufacturing operations.
CLO 4	Design and implement automation systems in food technology to enhance process control and resource management.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Strain gauge characteristics and weight measurement.
2	Measurement of pressure using bellows and diaphragm.
3	Preparation and calibration of thermocouple
4	Study the construction and working of Bourden pressure gauge.
5	Test and calibration of pressure gauges using dead weight tester
6	Study the mechanism of pH meter and its electrodes.
7	Study a Proximity sensor.
8	Study the different parts and working of pressure switch.
9	Study the different parts of an indicating instrument
10	Study of RTD and Thermister.
11	Study of different speed measurement sensor/ instruments.
12	Study of LVDT
13	Study of level / flow controller
14	Study of PLC.
15	Visit to a automatic controlled dairy plant

a. Course Name: Technology of Oils and Fats

b. Course Code: 03635319

c. Prerequisite: Students should have basic knowledge of science up to 10th std.

d. Rationale: The rationale of **Technology of Oils and Fats** is to understand the extraction, processing, and refinement of edible oils and fats, emphasizing their role in nutrition, food applications, and the development of innovative, high-quality, and sustainable fat-based products.

e. Course Learning Objective:

CLOBJ 1	To understand the sources, composition, and properties of edible oils and fats.
CLOBJ 2	To learn the techniques for the extraction, processing, and refinement of oils and fats.
CLOBJ 3	To study the role of oils and fats in food formulations and their nutritional significance.
CLOBJ 4	To explore quality control, safety standards, and innovations in the production and application of oils and fats.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of the sources, properties, and composition of edible oils and fats.
CLO 2	Apply appropriate techniques for the extraction, processing, and refinement of oils and fats.
CLO 3	Evaluate the role of oils and fats in food products, including their nutritional and functional significance.
CLO 4	Implement quality control measures and adhere to safety standards in the production and application of oils and fats.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Physico-chemical aspects of fats and oils :Chemical composition, Physical properties, Factors affecting physical properties	10%	3
2	Lipid deterioration: Lipolysis. Factors affecting oxidation. Thermal oxidation of fats and oils. Photosensitized oxidation, Autoxidation.	10%	4
3	Role of lipids in food flavor	16.67%	5
4	Processing of fats and oils : Extraction,Refining	16.67%	6
5	Physical modification (Fractionation, winterization). Chemical modification (Hydrogenation, esterification)	13.33%	4
6	Vegetable oils. Vegetable fats. Animal oils. Animal fats. Fat substitutes	13.33%	4
7	Composition and identity. Tests for adulteration, Fats and oils functionality Palatability, safety, Distinction between functional and nutraceutical.Omega-e polyunsaturated fatty acids.	20%	6
Total		100%	32

i. Text Book and Reference Book:

1. "Bailey's Industrial Oil and Fat Products" by Fereidoon Shahidi.
2. "Edible Oil Processing" by Wolf Hamm, Richard J. Hamilton, and Gijs Calliauw.
3. "The Chemistry and Technology of Edible Oils and Fats" by A. Karleskind.
4. "Food Oils and Fats: Technology, Utilization, and Nutrition" by H. B. Wescott.

a. Course Name: Technology of Oils and Fats Lab

b. Course Code: 03635320

c. Prerequisite: Students should have basic knowledge of science up to 10th std.

d. Rationale: The rationale of **Technology of Oils and Fats** is to understand the extraction, processing, and refinement of edible oils and fats, emphasizing their role in nutrition, food applications, and the development of innovative, high-quality, and sustainable fat-based products.

e. Course Learning Objective:

CLOBJ 1	To understand the sources, composition, and properties of edible oils and fats.
CLOBJ 2	To learn the techniques for the extraction, processing, and refinement of oils and fats.
CLOBJ 3	To study the role of oils and fats in food formulations and their nutritional significance.
CLOBJ 4	To explore quality control, safety standards, and innovations in the production and application of oils and fats.

f. Course Learning Outcomes:

CLO 1	Demonstrate knowledge of the sources, properties, and composition of edible oils and fats.
CLO 2	Apply appropriate techniques for the extraction, processing, and refinement of oils and fats.
CLO 3	Evaluate the role of oils and fats in food products, including their nutritional and functional significance.
CLO 4	Implement quality control measures and adhere to safety standards in the production and application of oils and fats.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Determination of the Acid value in fats and oils using titration
2	Analysis of Saponification Value of fats and oils using alkaline hydrolysis
3	Estimation of peroxide value in oils as a indicator of Oxidative Rancidity .
4	Determination of iodine value to asses to degree of unsaturation in fats and oils
5	Boudouin test for ghee adulteration detection
6	Measurement of smoke point of different cooking oils using of hot plate or bunsen burner

- a. Course Name:** Sensory Evaluation of Food Products
- b. Course Code:** 03635321
- c. Prerequisite:** Knowledge of general food science.
- d. Rationale:** The rationale of Sensory Evaluation of Food Products is to understand and apply scientific methods for assessing the sensory characteristics of food, such as appearance, taste, aroma, texture, and overall acceptability, ensuring the development of high-quality products that meet consumer preferences and market demands.

e. Course Learning Objective:

CLOBJ 1	To understand the principles and importance of sensory evaluation in food product development and quality assurance.
CLOBJ 2	To learn various sensory evaluation methods and techniques for assessing food attributes such as taste, texture, aroma, and appearance.
CLOBJ 3	To develop skills in designing and conducting sensory tests, including data collection and statistical analysis.
CLOBJ 4	To explore the role of consumer preferences and sensory perception in driving food product innovation and acceptance.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of sensory evaluation principles and their application in food quality and product development.
CLO 2	Apply sensory testing techniques to assess attributes such as taste, texture, aroma, and appearance in food products.
CLO 3	Analyze sensory evaluation data using appropriate statistical tools to make informed decisions about food quality and consumer preferences.
CLO 4	Develop and optimize food products based on sensory analysis and consumer feedback to meet market demands.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction :Definition and importance of sensory evaluation in relation to consumer acceptability and economic aspects. Design and requirements of a sensory evaluation laboratory. Basic principles: senses and sensory perception. Fundamental rules for scoring and grading of milk and milk products. Procedure and types of tests - difference tests (Paired comparison, due- trio, triangle) ranking, scoring, hedonic scale, and descriptive tests. Panel selection, screening, and training of judges.	32%	10
2	Milk :Score card and its use. Judging and grading of milk, defects associated with milk	6 %	02
3	Cream:Desirable attributes and defects in cream, Score card for cream, sensory evaluation of different types of cream.	6 %	02
4	Butter:Specific requirements of high-grade butter, undesirable attributes of butter, butter score-card, sensory evaluation of butter.	6 %	02
5	Ghee:Grades of ghee, special requirements of quality ghee, defects in ghee, sensory evaluation of ghee.	6 %	02
6	Fermented milk:Desirable and undesirable characteristics of fermented milks, sensory evaluation of dahi, yoghurt, chakka, srikhand, lassi and other fermented drinks.	6 %	02
7	Frozen dairy products :Desirable and undesirable characteristics of frozen dairy products. Sensory evaluation of ice cream, kulfi and milk sherbets.	6 %	02
8	Cheese: Sensory Quality attributes of some common	6 %	02

	cheese varieties and their defects, score card for cheese. Sensory evaluation and grading for cheddar, cottage and other varieties of cheeses.		
9	Dried dairy products :Desirable and undesirable characteristic of dried milks. Sensory evaluation and grading of dry milk products.	7 %	02
10	Concentrated milks :Desirable attributes and defects Sensory evaluation and grading of evaporated and condensed	6 %	02
11	Heat desiccated Indian milk products :Desirable and undesirable characteristics. Sensory evaluation of khoa and khoa based sweets.	7 %	02
12	Acid coagulated Indian milk products: Desirable and undesirable characteristics. Sensory evaluation of paneer, chhana and chhana based sweets.	6 %	02
Total		100%	32

i. Text Book and Reference Book:

1. Sensory Evaluation of Food: Principles and Practices" by Harry T. Lawless and Hildegard Heymann.
2. "Introduction to Sensory Evaluation of Food" by F. Marian McBride and Marc A. Drake.
3. "Sensory and Consumer Research in Food Product Design and Development" by Howard R. Moskowitz, Jacqueline H. Beckley, and Anna V.A. Resurreccion.
4. "Sensory Evaluation Techniques" by Gail Vance Civille and B. Thomas Carr.

- a. Course Name:** Sensory Evaluation of Food Products lab
- b. Course Code:** 03635322
- c. Prerequisite:** Knowledge of general food science.
- d. Rationale:** The rationale of Sensory Evaluation of Food Products is to understand and apply scientific methods for assessing the sensory characteristics of food, such as appearance, taste, aroma, texture, and overall acceptability, ensuring the development of high-quality products that meet consumer preferences and market demands.

e. Course Learning Objective:

CLOBJ 1	To understand the principles and importance of sensory evaluation in food product development and quality assurance.
CLOBJ 2	To learn various sensory evaluation methods and techniques for assessing food attributes such as taste, texture, aroma, and appearance.
CLOBJ 3	To develop skills in designing and conducting sensory tests, including data collection and statistical analysis.
CLOBJ 4	To explore the role of consumer preferences and sensory perception in driving food product innovation and acceptance.

f. Course Learning Outcomes:

CLO 1	Demonstrate an understanding of sensory evaluation principles and their application in food quality and product development.
CLO 2	Apply sensory testing techniques to assess attributes such as taste, texture, aroma, and appearance in food products.
CLO 3	Analyze sensory evaluation data using appropriate statistical tools to make informed decisions about food quality and consumer preferences.
CLO 4	Develop and optimize food products based on sensory analysis and consumer feedback to meet market demands.

g. Teaching & Examination Scheme:

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

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. NO.	Experiment List
1	Determination of threshold value for basic tastes & odours.
2	Sensory evaluation of milk and cream.
3	Sensory evaluation of butter and ghee.
4	Sensory evaluation of condensed and evaporated milk.
5	Sensory evaluation of milk powders.
6	Sensory evaluation of cheese and related products.
7	Sensory evaluation of cheese and related products.
8	Sensory evaluation of khoa and khoa-based sweets.
9	Sensory evaluation of chhana and chhana based sweets.
10	Sensory evaluation of dahi and fermented dairy products.

- a. **Course Name:** Hands on Training
- b. **Course Code:** 03635324
- c. **Prerequisite:** Knowledge of food technology.
- d. **Rationale:** The course aim in diploma food technology to provide practical exposure to food processing, preservation, and quality control techniques, enabling students to apply theoretical knowledge, develop technical skills, and gain industry-relevant experience for a successful career in the food sector.

e. Course Learning Objective:

CLOBJ 1	To develop practical skills in food processing, preservation, and packaging techniques.
CLOBJ 2	To learn the application of quality control and assurance methods in food production.
CLOBJ 3	To gain experience in operating food industry equipment and understanding their functions.
CLOBJ 4	To bridge the gap between theoretical knowledge and real-world industrial practices in food technology.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to apply food processing and preservation techniques in real-world scenarios.
CLO 2	Gain proficiency in using laboratory instruments and equipment for food quality testing and analysis.
CLO 3	Successfully implement quality control measures and understand their impact on food safety and consistency.
CLO 4	Develop problem-solving skills and the ability to adapt to the operational demands of the food industry.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content: NA