COMPETENCY BASED CURRICULUM

DIPLOMA
IN
FOOD TECHNOLOGY

(Duration 03 Years)
NSQF Level – 5

Under
Haryana State Board of Technical Education

Developed By

Curriculum Development Center

National Institute of Technical Teachers Training & Research

(Ministry of Education, Government of India)

Sector - 26, Chandigarh, UT, India

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PREFACE

Learning and learning experience are the foundation of any education system. Appropriateness of education and its useful implications stand on the platform of knowledge and skill. But the knowledge and skill cannot be quantified qualitatively without ensuring learning experience. Curriculum is the pathway to select and organise learning experience. It helps the teachers to provide tangible resources, goals and objectives to learners. Curriculum acts as a catalyst to stimulate creativity, innovation, ethics, values, responsibility and many human factors. Curriculum embodies rigour and high standards and creates coherence to empower learner to meet the industrial and societal needs. Curriculum is a central guide for a teacher to plan a standard based sequence for the instructional delivery.

The industrial revolution 4.0 has forced the technical education system to reinvent the curriculum to meet the human resource requirement of the industry. The data driven systems relying on the subjects like machine-learning, Artificial Intelligence, Data Science etc. are literally forcing the technical education system to offer different subjects differently to address the emerging challenges. The non-linear way of learning now facilitates students to choose path of knowledge to skill or vice-versa. The bi-directional process requires innovative curriculum design and revision. Diploma programme is now more challenging than ever. The level of skill and knowledge demanded by industry from diploma holders are highly interdisciplinary at the same time address special need. Hence, there is a need to align the curriculum to National Skill Qualification Framework(NSQF).

National Education Policy, NEP-2020 has now opened up diversities for the education system to explore and exploit to make the education relevant. The policy emphasizes to inculcate value, ethics, respect to culture and society etc. along with industry ready knowledge and skill among the students. The interdisciplinary nature of curriculum, academic bank of credits and integration of technology in teaching- learning envisaged in NEP-2020 make it more challenging for curriculum development. NITTTR, Chandigarh has developed the art of curriculum development over 54 years of its existence. The expertise and experience available in the institute follow time-tested and acclaimed scientific methods to design/revise curriculum. The experienced faculty members entrusted with the curriculum development or revision activities are well-versed with NSQF, NEP and Outcome based education. I am happy to note that **Haryana State Board of Technical Education, Panchkula, Haryana** reposed their confidence on this expertise to develop **AICTE/NSQF/NEP 2020** aligned curriculum for the state. This documented curriculum is an outcome of meticulous planning and discussions among renowned experts of the subject through series of workshops. The effective implementation of this curriculum supported with quality instructional resources will go a long way in infusing the learning experience among learners to make them industry ready.

Director

National Institute of Technical Teachers Training & Research, Chandigarh

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Professor & Head
Curriculum Development Center
National Institute of Technical Teachers Training & Research, Chandigarh

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1. SALIENT FEATURES

1.	Name	:	**Diploma in Food Technology**
2.	Duration	:	**03 Years**
3.	Hours per week	:	**35**
4.	Entry Qualification	:	**10thPass**
5.	Student Intake	:	**As per sanctioned strength**
6.	Pattern	:	**Semester**
7.	Scheme	:	**Multi Pont Entry and Exit**
8.	NSQF Level	:	**5**
9.	Theory Practical Ratio	:	**34 :66**
10.	Project Work	:	**Minor and Major Project**
11.	In-house/Industrial Training	:	**Mandatory after First and Second Year**

2. NSQF GUIDELINES

National Skill Qualification Framework has defined total Ten Levels. Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Fig1: NSQF Domains

NSQF LEVEL - 3 COMPLIANCE

The NSQF level - 3 descriptor is as follows:

Process	• Person may carry out a job which may require limited range of activities routine and predictable.
Professional Knowledge	• Basic facts, process and principle applied in trade of employment.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application.
Core Skill	• Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Under close supervision. Some responsibility for own work within defined limit.

Fig 2: NSQF Level – 3 Descriptor

Work requiring knowledge, skills and aptitudes at level 3 will be routine and predictable. Job holders will be responsible for carrying out a limited range of jobs under close supervision. Their work may require the completion of a number of related tasks. People carrying out these job roles may be described as "Semi skilled workers". Individuals in jobs which require level 3 qualifications will normally be expected to be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation and should know the basic facts, processes and principles applied in the trade for which they are qualified and be able to apply the basic skills of the trade to a limited range of straightforward jobs in the occupation.

They will be expected to understand what constitutes quality in their job role and more widely in the sector or sub-sector and to distinguish between good and bad quality in the context of the jobs they are given. Job holders at this level will be expected to carry out the jobs they are given safely and securely. They will work hygienically and in ways which show an understanding of environmental issues. This means that they will be expected to take responsibility for their own health and safety and that of fellow workers and, where appropriate, customers and/or clients. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social environment. They should be able to make a good contribution to team work.

NSQF LEVEL - 4 COMPLIANCE

The NSQF level-4 descriptor is given below:

Process	• Work in familiar, predictable, routine, situation of clear choice
Professional Knowledge	• Factual knowledge of field of knowledge or study.
Professional Skill	• Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.
Core Skill	• Communication written and oral, with required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment.
Responsibility	• Responsibility for own work and learning.

Fig 3: NSQF Level – 4 Descriptor

Work requiring knowledge, skills and aptitudes at level 4 will be carried out in familiar, predictable and routine situations. Job holders will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. People carrying out these jobs may be described as "skilled workers". Individuals in jobs which require level 4 qualifications should be able to communicate clearly in speech and writing and may be required to use arithmetic and algebraic processes. They will be expected to have previous knowledge and skills in the occupation in which they are employed, to appreciate the nature of the occupation and to understand and apply the rules which govern good practice. They will be able to make choices about the best way to carry out routine jobs where the choices are clear.

They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their job roles. Job holders at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They will work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment. They should be able to guide or lead teams on work within their capability.

NSQF LEVEL - 5 COMPLIANCE

The NSQF level-5 description is given below:

Process	• Job that requires well developed skill, with clear choice of procedures in familiar context.
Professional Knowledge	• Knowledge of facts, principles, processes and general concepts, in a field of work or study.
Professional Skill	• A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.
Core Skill	• Desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.
Responsibility	• Responsibility for own work and learning and some responsibility for others' works and learning

Fig 4: NSQF Level – 5 Descriptor

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning. People carrying out these jobs may be described as "fully skilled workers" or "supervisors".

Individuals employed to carry out these jobs will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes. They should also be able to collect and organize information to communicate about the work. They will solve problems by selecting and applying methods, tools, materials and information. They will be expected to have previous knowledge and skills in the occupation, and to know and apply facts, principles, processes and general concepts in the occupation. They will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise.

In working with others, they will be expected to conduct themselves in ways which show an understanding of the social and political environment.

3. NATIONAL EDUCATION POLICY (NEP) -2020

NEP 2020 aims at a comprehensive holistic education to develop all capacities of human beings - intellectual, aesthetic, social, physical, emotional, and moral - in an integrated manner. A holistic arts education will help develop well-rounded individuals that possess: critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. Such a holistic education shall be, in the long term, the approach of all undergraduate programmes, including those in professional, technical, and vocational disciplines.

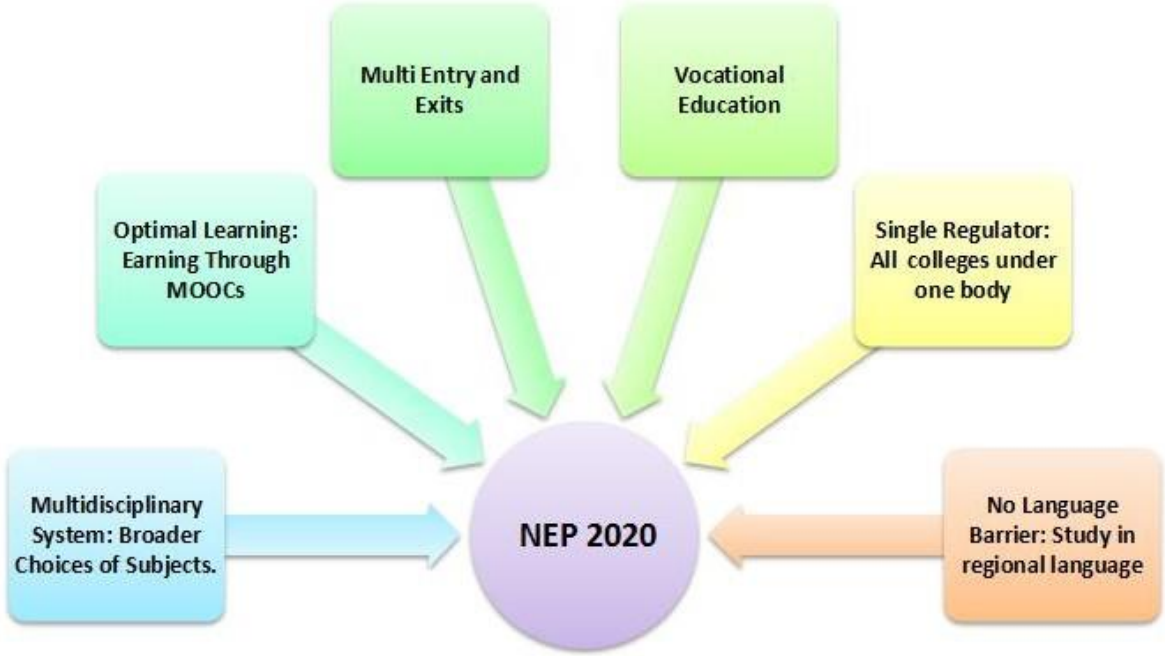

Fig 5: NEP 2020

Flexibility in curriculum and novel and engaging course options will be on offer to students, in addition to rigorous specialization in a subject or subjects. Pedagogy for courses will strive for significantly less rote learning and an increased emphasis on communication, discussion, debate, research, and opportunities for cross-disciplinary and interdisciplinary thinking. The flexible and innovative curriculum shall emphasize on offering credit-based courses and projects in the areas of community engagement and service, environmental education and value-based education. As part of a holistic education, students will be provided with opportunities for internships with local

industry, businesses, artists, crafts persons, villages and local communities, etc. as well as research internships with faculty and researchers at their own or other HEIs or research institutions, so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

Effective learning requires relevant curriculum, engaging pedagogy, continuous formative assessment and adequate student support. The curriculum must be updated regularly aligning with the latest knowledge requirements and shall meet specified learning outcomes. High-quality pedagogy is then necessary to successfully impart the curricular material to students; pedagogical practices determine the learning experiences that are provided to students - thus directly influencing learning outcomes. The assessment methods have to be scientific and test the application of knowledge. Higher Education Institutes should move to a criterion-based grading system that assesses student achievement based on the learning goals for each programme, making the system fairer and outcomes more comparable. HEIs should also move away from high-stakes examinations towards more continuous and comprehensive evaluation.

4. DIPLOMA PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Perform tasks in limited range of activities, familiar situation with clear choice of procedures.

PO2: Acquire knowledge of principles and processes in the field of Food Technology.

PO3: Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Take the responsibility of own works and supervises others work.

PO6: Select multidisciplinary and open subjects of own interest and perform self-learning through Massive Open Online Courses.

5. DERIVING CURRICULUM SUBJECT AREAS FROM DIPLOMA PROGRAMME OUTCOMES

The following curriculum areas have been derived from Diploma Programme Outcomes:

Sr. No.	Programme Outcomes	Curriculum Subjects / Areas
1.	Perform tasks in limited range of activities, familiar situation with clear choice of procedures.	• Applied Physics -I • Engineering Graphics • Basic Microbiology • Basics of Food Technology • Food Chemistry and Nutrition • Food Microbiology • Technology of Non-alcoholic Beverages • Technology of Cereals and Pulses • Technology of Meat, Fish & Poultry Products • Fruit & Vegetables Technology • Food Fermentation Technology • Food Packaging Technology • Food Additives, Spices and Condiments • Computer Applications in Food Technology • Health & Functional Foods • Technology of Oils and Fats • Programme Elective –I • Waste Management in Food Industry • Programme Elective -II
2.	Acquire knowledge of principles and processes in Food Technology related field.	• Handling, Transportation and Storage of Foods • Principles of Food Processing and Preservation • Principles of Food Engineering

		• Bakery & Confectionery Technology • Food Analysis & Quality Control • Technology of Milk & Milk Products • Food Packaging Technology • Food Additives, Spices and Condiments • Computer Applications in Food Technology • Health & Functional Foods • Technology of Oils and Fats • Programme Elective –I • Food Laws and Standards • Waste Management in Food Industry • Programme Elective -II
3.	Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**	• Unit Operations in Food Processing • Industrial/In-House -I • Technology of Non-alcoholic Beverages • Technology of Cereals and Pulses • Technology of Meat, Fish & Poultry Products • Fruit & Vegetables Technology • Food Fermentation Technology • Industrial Training-II • Minor Project • Major Project/Industrial Training
4.	Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• English and Communication Skills -I • Applied Mathematics -I • Fundamentals of IT • Applied Mathematics -II • Environmental Studies & Disaster Management • English and Communication Skills -II • Entrepreneurship Development and Management • Industrial/In-House Training-I

		• Industrial Training-II • Minor Project • Major Project/Industrial Training
5.	Take the responsibility of own works and supervises others work.	• Industrial/In-House Training-I • Industrial Training-II • Minor Project • Major Project/Industrial Training
6.	Select multidisciplinary and open subjects of own interest and perform self learning through Massive Open Online Courses.	• Multidisciplinary Elective • Open Elective

FIRST YEAR

NSQF LEVEL - 3

FIRST YEAR
6. STUDY AND EVALUATION SCHEME

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
1.1	*English & Communication Skills – I	2	2	2+1=3	40	40	80	60	60	120	200
1.2	**Applied Mathematics	4	-	4+0=4	40	-	40	60	-	60	100
1.3	**Applied Physics	2	2	2+1=3	40	40	80	60	60	120	200
1.4	Basic Microbiology	2	4	2+2=4	40	40	80	60	60	120	200
1.5	Basics of Food Technology	3	6	3+3=6	40	40	80	60	60	120	200
1.6	*Fundamentals of IT	2	4	2+2=4	40	40	80	60	60	120	200
	#Student Centered Activities	-	2	-	-	-	-	-	-	-	-
	Total	**15**	**20**	**24**	**240**	**200**	**440**	**360**	**300**	**660**	**1100**

* Common with other diploma programmes

** Same as Applied Mathematics-I and Applied Physics-I. Also common with other diploma programmes.

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga, Human Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C s	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Total	Th	Pr	Total	
2.1	Handling, Transportation and Storage of Foods	2	4	2+2=4	40	40	80	60	60	120	200
2.2	Principles of Food Processing and Preservation	2	4	2+2=4	40	40	80	60	60	120	200
2.3	Food Chemistry and Nutrition	2	4	2+2=4	40	40	80	60	60	120	200
2.4	*Environmental Studies and Disaster Management	2	-	2+0=2	40	-	40	60	-	60	100
2.5	Food Microbiology	2	4	2+2=4	40	40	80	60	60	120	200
2.6	Unit Operations in Food Processing	2	4	2+2=4	40	40	80	60	60	120	200
	#Student Centred Activities	-	3	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**22**	**240**	**200**	**440**	**360**	**300**	**660**	**1100**

* Common with other diploma programmes

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Games, Yoga, Human Ethics, Knowledge of Indian System, Hobby clubs e.g. Photography etc., Seminars, Declamation contests, Educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

Summer Internship/In-house Training: After 2nd semester, students shall undergo Summer Internship of 4 Weeks

7. HORIZONTAL AND VERTICAL ORGANISATION OF SUBJECTS

Sr. No.	Subjects/Areas	Hours Per Week	
		First Semester	Second Semester
1.	English & Communication Skills – I	4	-
2.	Applied Mathematics	4	-
3.	Applied Physics	4	-
4.	Basic Microbiology	6	-
5.	Basics of Food Technology	9	-
6.	Fundamentals of Information Technology	6	-
7.	Handling, Transportation and Storage of Foods	-	6
8.	Principles of Food Processing and Preservation	-	6
9.	Food Chemistry and Nutrition	-	6
10.	Environmental Studies and Disaster Management	-	2
11.	Food Microbiology	-	6
12.	Unit Operations in Food Processing	-	6
13.	Student Centered Activities	2	3
	Total	**35**	**35**

8. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

In government and private sectors related to Food Technology, **"Semi Skilled workers"** are required to carry out limited rangeof predictable tasks under close supervision. They are normally expected to communicate clearly in speech and along with knowledge of arithmetic and algebraic processes. They should know the basic facts, processes and principles applied in limited area of Food Technology.

Food Technology NSQF Level – 3 pass out students are expected to recall and demonstrate practical routine and repetitive skills, in narrow range of related applications. They should have the basic knowledge of principles of Food Technology. They should demonstrate general manual and machining skills along with awareness of dignity of labour, safety at work place, team working and right attitude. They should have good knowledge of physical principles and analysis in various technical fields. They are expected to handle wide variety of instruments while testing, trouble shooting, calibration etc. along with the knowledge of working principles and operation of different instruments. They are expected to show their capability to design their own projects related to Food Technology as per industrial requirement.

They will have scope of wage/self-employment in the following major areas:

1. Wage employment
   - Fruit and vegetable processing
   - Bakery and confectionery
   - Beverages
   - Dairy
   - Oil and fat
   - Meat, fish and poultry
   - Health and specialized food
   - Grain milling
   - Convenience food
   - Quality control
   - Educational institutions
   - KVIC etc.

2. Self-employment
   - Fruit and vegetable processing
   - Bakery and confectionery
   - Dairy
   - Milling of grains and spices
   - Oil expelling units
   - Snacks
   - Service units to larger industry/ ancillary units

9. PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this programme, the student will be able to:

PO1: Perform tasks in limited range of activities, familiar situation with clear choice of procedures.

PO2: Acquire knowledge of principles and processes in the field of Food Technology.

PO3: Develop skills to accomplish quality tasks and solve problems using methods, tools, materials and information**.**

PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.

PO5: Take the responsibility of own works and supervises others work.

PO6: Select multidisciplinary and open subjects of own interest and perform self learning through Massive Open Online Courses.

10. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Carry out a task which may require limited range of predictable activities.	• Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. Select proper tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. Draw Orthographic views of different objects viewed from different angles. • Draw and interpret sectional views of an object which are otherwise not visible in normal view. • Draw Isometric views of different solids and develop their surfaces. • Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances/fittings. • Draw orthographic views of different objects by using basic commands of AutoCAD.
PO2: Acquire knowledge of Basic facts, process and principles related to Food Technology for employment.	• Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy. • Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications. • Characterize properties of material to prepare new materials for various engineering applications. • Differentiate between the beneficial and harmful microorganisms.

	• Classify the living system. • Describe the isolation techniques of pure culture. • Explain about the microbial growth. • Explain the morphology of bacteria and fungi. • Define basic food definitions and terminologies. • Explain different constituents of food and their basic functions in human body. • Implement different food processing unit operations. • Describe in brief the different food preservation and processing techniques. • Use different food technology equipments/instruments. • State the importance of major nutrients. • Discuss the importance of minor nutrients. • Explain the importance of food pigments
PO3: Demonstrate practical skill in narrow range of Food Technology applications.	• Elaborate scientific work, energy and power, forms of friction and solve problems related to them. • Comprehend properties of matter and effect of temperature on various matter and phenomenon. • Demonstrate the use of physical principles and analysis in various fields of engineering. • Prepare independently simple jobs and inspect the same. Select proper tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. • Select and handle tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring tools/equipment. • Perform safety procedures to maintain good house

	keeping practices. • Handle materials, sequence of operations, tools to make a given job based on interpretation of drawing as per given specification • Develop a job using resources of shops and compare the job with given specifications. • Analyze a given job and identify various operations required to make it. • Use the material handling equipment. • Summarize the handling of plant foods. • Handle animal foods • Apply processes of Sterilization, Pasteurization, Blanching, and Canning. • Use hurdle technology and pulsed electric filed techniques for food preservation • Apply the concept of Thermal Death Time. • Use different antimicrobial agents.
PO4: Demonstrate skill of communication, basic mathematics, collecting and organizing information along with knowledge of social, political and natural environment.	• Identify the nuances of Communication, both Oral and Written. • Acquire knowledge of the meaning of communication, communication process and speaking skills. • Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication. • Communicate effectively with an increased confidence to read, write and speak in English language fluently. • Understand the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry. • Formulate engineering problems into mathematical formats with the use matrices, coordinate geometry and trigonometry • Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem. • Explore the idea of location, graph, and linear relationships between two variables.

	• Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers. • Handle the Computer / Laptop / Mobiles / Internet Utilities and Install/Configure OS. • Assemble a PC and connect it to external devices. • Manage and Use Office practiced Automation Tools. • Develop worksheets and Prepare presentations. • Formulate the engineering problems into mathematical format with the use of differential equations and differential • Use the differentiation and Integration in solving various Mathematical and Engineering problems. • Calculate the approximate area under a curve by applying integration and numerical methods. • Understand the purposes of measures of central tendency and calculate the measures of central • Tendency (mode, median, mean) for a set of data. • Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLabsoftware. • Comprehend the importance of sustainable ecosystem • Demonstrate interdisciplinary nature of environmental issues • Implement corrective measures for the abatement of pollution. • Identify the role of non-conventional energy resources in environmental protection. • Manage various types of disasters
PO5: Perform task under close supervision with some responsibility for own work within defined limit.	• Identify tools, equipments and their respective functions. • Prepare independently simple jobs and inspect the same. • Select and Handle tools for a particular operation. • Handle safety equipment, follow safety procedures and measures. • Take measurements with basic measuring

	tools/equipment. • Perform safety procedures to maintain good housekeeping practices. • Handle materials, sequence of operations, tools to make a given job based on interpretation of drawing as per given specification • Develop a job using resources of shops and compare the job with given specifications. • Analyze a given job and identify various operations required to make it. • Use the material handling equipment. • Summarize the handling of plant foods. • Handle animal foods • Apply processes of Sterilization, Pasteurization, Blanching, and Canning. • Use hurdle technology and pulsed electric filed techniques for food preservation • Apply the concept of Thermal Death Time. • Use different antimicrobial agents.

11. SUBJECTS & DETAILED CONTENTS

FIRST SEMESTER

1.1 ENGLISH & COMMUNICATION SKILLS – I

L	P
2	2

RATIONALE

Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life –personal, social and professional. This course is intended to break fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework. This course is designed to help students to acquire the concept of communication and develop an ability or skills to use them effectively to communicate with the individuals and community.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Identify the nuances of Communication, both Oral and Written.
CO2: Acquire knowledge of the meaning of communication, communication process and Speaking skills.
CO3: Acquire enhanced vocabulary and in-depth understanding of Grammatical Structures and their usage in the communication.
CO4: Communicate effectively with an increased confidence to read, write and speak in English language fluently.

DETAILED CONTENTS

UNIT I
Reading

1.1 Techniques of reading: Skimming and Scanning
1.2 Extensive and Intensive Reading: Textual Study
1.3 Homecoming – R.N. Tagore
1.4 Life Sketch of Sir MokshagundamVisvesvarayya
1.5 Life Sketch of Dr. Abdul Kalam
1.6 Narayan Murthy's speech at LBSNA, Dehradun

UNIT II

Fundamentals of Communication

2.1 Concept and Process of Communication,
2.2 Types of Communication (Verbal Communication)
2.3 Barriers to Communication
2.4 Speaking Skill: Significance and essentials of Spoken Communication
2.5 Listening Skill: Significance and essentials of Listening

UNIT III

Grammar and Usage

3.1 Nouns
3.2 Pronouns
3.3 Articles
3.4 Verbs(Main and Auxiliary)
3.5 Tenses

UNIT IV

Writing Skills

4.1 Significance, essentials and effectiveness of Written Communication
4.2 Notice Writing
4.3 Official Letters and E-mails.
4.4 Frequently-used Abbreviations used in Letter-Writing
4.5 Paragraph Writing
4.6 Netiquettes

PRACTICAL EXERCISES

1 Reading

Reading Practice of lessons in the Lab Activity classes.

i. Comprehension exercises of unseen passages along with the lessons prescribed.
ii. Vocabulary enrichment and grammar exercises based on the selected readings.
iii. Reading aloud Newspaper headlines and important articles.

2 Fundamentals of Communication

i. Introducing oneself, others and leave- taking(talking about yourself)
ii. Just a minute (JAM) sessions: Speaking extempore for one minute on given topics
iii. Situational Conversation: Offering-Responding to offers; Congratulating; Apologising and Forgiving; Complaining; Talking about likes and dislikes, Self-introduction Mock Interviews.

3 Grammar and Usage

i. Written and Oral Drills will be undertaken in the class to facilitate holistic linguistic competency among learners.
ii. Exercises on the prescribed grammar topics.

4 Writing Skills

i. Students should be given Written Practice in groups so as to inculcate team-spirit and collaborative learning .
ii. Group exercises on writing paragraphs on given topics.
iii. Opening an e-mail account, receiving and sending emails

RECOMMENDED BOOKS

1. Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 2", M/S Abhishek Publications, Chandigarh.
2. V Sasikumar & PV Dhamija, "Spoken English", Tata MC Graw Hills, New Delhi, Second Edition.
3. JK Gangal, "A Practical Course in Spoken English", PHI Learning Pvt. Ltd., New Delhi.
4. NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5. RC Sharma and Krishna Mohan, "Business Correspondence & Report writing", Tata MC Graw Hills, New Delhi, Fourth Edition.
6. Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
7. Nira Konar, "Communication Skills for professionals", PHI Learning Pvt. Ltd., New Delhi.
8. Krishna Mohan & Meera Banerji, "Developing Communication Skills", Macmillan Publishers India Ltd., New Delhi, Second Edition
9. M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.

10. Andrea J Rutherfoord, “Basic Communication Skills for Technology”, Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. This subject contains four units of equal weight age.

1.2 APPLIED MATHEMATICS

L	P
4	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, matrices, t-ratios and co-ordinates for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Understand the geometric shapes used in engineering problems by Co-ordinate Geometry and Trigonometry.
CO2: Formulate engineering problems into mathematical formats with the use matrices, co-ordinate geometry and trigonometry
CO3: Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem.
CO4: Explore the idea of location, graph, and linear relationships between two variables.
CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Algebra

1.1 Complex Numbers: definition of complex number, real and imaginary parts of a complex number, Polar and Cartesian Form and their inter conversion, Conjugate of a complex number, modulus and amplitude, addition subtraction, multiplication and division of complex numb
1.2 Logarithms and its basic properties

UNIT II

Binomial Theorem, Determinants and Matrices

2.1 Meaning of ${}^{n}p_{r}$ & ${}^{n}c_{r}$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion up to 3 terms - without proof), first binomial approximation with application to engineering problems.

2.2 Determinants and Matrices – Evaluation of determinants (upto 2^{nd}order), solution of equations (upto 2 unknowns) by Crammer's rule, definition of Matrices and its types, addition, subtraction and multiplication of matrices (upto 2^{nd} order).

UNIT III

Trigonometry

3.1 Concept of angle, measurement of angle in degrees, grades, radians and their conversions.

3.2 T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa

3.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

UNIT-IV

Co-ordinate Geometry

4.1 Cartesian and Polar co-ordinates (two dimensional), Distance between two points, mid-point, centroid of vertices of a triangle.

4.2 Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.

UNIT V

Geometry of Circle and Software Circle

5.1 General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius
ii. Three points lying on it
iii. Coordinates of end points of a diameter

Software

5.2 **MATLAB Or SciLab software –** Theoretical Introduction, MATLAB or Scilabas Simple Calculator (Addition and subtraction of values –Trigonometric and Inverse Trigonometric functions) – General Practice

RECOMMENDED BOOKS

1. R. D. Sharma, "Applied Mathematics – I & II for Diploma Courses", Dhanpat Rai Publications.
2. "Mathematics for Class XI", NCERT Publication, New Delhi.
3. "Mathematics for Class XII", NCERT Publication, New Delhi.
4. H. K Dass, "Applied Mathematics for Polytechnics", CBS Publishers & Distributers.
5. A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics – I", CBS Publisher, New Delhi.
6. A Ganesh and G Balasubramanian, "Textbook of Engineering Mathematics –II", CBS Publisher, New Delhi.
7. G. B. Thomas, R. L. Finney, "Calculus and Analytic Geometry", Addison Wesley, Ninth Edition.
8. B S Grewal, "Elementary Engineering Mathematics", Khanna Publishers, Delhi, Thirty-fifth edition.
9. R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, Second Edition, 2003.
10. SS Sabharwal & Dr Sunita Jain, "Applied Mathematics Vol. I & II", Eagle Parkashan, Jalandhar.
11. S Kohli, "Engineering Mathematics Vol. I & II", IPH, Jalandhar.
12. Reena Garg & Chandrika Prasad, "Advanced Engineering Mathematics", Khanna Publishing House, New Delhi
13. R. Pratap, "Getting Started with MATLAB 7", Oxford University Press, Seventh Edition.

14. E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. https://www.scilab.org

INSTRUCTIONAL STATREGY

This is theoretical subject and contains five units of equal weightage. Basic elements of algebra, trigonometry and co-ordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics related to Algebra, Trigonometry and Coordinate Geometry that the industry requires. Examples to be used should be related to engineering. Useful software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Students should be able to relate to the actual use of these examples and the way mathematical calculations will help them in doing their job.

1.3 APPLIED PHYSICS

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various technical fields are given prominence in the course content.

COURSE OUTCOMES

After completing this course, student should be able to:

CO1: Identify physical quantities, select their units and make measurements with accuracy.

CO2: Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications.

CO3: Elaborate scientific work, energy and power, forms of friction and solve problems related to them.

CO4: Comprehend properties of matter and effect of temperature on various matter and phenomenon.

CO5: Demonstrate the use of physical principles and analysis in various technical fields.

DETAILED CONTENTS

UNIT I

Unit and Dimensions

1.1 Definition of Physics, physical quantities- fundamental and derived

1.2 Units: fundamental and derived

1.3 System of units: CGS, FPS, MKS, SI

1.4 Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)

1.5 Dimensional equations, principle of homogeneity of dimensional equation

1.6 Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration)

UNIT II
Force and Motion

2.1 Scalar and vector quantities– definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector)

2.2 Vector algebra- addition of vectors, Triangle &Parallelogram law (statement and formula only),

2.3 Scalar and vector product (statement and formula only)

2.4 Force and its units, resolution of force (statement and formula only)

2.5 Newton's laws of motion (statement and examples)

2.6 Linear momentum, Law of conservation of linear momentum (statement and examples), Impulse

2.7 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces (definition and formula only), application of centripetal force in banking of road

2.8 Rotational motion: definition with examples

2.9 Definition of torque, angular momentum, moment of inertia and its physical significance

UNIT III
Work, Power and Energy

3.1 Work- definition, symbol, formula and SI unit, types of work (zero work, positive work and negative work) with example

3.2 Friction– definition and its simple daily life applications

3.3 Power- definition, formula and units

3.4 Energy- definition and its SI unit, examples of transformation of energy.

3.5 Kinetic energy- definition, examples, formulaand its derivation

3.6 Potential energy- definition, examples, formulaand its derivation

3.7 Law of conservation of mechanical energy for freely falling bodies (with derivation)

3.8 Simple numerical problems based on formula of Power and Energy

UNIT IV

Properties of Matter

4.1 Elasticity and plasticity- definition, deforming force, restoring force, example of elastic and plastic body

4.2 Definition of stress and strain, Hooke's law, modulus of elasticity

4.3 Pressure- definition, atmospheric pressure, gauge pressure, absolute pressure, Pascal's law

4.4 Surface tension- definition, SI unit, applications of surface tension, effect of temperature on surface tension

4.5 Viscosity: definition, unit, examples, effect of temperature on viscosity

UNIT V

Heat and Temperature

5.1 Definition of heat and temperature (on the basis of kinetic theory)

5.2 Difference between heat and temperature

5.3 Principle and working of mercury thermometer

5.4 Modes of transfer of heat- conduction, convection and radiation with examples.

5.5 Properties of heat radiation

5.6 Different scales of temperature and their relationship

PRACTICAL EXCERCISES

1. Familiarization of measurement instruments and their parts (for example – Vernier caliper, screw gauge, sphere meter, travelling microscope etc.), and taking a reading. (compulsory to all students)
2. To find diameter of solid cylinder using a Vernier caliper
3. To find internal dia meter and depth of a beaker using a Vernier caliper and hence find its volume.
4. To find the diameter of wire using screw gauge
5. To find thickness of paper using screw gauge.
6. To determine the thickness of glass strip using a sphero meter
7. To determine radius of curvature of a given spherical surface by a sphero meter.
8. To verify parallelgram law of force
9. To determine the atmospheric pressure at a place using Fortin's Barometer

10. To determine force constant of spring using Hooke's law
11. Measuring room temperature with the help of thermometer and its conversion in different scale.

RECOMMENDED BOOKS

1. "Text Book ofPhysics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr.HH Lal, "Applied Physics, Vol.I and Vol.II", TTTI Publications, Tata McGraw Hill, Delhi.
3. AS Vasudeva, "Applied Physics – I", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – I", Eagle Prakashan, Jalandhar.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
6. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in
2. The Physics Classroom
3. https://www.khanacademy.org/science/physics

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students. Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

1.4 BASIC MICROBIOLOGY

L	P
2	4

RATIONALE

The main objectives of this subject are to develop knowledge and skills in the students in the following major areas:

a) the nature of micro-organisms found in food
b) techniques to assess the growth of micro-organisms
c) nature of useful micro-organisms
d) techniques to identify the micro-organisms

The basic knowledge and skills about these aspects are essential to understand others subject areas and for the application of microbiological considerations required in the food preservation and processing technology.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Differentiate between the beneficial and harmful microorganisms.
CO2: Classify the living system.
CO3: Describe the isolation techniques of pure culture.
CO4: Explain about the microbial growth.
CO5: Explain the morphology of bacteria and fungi.

DETAILED CONTENTS

UNIT I

Introduction to microbiology

Definition of Microbiology, micro-organisms, microscope, radiation, sterilization, filtration, asepsis, pasteurization.
Historical developments in microbiology

UNIT II
Classification of living system

Whittaker's five kingdom concept, Classification of microorganisms (Unicellular, Multi-cellular Prokaryotes, eukaryotes)
Cell and cell organelles - their functions.

UNIT III
Stains and pure culture

Stains: methods of staining (simple staining and differential staining).
Pure culture: Isolation techniques of pure culture (streak plate, pour plate, spread plate and serial dilution technique) and preservation method of pure culture.

UNIT IV
Microbial growth

Nutrient requirement of micro-organisms, Growth curve and its different phases, factors affecting microbial growth.

UNIT V
Morphology of bacteria and Fungi

Bacteria: Structure, size and shape. Types depending upon different requirements. Gram positive and negative bacteria, Mode of reproduction.
Fungi: Structure, growth requirements of yeast and mould. Mode of reproduction and importance

PRACTICAL EXERCISES

1. To list the Good laboratory practices and laboratory precautions.
2. To identify the equipment related to microbiology.
3. To establish the Standard Operating Procedure (SOP) for the cleaning of glass wares.
4. To prepare different culture media.
5. To draw a compound microscope and label its parts.
6. To sterilize glassware and culture media by moist heat-autoclave.

7. To sterilize glassware and culture media by dry heat-hot air oven.
8. To perform simple staining of bacterial cells.
9. To prepare nutrient agar and broth.
10. To perform aseptic transfer of culture
11. To enumerate the bacteria in the media by pour plate technique.
12. To enumerate the bacteria in the media by spread plate technique.
13. To enumerate the bacteria in the media by streak plate technique.
14. To count the number of cells in a culture
15. To perform simple staining of bacteria
16. To perform the differential staining/ Gram staining of bacteria.
17. To perform capsulestaining
18. To perform spore staining

RECOMMENDED BOOKS

1. Essentials of Microbiology by K.S. Bilgrami, CBS Publishers & Distributors-New Delhi
2. Food Microbiology by W.C. Frazier: Tata Mc Graw Hill, New Delhi
3. Modern Food Microbiology by James M. Jay; CBS Publishers & Distributors-New Delhi
4. Bacteriology by Salle; Published by Tata Mc Graw Hill, New Delhi
5. Basic Food Microbiology; Bannett Chapmen and Hall publisher, USA
6. Standard Methods for Waste Water Analysis – American Public Health Association (APHA), Philadelphia, Pennsylvania.
7. Basics of Biotechnology by S.Deswal and A. Deswal
8. Essential microbiology, by Stuart Hogg.
9. Basic food microbiology by George J. Banwart.
10. A textbook of Basic and applied microbiology (K.R. Aneja).
11. Fundamentals of Microbiology by Jeffrey C. Pommerville.
12. Basic microbiology Techniques by Susan G. Kelley, Frederick J.

SUGGESTED WEBSITES

1. http://www.uprtou.ac.in/
2. https://www.sciencedirect.com/
3. https://microbenotes.com/
4. https://egyankosh.ac.in/
5. https://faculty.weber.edu/
6. https://en.wikipedia.org/

7. http://ecoursesonline.iasri.res.in/

INSTRUCTIONAL STATREGY

Teachers should make use of charts and other appropriate media to support classroom instruction. Emphasis during the practical session should be on performance by individual students and teacher should develop instructional manual for various exercises to facilitate the students. Visits to some of the local industries and quality control centers may be arranged to demonstrate various aspects of basic microbiology to the students. Experts may be invited to deliver lectures on latest developments in the field. This subject contains five units of equal weightage.

1.5 BASICS OF FOOD TECHNOLOGY

L	P
3	6

RATIONALE

The course Basics of Food Technology acquaints the students with the fundamental aspects related to food processing, preservation, nutrition, safety, and other relevant food issues. The students will learn about the application of physical, chemical, and microbiological sciences to food processing and preservation in this course. An understanding of science as it applies to foods will assist students with interest in career and technical education, to understand the food industry as well as food preservation in their daily lives.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Define basic food definitions and terminologies.
CO2: Explain different constituents of food and their basic functions in human body.
CO3: Implement different food processing unit operations.
CO4: Describe in brief the different food preservation and processing techniques.
CO5: Use different food technology equipments/instruments.

DETAILED CONTENTS

UNIT 1
Introduction

Different Terminologies: Food Engineering, Biochemists, Food Chemistry, Food Analysis, Food Microbiology, Food Processing, Nutritionists, Activities of food technologists.

Characteristics of the Food Industry

Introduction to food industry, Functional division of food industry, Classification of food industry on the basis of product lines.

Classification and Nutritive Aspects of Food constituents

Classification of food constituents,

Definition, Basic formula and Classification of: Carbohydrates, Proteins, Fats and oils, Vitamins, Minerals, Water and Fiber.

Nutritional importance of: Carbohydrates, Proteins, Fats and oils, Vitamins, Minerals, Water and Fiber.

UNIT II

Unit Operations in Food Processing

Basic introduction to common unit operations: Material handling, Cleaning, Separation, Disintegration, Pumping, Mixing, Heat exchanging (Cooling, Evaporation, Drying), Forming, Packaging.

Quality Factors in Foods

Food quality definition, Introduction to food quality detectable by our senses: Appearance factor (Size and shape, Colour and gloss, Consistency), Textural factors, Flavour factor.

Food Deterioration and its control

Definition of food quality, shelf life, Major causes of food deterioration, Responsible factors of food deterioration.

Principles of food preservation Control of micro-organisms and enzymes by- Addition of heat (Evaporation, dehydration, Concentration, Drying), Removal of heat, Acid, Radiation, Filtration, Sugar and salt, Intermediate moisture food.

UNIT III

Heat Preservation and Processing

Modes of heat transfer, Definitions of Sterilization, Pasteurization (batch pasteurization, High temperature short time pasteurization), Blanching, Aseptic canning Criteria for selecting heat treatment, Introduction to thermal death curve.

Cold Preservation and Processing

Difference between refrigeration and freezing, refrigeration and cold

Storage, Controlled atmosphere storage, Freezing and frozen storage, Freezing methods- Air freezing, Indirect contact freezing, Immersion freezing, Cryogenic liquids freezing.

Irradiation, Microwave and Ohmic processing of foods

Concept of wavelength, Classification of radiant energy on the basis of wave length, Most often radiation particles used for food preservation, Benefits and effects of food irradiations,
Basic principle of microwave heating, Food applications of microwave heating.
Introduction to ohmic heating and its benefit.

UNIT IV

Meat, Fish, Poultry and Eggs

Meat- Definition, Basic composition and nutritive value, Classification.
Fish- Definition, Basic composition and nutritive value
Poultry- Definition, Basic composition and nutritive value, Classification.
Eggs- Definition, Basic composition and nutritive value, Classification on the basis of weight.

Cereal Grains, Legumes and Oilseeds

Cereal grains- Definition, Basic composition and nutritive value, Structural parts of grain, Storage.
Legumes- Definition, Basic composition and nutritive value.
Oil seed- Definition, Basic composition and nutritive value.

Vegetables and Fruits

Vegetables- Definition, Classification, Basic composition and nutritive value.
Fruits- Definition, Basic composition and nutritive value.

UNIT V

Beverages

Definition, Classification-
Nonalcoholic beverages- Definition, Ingredients used, General manufacturing steps, Basic introduction and types of - Fruit beverage, Coffee and Tea.
Alcoholic beverages- Introduction to beer and wine.
Milk: Definition, Composition, Basic processing steps, Types of milk.

Principles of Food Packaging

Definition, Functions of food packaging, Requirements of effective food packaging, Introduction to common food packaging materials.

Hunger and related terms

Introduction to hunger, Definitions- absolute poverty, anemia, daily calorie requirement, famine, food security, infant mortality rate, malnutrition, stunting, under five mortality rate, under nutrition, underweight.

Nutritional problems- Protein calorie malnutrition, chronic energy deficiency, iron deficiency, iodine deficiency, vitamin deficiency.

PRACTICAL EXERCISES

1. Prepare a list of general laboratory safety protocols.
2. Draw the diagrams of common lab glassware and label their names.
3. Demonstrate the working/SOP of hot air oven.
4. Demonstrate the working/SOP of muffle furnace.
5. Demonstrate the working/SOP of single stage distillation unit.
6. Demonstrate the working/SOP of heating mantle.
7. Demonstrate the working/SOP of shaking water bath.
8. Demonstrate the working/SOP of centrifuge.
9. Demonstrate the working/SOP of magnetic stirrer.
10. Demonstrate the working/SOP of sensitive digital weighing balance.
11. Demonstrate the working/SOP of humidity cabinet.
12. Demonstrate the working/SOP tray drier.
13. Demonstrate the working/SOP of auto clave.
14. Demonstrate the working/SOP of refrigeration system.
15. Demonstrate the working/SOP of microwave oven.

Note: If any of the equipment is not available in the institute, the visit can be managed to the relevant food industry or in any other institute.

RECOMMENDED BOOKS

1. Potter NN and Hotchkiss JH, Food science.
2. N. ShakuntlaManay& M. Shadaksharaswamy, Food facts and principles.
3. Srilakshmi B, Food Science.
4. Avanthi Sharma, A text book of Food Science and Technology.
5. Sumati R Mudambi, Shalini M Rao and Rajagopal M.V, Food Science.

SUGGESTED WEBSITES

1. www.fssai.gov.in/
2. http://mofpi.nic.in/
3. http://www.mondaq.com/india/x/244880/food+drugs+law/Laws+Governing+The+Food+Industry+In+India+Revisited
4. http://www.foodqualityandsafety.com/article/food-regulations-what-is-the-current-scenario-in-india-2/

INSTRUCTIONAL STRATEGY

This course being a basic course in nature, developing interest of students in this course should be our top priority. Aspects related to food technology must be related to everyday life and theory should be related to real world applications supported by visits to relevant food industries or by showing videos of different food products and processing methods. This subject contains five units of equal weightage.

1.6 FUNDAMENTALS OF IT

L	P
2	4

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concepts of information technology and its scope, operating a computer: use of various office management tools, using internet and mobile applications etc. This course is intended to make new students comfortable with computing environment - Learning basic computer skills, learning basic application software tools, Understanding Computer Hardware, Cyber security awareness.

COURSE OUTCOMES

At the end of the course student will be able to:

CO1: Explain the basic components of Computers, Internet and issues of abuses/ attacks on information and computers.
CO2: Handle the computer/laptop/mobiles/Internet Utilities and Install/Configure OS.
CO3: Assemble a PC and connect it to external devices.
CO4: Manage and Use Office practiced Automation Tools.
CO5: Develop worksheets and Prepare presentations.

DETAILED CONTENTS

UNIT I

Basics of Computer

Brief history of development of computers, Definition of Computer, Block diagram of a Computer, Hardware, Software, Booting: Cold and Hot Booting, Interaction between the CPU and Memory with Input/output devices, Function of CPU and major functional parts of CPU.

Memory, Bit, Nibble, Byte, KB, MB, GB, TB, PB, Functions of memory, Use of storage devices in a Computer, List types of memory used in a Computer, Importance of cache memory, CPU speed and CPU word length.

UNIT II
Basic Internet Skills

Understanding browser, Introduction to WWW, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. Advantages of Email, Various email service providers, Creation of email id, sending and receiving emails, attaching documents with email and drive.
Effective use of Gmail, G-Drive, Google Calendar, Google Sites, Google Sheets, Online mode of communication using Google Meet & WebEx.

UNIT III
Basic Logic building

Introduction to Programming, Steps involved in problem solving, Definition of Algorithm, Definition of Flowchart, Steps involved in algorithm development, differentiate algorithm and flowchart, symbols used in flowcharts, algorithms for simple problems, flowcharts for simple problems, Practice logic building using flowchart/algorithms

UNIT IV
Office Tools

Office Tools like Libre Office/Open Office/MSOffice.
Open Office Writer – Typesetting Text and Basic Formatting, Inserting Images, Hyperlinks, Bookmarks, Tables and Table Properties in Writer
Introducing Libre Office/Open Office Calc, Working with Cells, Sheets, data, tables, using formulae and functions, using charts and graphics.
Open Office Impress – Creating and Viewing Presentations, Inserting Pictures and Tables, Slide Master and Slide Design, Custom Animation.

UNIT V

Use of Social Media

Introduction to Digital Marketing – Why Digital Marketing, Characteristics of Digital Marketing, Tools for Digital Marketing, , Effective use of Social Media like LinkedIn, Google+, Facebook, Twitter, etc.: Features of Social media, Advantages and Disadvantages of Social Media.

PRACTICAL EXERCISES

1. Browser features, browsing, using various search engines, writing search queries
2. Visit various e-governance/Digital India portals, understand their features, services offered
3. Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.
4. Using Administrative Tools/Control Panel Settings of Operating Systems
5. Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6. Explore features of Open Office tools and MS-Office, create documents, create presentation, create spread sheet, using these features, do it multiple times
7. Working with Conversion Software like pdfToWord, WordToPPT, etc.
8. Working with Mobile Applications – Searching for Authentic Mobile app, Installation and Settings, Govt. of India Mobile Applications
9. Creating email id, sending and receiving mails with attachments.
10. Using Google drive, Google calendar
11. Create Flow chart and Algorithm for the following

a. Addition of n numbers and display result
b. To convert temperature from Celsius to Fahrenheit
c. To find Area and Perimeter of Square
d. Swap Two Numbers
e. find the smallest of two numbers
f. Find whether given number is Even or Odd
g. To print first n even Numbers
h. find sum of series 1+2+3+…..+N
i. print multiplication Table of a number
j. generate first n Fibonacci terms 0,1,1,2,3,5…n (n>2)
k. sum and average of given series of numbers

l. Factorial of number n (n!=1x2x3x…n)
m. Armstrong Number
n. Find whether given number is Prime or not

RECOMMENDED BOOKS

1. R.S. Salaria, “Computer Fundamentals” Khanna Publishing House
2. Ramesh Bangia, “PC Software Made Easy – The PC Course Kit” Khanna Publishing House
3. Online Resources, Linux man pages, Wikipedia
4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by MokhtarEbrahim, Andrew Mallett
5. Vikas Gupta, “Comdex Hardware and Networking Course Kit” Dream Tech press, New Delhi, 2008
6. SumitabhaDas,“UNIX concepts and applications” Tata McGraw Hill, New Delhi, 4th Edition, 2008

SUGGESTED WEBSITES

1. https://nptel.ac.in/courses/106/106/106106222/ - NPTEL Course on Modern Application Development
2. https://onlinecourses.swayam2.ac.in/aic19_de01/preview -
3. https://spoken-tutorial.org/ - Tutorials on Introduction to Computers, HTML, LibreOffice Tools, etc.
4. NOTEPAD++
5. https://tms-outsource.com/blog/posts/web-development-ide/

INSTRUCTIONAL STRATEGY

This is a skill based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weight age.

SECOND SEMESTER

2.1 HANDLING, TRANSPORTATION AND STORAGE OFFOODS

L	P
2	4

RATIONALE

This subject is aimed to develop an understanding among the students about various methods of handling, transportation and storage of food grains and perishables. It will also impart knowledge and skills as how to minimize post – harvest loss of food commodities

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Explain about the importance of handling, transportation and storage of foods.
CO2: Describe the post-harvest changes in foods.
CO3: Use the material handling equipment.
CO4: Summarize the handling of plant foods.
CO5: Handle animal foods.

DETAILED CONTENTS

UNIT I
Introduction

Scope and importance of handling, transportation and storage of food and food products, post-harvest losses

UNIT II
Post-harvest changes in foods

Physiological, chemical, microbiological and biochemical

UNIT III

Various Unit operations and equipment of material handling

Various unit operations of post-harvest handling, transportation, introduction to different conveying systems like belt conveyors, chain conveyors, screw conveyors, hydraulic conveyors, pneumatic conveyors, vibrating and oscillating conveyors, bucket elevators.

UNIT IV

Plant foods

Grains Preparation of grains for storage, infestation control, mycotoxin, causes of spoilage and their prevention, types of storage structures.

1. Fruits and Vegetables
2. Handling, transportation and storage of fruits and vegetables.

UNIT V

Animal Foods

1. Meat**:** Pre-slaughter handling and transportation & storage requirements for meat animals, ante-mortem examination of animals.
2. Milk: collection, pre-cooling and transportation system of milk.
3. Eggs: Candling, grading, packaging, transportation and storage.

PRACTICAL EXERCISES

1. To identify and draw different laboratory equipment.
2. To perform sampling of stored food grains in Godowns.
3. To determine bulk density and tapped density of given grain sample.
4. To conduct ante-mortem examination of meat animals.
5. To determine moisture content of given stored food grain sample.
6. To determine germination rate and capacity of given stored food grain sample.
7. To analyze different food grain sample for foreign matter like straw parities, rodent excreta, rodents and insects infected grains.
8. To determine physical characteristics of given food grain sample.
9. To determine titrable acidity of stored juice sample.
10. To determine the quality of stored milk sample.

11. To determine the quality of egg by candling method.
12. To perform grading of egg.
13. Visit to a public distribution system (PDS) showing storage facilities, warehouse, cold storage, refrigeration system and slaughter house etc.
14. Visit and demonstration of material handling systems in various food industries

RECOMMENDED BOOKS

1. Handling, Transportation and Storage of Fruits and Vegetables by A Lloyd, Ryall Penizer (AVI Publications)
2. Proceedings of Regional Workshop on Warehouse Management of Stored Food Grains by Girish and Ashok Kumar(UNDP)
3. Modern Potato and Vegetable Storage by Volkind and Roslov(Amerind)
4. Controlled Atmospheric Storage of Fruits by MettelSkilv
5. Food Grains in Tropical and Sub Tropical Areas byHall
6. Food Storage Part of a system by Sinha and Muir(AVI)
7. Post-Harvest Technology of Fruits and Vegetables – Handling, Processing, Fermentation and Waste Management by LR Verma and VK Joshi; Indus Publishing com., New Delhi
8. Drying and Storage of Grains and Oilseeds by Brooker& Hall,CBS

SUGGESTED WEBSITES

1. https://egyankosh.ac.in/
2. http://ecoursesonline.iasri.res.in/
3. http://web.iku.edu.tr/
4. https://people.engr.ncsu.edu/
5. http://www.fao.org/

INSTRUCTIONAL STRATEGY

Teachers should prepare tutorial exercises for the students, involving visits to various food-processing units. These tutorials can be considered a mini projects. Students may be asked to bring specifications and catalogues from industries. Students may also be exposed to relevant National, BIS and international standards. An intensive exercise on actual workbench performance in the industries is recommended. Experts may be invited to deliver lectures on various themes. Use of audio-visual aids will also be useful for better conceptualization of various operations. This subject contains five units of equal weightage.

2.2 PRINCIPLES OF FOOD PROCESSING AND PRESERVATION

L	P
2	4

RATIONALE

Knowledge and skills related to food processing and preservation are essential for the diploma holder in food technology. In this subject, students are exposed to various techniques of food preservation such as low temperature, high temperature, moisture removal, chemicals, radiation and recent preservation. Relevant skills will also be imparted through this subject.

COURSE OUTCOMES

After going through this course, the students will be able to:

CO1: Apply processes of Sterilization, Pasteurization, Blanching, and Canning.
CO2: Differentiate between sun drying and dehydration & learn methods of dehydration.
CO3: Explain different freezing techniques.
CO4: Summarize the basic concepts of irradiation and microwave heating techniques.
CO5: Use hurdle technology and pulsed electric filed techniques for food preservation.

DETAILED CONTENTS

UNIT I

Basic considerations

Aims and objectives of food processing and preservation. Classification of foods on the basis of shelf life, pH, origin; Different types of food spoilage viz. microbiological, bio-chemical, chemical, physical and their effects on food quality; Principles of food preservation.

Preservation of food by adding preservative (Class-I and Class-II)

Definition, types, Class I and Class II preservatives; Introduction, permissible limit and mode of action of sugar, salt, vinegar, benzoic acid, sulphur dioxide and sulphites, nitrates and nitrites, sorbic acid; Introduction to pickling process (curing or fermentation with dry salting, fermentation in brine, salting without fermentation); Intermediate Moisture Food (IMF) like jam, jelly and marmalade.

UNIT II

Preservation of foods by high temperatures

Introduction, objectives, limitation of blanching and methods of blanching; Introduction, objectives, limitation and methods of sterilization, pasteurization (LTLT, HTST, UHT);
History, general process, advantages of canning of foods, spoilage and defects in cans, type of cans.

UNIT III

Preservation by water removal

Definition, drying as a means of preservation, Differences between sun drying and Dehydration (i.e. Mechanical drying like cabinet, tunnel, kiln, fluidized bed, pneumatic/flash, drum, spray, vacuum and freeze drying of foods), Factors affecting rate of drying, normal drying curve, Types o driers used in the food industry;
Definition evaporation and concentration, names of evaporators used in food industry, concept of freeze concentration and membrane process for food concentrations.

UNIT IV

Food Preservation by Low temperature

Introduction to refrigeration, cool storage and freezing, definition & principle of freezing; factors determining freezing rate; types of freezing i.e. slow freezing, quick freezing; Freezing methods-direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing; introduction to the term freezer burn and recrystallization;
Introduction to thawing, changes during thawing; advantages and limitations of freezing.

UNIT V

Food irradiation, microwave heating and recent advances in food preservation

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization, Radiation doses for spices, onions, potatoes and meat; basic concept of microwave heating.
Introduction to hurdle technology, pulsed electric filed.

Note: Wherever necessary equipment are not available students may be demonstrated that topic in relevant industry or in any other institute.

PRACTICAL EXERCISES

1. To identify different food machinery used in food processing.
2. To prepare Jam and evaluation for acceptability and cost of preparation.
3. To prepare Jelly and evaluation for acceptability and cost of preparation.
4. To prepare Marmalade and evaluation for acceptability and cost of preparation.
5. To prepare Fruit bars and evaluation for acceptability and cost of preparation.
6. To prepare Preserves and evaluation for acceptability and cost of preparation.
7. To prepare Tuity Fruity (Papaya) and evaluation for acceptability and cost of preparation.
8. To prepare Pickles-Lemon, Mango, Garlic, Mixed vegetable and evaluation for acceptability and cost of preparation.
9. To demonstrate the effect of blanching and food quality characteristics.
10. To prepare brine and syrup.
11. To perform dehydration of seasonal vegetable by using tray drier.
12. To perform dehydration of seasonal Fruit by using tray drier.
13. To perform freezing of seasonal vegetables products.
14. To perform reconstitution test for dried vegetable sample.
15. To prepare sauerkraut.
16. Visit to fruits and vegetable industry to see above operations

RECOMMENDED BOOKS

1. Drying and Storage of Grains and Oilseeds by Brooker& Hall, CBS
2. Food: Facts and Principles, by N. ShakuntalaManay, New Age International Publishers; Seventh edition (1 February 2018)
3. Physical Principles of Food Preservation: Revised and Expanded, by Daryl B. Lund and Marcus Karel, CRC Press; 2nd edition (20 June 2003)
4. Food science, by B. Srilakshmi, New Age International Publishers; Seventh edition (1 February 2018)
5. Fruit And Vegetable Preservation Principles And Practices Revised And Enlarged (Pb 2019),by R.P. by Srivastava and Sanjeev Kumar, CBS; 3rd edition (1 January 2019)
6. Laboratory manual in food preservation, author(s): Field, M.L. Author affiliation: Uni. Of Missouri, Colombia, Missouri

7. Handbook of food preservation,2nd edition, edited by M.ShafarRahma
8. Food Science by NN Potter, CBS publishers, New Delhi
9. Technology of Food Preservation by Desrosier, The Avi Publishing Company, Inc., Westport
10. Principles of Food Science by Fennema, Karrel, McGraw-Hill Book Company, New York
11. Preservation of Fruits and Vegetables by GirdhariLal, Sidhapa and Tandon, CBS Publishers, Delhi
12. Hand book of Analysis of Fruits and Vegetables by S Ranganna, Tata Me Graw- Hill. Publishing Company, New Delhi
13. Fruits and Vegetable Processing by Cruss, Oxford and IBH Publishing Co., New Delhi
14. Food Science by Mudambi, New Age International Pvt Ltd Publishers, New Delhi
15. Preservation of Fruits & Vegetables by IRRI, Oxford & IBH Publishing, New Delhi
16. Food Canning Technology by Larcousse & Brown
17. Food Composition & Preservation by Bhawna Sabarwal, Commonwealth Publishers 1999, New Delhi.
18. Food Preservation by S.K. Kulshrestha, Vikas publishing house Pvt. Ltd., New Delhi
19. Handbook of Food Preservation (Food Science and Technology), by M. Shafiur Rahman, CRC Press
20. Food Processing and Preservation , by B. Sivasankar, Prentice Hall India Learning Private Limited (1 January 2002)
21. Food Science by Bawa. A.S, O.P Chauhan etal., New India Publishing agency, 2013 (Unit I, II, III, IV)
22. Principles & Practices for the Safe Processing of Foods by Heinz, H J Heinz Company, UK.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17064
5. https://www.vnmkv.ac.in/student-academic/FPT-111.pdf

INSTRUCTIONAL STRATEGY

Teachers should prepare tutorial exercises for the students, involving visits to various food processing units. These tutorials can be considered a mini projects. Students may be asked to bring specifications and catalogues from industries. Students may also be exposed to relevant National, BIS and international standards. An intensive exercise on actual workbench performance in the industries is recommended. Experts may be invited to deliver lectures on various themes. Use of audio-visual aids will also be useful for better conceptualization of various operations. This subject contains five units of equal weightage.

2.3 FOOD CHEMISTRY AND NUTRITION

L	P
2	4

RATIONALE

Diploma holders in food technology are required to test the food products in the laboratories and should have theoretical as well as practical understanding of food chemistry and nutrition, which relates to different aspects of food chemistry and nutrients such as water, carbohydrates, fats, protein, minerals, vitamins, food pigments, enzymes etc. Hence the subject is included for developing these competencies.

COURSE OUTCOME

After undergoing this course, the student shall be able to:

CO1: Explain basic concept of food chemistry and nutrition.
CO2: Correlate interrelationship between water activity and food preservation.
CO3: State the importance of major nutrients.
CO4: Discuss the importance of minor nutrients.
CO5: Explain the importance of food pigments.

DETAILED CONTENTS

UNIT I
Introduction

1. Definition of food, food chemistry, nutrition, nutrients, adequate nutrition, optimum nutrition and good nutrition, malnutrition, balanced diet, RDA.
2. Inter-relationship between nutrition and health.
3. Food guide pyramid.

UNIT II
Water

1. Structure of water molecule, sources, functions.
2. Moisture in foods: hydrogen bonding, bound water, free water.
3. Water activity and its importance.

UNIT III

Major Nutrients

1. Carbohydrates: composition, classification, sources, physical and chemical properties, deficiency disorders.
2. Lipids: definition of fat, oil, fatty acid, saturated fatty acids, unsaturated fatty acids, MUFA and PUFA. Classification of lipids (simple, complex and derived), functions of fats.
3. Proteins: basic composition, classification, sources, nutritional importance and deficiency disorders.

UNIT IV

Minor Nutrients

1. Vitamins: classification (fat soluble and water soluble), functions, sources, deficiency disorders.
2. Minerals: Functions, sources and deficiency disorders of following minerals:
3. Calcium, iodine, iron, fluorine, sodium and potassium.

UNIT V

Enzymes and food pigments

1. Enzymes: definition, nomenclature and classification.
2. Food Pigments: Importance and plant sources of following pigments:
3. Carotenoids, chlorophyll, anthocyanins, anthoxanthins and tannins.

PRACTICAL EXERCISES

1. Enumerate the safety measures in the laboratory.
2. Identify and draw diagrams of different equipment/ glass wares / utensils used in laboratory.
3. Preparation of N/10 NaOH solution.
4. Preparation of 1 molar solution.
5. Preparation of 1 molar solution.
6. To determine the moisture content by hot air oven method in a given food sample.
7. To determine the protein by Kjeldhal method in a given food sample.
8. To determine the reducing sugar in a given food sample.

9. To determine the non- reducing sugar in a given food sample.
10. To determine the reducing sugar in a given food sample.
11. To determine the crude fat by Soxhlet method in a given food sample.
12. To determine the ash content in a given food sample.
13. To determine the crude fiber content in a given food sample.
14. To determine the pH of a given sample.
15. To determine the acidity of given food sample/ beverage.
16. Visit to hospital/slide show on various nutritional deficiency disorders

Note: Wherever necessary equipment are not available students may be demonstrated that topic in relevant industry or in any other institute.

RECOMMENDED BOOKS

1. Essentials of Food and Nutrition by Swaminathan Vol. I and II, Health Kalyani publishers, New Delhi
2. Food Chemistry by LH Meyer, Van Nostrand Reinhold Co. New York**...**
3. Hand book of Analysis of Fruits and Vegetables by S. Ranganna, Tata Me Graw- Hill. Publishing Company, New Delhi
4. Biochemistry by Mohinder Singh, Sejwal Publisher. NewDelhi
5. Introduction to Biochemistry by Braverman, Elsevier Scientific Publishing
6. Food Chemistry by Linhinger, CBS Publishers, Delhi...
7. Food Chemistry byFANNEMA,
8. Hand Book of Food & Nutrition by Swaminathan, Narosa Publishing House, New Delhi
9. A Text Book of BiochemistryA.V.S.S. Rama Rao, U B S Publishers, New Delhi
10. A Text Book of BiochemistryA.K.Berry, Narosa PublishingHouse
11. Nutrition & Dietetics by Joshi, Tata McGraw-Hill Education, NewDelhi
12. Clinical Dietetics and Nutrition by Anita& Abraham, Oxford University Press, USA
13. Chemical Changes in Food during Processing by Richardson, John W. Finley ... Avi Publishing Co Inc.
14. Fundamentals of Food & Nutrition by Sumati R. Mudambi, Published by New Age International (P)Ltd.,
15. Nutrition & Dietetics byRose
16. Food science by Sri Laxmi, New Age International Publishers, New Delhi
17. Food chemistry (Narosa publication) by H.K. Chopra and P.S. Panesar (2010), Published By Morgan &Claypool

SUGGESTED WEBSITES

1. https://byjus.com/chemistry/food-chemistry/
2. http://ecoursesonline.iasri.res.in/
3. https://mynutrition.wsu.edu/
4. https://www.sciencedirect.com/
5. https://egyankosh.ac.in/

INSTRUCTIONAL STRATEGY

This is one of the basic subjects for the diploma holders in food technology. Teacher should design appropriate tutorial exercises for the students. Students may be given sufficient practice on different experiments, individually, under the guidance of teacher. Teachers may also prepare charts and slides. Student may be taken to industry for showing different tests. This subject contains five units of equal weightage.

2.4 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

L	P
2	-

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industrial and construction activitiesso that he/she may help in balancing the ecosystem and controlling pollution by various control measures. The course is intended to provide a general concept in the dimensions of environmental pollution and disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

COURSE OUTCOMES

After undergoing the subject, the student will be able to:

CO1: Comprehend the importance of sustainable ecosystem
CO2: Demonstrate interdisciplinary nature of environmental issues
CO3: Implement corrective measures for the abatement of pollution.
CO4: Identify the role of non-conventional energy resources in environmental protection.
CO5: Manage various types of disasters

DETAILED CONTENTS

UNIT I
Introduction

1.1 Basics of ecology, eco system- concept, and sustainable development, Sources, advantages, disadvantages of renewable and nonrenewable energy.
1.2 Rain water harvesting
1.3 Deforestation – its effects & control measures

UNIT II
Air and Noise Pollution

2.1 Air Pollution: Source of air pollution. Effect of air pollution on human health, economy, Air pollution control methods.
2.2 Noise Pollution: Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimizing noise pollution.

UNIT III
Water and Soil Pollution

3.1 Water Pollution: Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of DO, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.
3.2 Soil Pollution :Sources of soil pollution, Effects and Control of soil pollution, Types of Solid waste- House hold, Industrial, Agricultural, Biomedical, Disposal of solid waste, Solid waste management E-waste, E – waste management

UNIT IV
Impact of Energy Usage on Environment

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings, Concept of Carbon Credit & Carbon footprint.

UNIT V
Disaster Management

A. Different Types of Disaster:
Natural Disaster: such as Flood, Cyclone, Earthquakes and Landslides etc.
Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc.
B. Disaster Preparedness:
Disaster Preparedness Plan
Prediction, Early Warnings and Safety Measures of Disaster

Psychological response and Management (Trauma, Stress, Rumour and Panic)

RECOMMENDED BOOKS

1. Environmental Studies by S.C. Sharma & M.P. Poonia, Khanna Publishing House, New Delhi
2. Environmental and Pollution Awareness by Sharma BR; SatyaPrakashan, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
5. Environmental Engineering and Management by Suresh K Dhamija; S K KatariaandSons, New Delhi.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.
7. Disaster Management by Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.
8. Disaster Science and Management by Tushar Bhattacharya, McGraw Hill Education (India) Pvt. Ltd.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies and Disaster Management like expert lectures, seminars, visits etc. may also be organized This subject contains five units of equal weightage.

2.5 FOOD MICROBIOLOGY

L	P
2	4

RATIONALE

This subject is aimed to develop an understanding among the students on various micro flora associated with food products and their beneficial role as well as deleterious effect on processed food products.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Define food microbiology related terms.
CO2: Describe the microbiology of different food commodities.
CO3: Recognize the food borne pathogens causing illness.
CO4: Apply the concept of Thermal Death Time.
CO5: Use different antimicrobial agents.

DETAILED CONTENTS

UNIT I
Introduction

1. Definition of food microbiology, food spoilage, food safety, food fermentation, food preservation, pasteurization, irradiation, freezing, chilling, Appertization, food poisoning, food infection, food intoxication
2. Historical developments / milestones in the food microbiology:
3. Food preservation
4. Food spoilage
5. Food legislation
6. Food poisoning

UNIT II

Microbiology of primary food commodities

1. Milk and milk products
2. meat and meat products
3. fruits and vegetables
4. cereals and cereal product: bread

UNIT III

Common food borne pathogens causing illness

1. Staphylococcus aureus
2. E. coli
3. Salmonella
4. Clostridium botulinum
5. Listeria monocytogenes

UNIT IV

Thermal death time

1. Concept of TDT
2. D valu
3. Fvalue
4. Z value

UNIT V

Control of micro-organisms

1. Anti-microbial agents and its types: physical and chemical agents.

Note: Wherever necessary equipments are not available, students may be demonstrated that topic in relevant industry or in any other institute.

PRACTICAL EXERCISES

1. To identify of different equipment and its uses related to food microbiology.
2. To prepare different culture media.
3. To estimate total microbial count of food sample byDMC method.
4. To estimate total microbial count of food sample by SPCmethod.
5. To find the microbiological quality of milk by MBRT.
6. To find microbiological quality of milk by Resazurin test
7. To estimate total microbial count of yeast andmould.
8. Study of growth curve of micro-organisms.
9. Estimation of total microbial count of fruit juices.
10. Estimation of total microbial count of canned food.
11. Estimation of total microbial count of fruit jam.
12. Coliform test for water by CPC method.

RECOMMENDED BOOKS

1. Essentials of Microbiology by KS Bilgrami;CBS
2. Food Microbilogy by WC Frazier; Tata McGrawHill
3. Modern Food Microbilogy by James M Jay;CBS
4. Bacteriology bySale
5. Standard Methods for Waste Water Analysis byAPHA
6. Basic Food Microbilogy: Bannett , Chapman andHall
7. Food Microbiology by M.R.Adams
8. Hand Book of Microbiology byBisen
9. Text Book of Fungi bySharma
10. Basic food microbiology by George J. Banwart.
11. Laboratory manual of food microbiology by Neelimagarg, K.L. garg.
12. Fundamental food microbiology by B. Ray, ArunBhunia.
13. Food microbiology: An introduction by Thomas J. Montville.
14. Food microbiology by K Vijaya Ramesh.

SUGGESTED WEBSITES

1. https://egyankosh.ac.in/
2. https://faculty.weber.edu/

3. https://en.wikipedia.org/
4. http://ecoursesonline.iasri.res.in/
5. https://www.fightbac.org/
6. https://www.sciencedirect.com/

INSTRUCTIONAL STRATEGY

This being one of the most basic subjects for the students of food technology, the teachers should lay a lot of emphasis on explaining the facts, concepts, principles, and procedures involved in

various topics. The students should be given appropriate tutorial exercises. Teachers should made use of chart and other appropriate media to support classroom instruction. Emphasis during the practical session should be on performance by individual students and teacher should develop instructional manual for various exercises to facilitate the students. Visits to some of the local industries and quality control centers may be arranged to demonstrate various aspects of basic microbiology to the students. Experts may be invited to deliver lecturers on latest developments in the field. This subject contains five units of equal weightage.

2.6 UNIT OPERATIONS IN FOOD PROCESSING

L	P
2	4

RATIONALE

This subject is aimed to develop an understanding among the students about various unit operation involved in food processing such as cleaning, sorting, grading, mixing, size reduction, filtration, sieving, membrane separation, extraction, distillation and crystallization and their importance.

COURSE OUTCOMES

After going through this course, the student will be able to:

CO1: Summarize the basic theory of cleaning, sorting, grading, peeling and mixing process.
CO2: Apply the principle of size reduction and different extraction methods.
CO3: Describe the sieving and membrane separation process and equipments used.
CO4: Explain the basic theory of filtration and centrifugation.
CO5: Implement the distillation and crystallization process**.**

DETAILED CONTENTS

UNIT I

Introduction to unit operation in food processing; preliminary unit operation- objective of cleaning, methods of cleaning (abrasion, aspiration, electrostatic, magnetic, flotation, soaking, spray washing); air screen cleaners; specific gravity cleaners, objective of sorting (size, shape, color, weight); Grading;

Introduction to mixing process; objectives of mixing in food processing; Mixing of fluids (blending) Paddle mixer, turbine mixer, anchor mixer, helical mixer, propeller mixer; mixing of dough and paste like material (kneading) planetary mixers, horizontal dough mixer, Z- blade mixer; mixing of dry solids (tumbler mixer, ribbon mixer, internal screw mixer),

UNIT II

Size Reduction-Theory of comminution; Size reduction procedures-crushing, impact, shearing, cutting; Size reduction equipment; jaw crusher, gyratory crusher, crushing rolls, hammer mills, attrition mills, fluid energy jet mill, rolling compression mills), cutting machines in food industry, construction and operation; homogenization (pressure homogenizers, colloid mill, ultrasonic homogenizer) Selection criteria for size-reduction equipment; Extraction-hydraulic/plate press, screw press; pulpers

UNIT III

Sieving: Separation based on size and shape (mesh size) ; definition of ideal and actual screen, oversize and under size particles, aperture, trough, blinding of screen,; perforated metal screens; wire mesh screen; BIS and ASTM sieve size standards; types of screens; grizzly; gyratory screen, revolving screen; shaking screen; vibratory screen; horizontal screen; factors affecting efficiency of screen; application of size separation

Membrane separation: General considerations, type of membrane filtration (micro, ultra, nano and reverse osmosis)

UNIT IV

Filtration terminology (feed slurry, filtrate, filter medium, filter aids, filter cake, filter), theory of filtration, types of filtration process (surface, depth, filter aid, plate frame, rotary drum, cartridge filter, bag filters)

Cyclone separator, cream separator and Gerber centrifuge

UNIT V

Definition of crystallization, nucleation, precipitation, solubility, saturated solution, supersaturation and recrystallization; types of crystallizer- tank type, agitated batch, Swenson-Walker, krystal; application of crystallization.

Definition of distillation terminology distillate, condensation, condenser; types of distillation process (simple, fractional, steam, vacuum); application of distillation process in food industry

Note: Wherever necessary equipment are not available students may be demonstrated that topic in relevant industry or in any other institute.

PRACTICAL EXERCISES

1. To determine the bulk density and true density of given food sample.
2. To study the construction of color sorting equipment used in food industry.
3. To study the working principle and construction of abrasion peeling equipment.
4. To study the working principle and construction of ball-mill.
5. To demonstrate the size reduction of grains using mill.
6. To demonstrate the oil extraction using oil expeller.
7. To demonstrate the juice extraction by using bucket press and screw press juice extractor.
8. To demonstrate the steam distillation of herbs.
9. To study the construction of revolving screens.
10. To demonstrate the preparation of distilled water by using lab scale simple distillation unit.
11. To study the working principle and construction of lab scale sieve shaker.
12. Demonstration on working and construction of fruit pulpers.
13. To study the working principle and construction of cyclone separator.
14. To study the working principle and construction of dough mixer.
15. To study the working principle and construction of Swenson walker crystallizer.
16. Visit to various food industries for demonstration of various unit operations

RECOMMENDED BOOKS

1. Handling, Transportation and Storage of Fruits and Vegetables by A Lloyd, RyallPenizer (AVI Publications).
2. Unit Operations in Food Engineering by Albert Ibarz and Gustavo V. Barbosa-Cánovas, CRC Press
3. Introduction to Food Engineering by R. Paul Singh, Dennis R. Heldman
4. Unit Operations in Food Processing by R. L. Earle
5. Fundamentals of Food Engineering by DG Rao, PHI Learning Private Limited, New Delhi.
6. Transport Processes and Separation Processes Principles by Geankoplis CJ, Printice Hall India, New Delhi.
7. Unit Operations of Chemical Engineering by Warren, L McCabe, J.C. Smith and Peter Harriot, McGraw Hill.
8. Fundamentals and Operations in Food Process Engineering, by bySusanta Kumar Das and Madhusweta Das, CRC Press
9. Handbook of Food Processing Equipment by George Saravacos, Athanasios E. Kostaropoulos, Springer

10. Unit Operations – I & II, by K. A. Gavhane, NiraliParkashan
11. Handbook of Post-harvest Technology by Chakraverty, A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S., Marcel Dekker Press, USA, 2001.
12. Food Storage Part of a system by Sinha and Muir (AVI)
13. Post Harvest Technology of Fruits and Vegetables – Handling, Processing, Fermentation and Waste Management by LR Verma and VK Joshi; Indus Publishing com., New Delhi
14. Drying and Storage of Grains and Oilseeds by Brooker& Hall, CBS.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://epgp.inflibnet.ac.in/

INSTRUCTIONAL STRATEGY

Teachers should prepare tutorial exercises for the students, involving visits to various food processing units. These tutorials can be considered a mini projects. Students may be asked to bring specifications and catalogues from industries. Students may also be exposed to relevant National, BIS and international standards. An intensive exercise on actual workbench performance in the industries is recommended. Experts may be invited to deliver lectures on various themes. Use of audio-visual aids will also be useful for better conceptualization of various operations. This subject contains five units of equal weightage.

SECOND YEAR

NSQF LEVEL - 4

12. STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
3.1	Industrial/In-house Training – I	-	2	0+2=1	-	40	40	-	60	60	100
3.2	Technology of Non-alcoholic Beverages	2	4	2+2=4	40	40	80	60	60	120	200
3.3	Technology of Cereals and Pulses	2	4	2+2=4	40	40	80	60	60	120	200
3.4	Technology of Meat, Fish & Poultry Products	2	4	2+2=4	40	40	80	60	60	120	200
3.5	Fruit & Vegetables Technology	2	4	2+2=4	40	40	80	60	60	120	200
3.6	Food Fermentation Technology	2	4	2+2=4	40	40	80	60	60	120	200
3.7	Multidisciplinary Elective (MOOCs^{+}/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
# Student Centered Activities(SCA)		-	1	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**23**	**240**	**240**	**480**	**360**	**360**	**720**	**1200**

\+ Assessment of Multidisciplinary Elective through MOOCs shall be based on assignments out of 100 marks.

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

FOURTH SEMESTER :

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
4.1	*English & Communication Skills – II	2	2	2+1=3	40	40	80	60	60	120	200
4.2	Principles of Food Engineering	2	2	2+1=3	40	40	80	60	60	120	200
4.3	Bakery & Confectionery Technology	2	4	2+2=4	40	40	80	60	60	120	200
4.4	Food Analysis & Quality Control	2	4	2+2=4	40	40	80	60	60	120	200
4.5	Technology of Milk & Milk Products	2	4	2+2=4	40	40	80	60	60	120	200
4.6	Open Elective (MOOCs^{+}/Offline)	2	-	2+0=2	40	-	40	60	-	60	100
4.7	Minor Project	-	6	0+3=3	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	1	-	-	-	-	-	-	-	-
	Total	**12**	**23**	**23**	**240**	**240**	**480**	**360**	**360**	**720**	**1200**

* Common with other Diploma Courses

\+ Assessment of Open Elective through MOOCs shall be based on assignments out of 100 marks.

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Industrial Training: After 4th Semester, students shall undergo Industrial Training of 4 Weeks.

13. HORIZONTAL AND VERTICAL SUBJECTS ORGANISATION

Sr. No.	Subjects/Areas	Hours Per Week	
		Third Semester	Fourth Semester
1.	Industrial/In-house Training – I	2	-
2.	Technology of Non-alcoholic Beverages	6	-
3.	Technology of Cereals and Pulses	6	-
4.	Technology of Meat, Fish & Poultry Products	6	-
5.	Fruit & Vegetables Technology	6	-
6.	Food Fermentation Technology	6	-
7.	Multidisciplinary Elective (MOOCs /Offline)	2	-
8.	English & Communication Skills – II	-	4
9.	Principles of Food Engineering	-	4
10.	Bakery & Confectionery Technology	-	6
11.	Food Analysis & Quality Control	-	6
12.	Technology of Milk & Milk Products	-	6
13.	Open Elective (MOOCs /Offline)	-	2
14.	Minor Project	-	6
15.	Student Centered Activities	1	1
	Total	**35**	**35**

14. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to Food Technology require **skilled workers** to work in familiar, predictable, routine situations of clear choice. They are expected to have factual knowledge of automation and robotics field. They shall be able to write and speak with required clarity. Students after passing level 4 shall have understanding of basic arithmetic, algebraic principles along with basic understanding of social and natural environment. They are expected to recall and demonstrate quality skill in narrow range of applications using appropriate rules and tools.

Skilled workers will be responsible for carrying out a range of jobs, some of which will require them to make choices about the approaches they adopt. They will be expected to learn and improve their practice on the job. They should know what constitutes quality in the occupation and should distinguish between good and bad quality in the context of their job roles. Skilled worker at this level will be expected to carry out their work safely and securely and take full account of the health and safety on colleagues and customers. They should work hygienically and in ways which show an understanding of environmental issues. In working with others, they will be expected to conduct themselves in ways which show a basic understanding of the social and political environment. They might find work with various food companies.

They will have scope of wage/self-employment in the following major areas:

1. Wage employment
   - Fruit and vegetable processing
   - Bakery and confectionery
   - Beverages
   - Dairy
   - Oil and fat
   - Meat, fish and poultry
   - Health and specialized food
   - Grain milling
   - Convenience food
   - Quality control
   - Educational institutions
   - KVIC etc.

2. Self-employment
   - Fruit and vegetable processing
   - Bakery and confectionery
   - Dairy
   - Milling of grains and spices
   - Oil expelling units
   - Snacks
   - Service units to larger industry/ ancillary units

15. PROGRAMME OUTCOMES

The program outcomes are derived from five domains of NSQF Level – 4 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Work in familiar, predictable, routine situation of clear choice.

PO2: Acquire factual knowledge in the field of Food Technology for employment.

PO3: Recall and demonstrate quality skills in routine and repetitive in narrow range of applications using appropriate rules and tools.

PO4: Write and speak with required clarity and show basic understanding of social and natural environment.

PO5: Perform tasks with responsibility for own work and learning.

PO6: Select multidisciplinary and open elective of own interest to develop self-learning through MOOCs.

16. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be Assessed	Assessment Criteria for the Course Outcomes
PO1: Work in familiar, predictable, routine situation of clear choice.	• Explain scope and status of beverage industry in India and water quality • Identify and use ingredients of food beverages and their quality • Discuss mineral water processing and its specifications and standards • Explain wheat Structure, types of wheat, composition, wheat milling technology, pasta and extruded products. • Describe varieties of rice, various physical parameters, parboiling, milling of rice. • Explain structure, milling of maize
PO2: Acquire factual knowledge in the field of Food Technology for employment	• Explain the structure, composition and nutritive value of meat and meat products and ante-mortem and postmortem changes and factors affecting the quality of meat produced and different slaughter methods. • Summarize chemical composition and nutritive value of poultry meat, Inspection and Dressing of poultry birds, factors affecting the quality • Explain composition and nutritive value of fish, processing and preservation of fish-Canning, Salting, Freezing, Drying and Smoking, Fish products like fish meal, fish protein concentrate, fish liver oil; by-product utilization in meat, poultry and fish industry • Explain the fermentation process, type of fermentation and nutritive value of fermented food.

	• Explain the working and different parts of the fermenter. • Summarize the process to prepare distilled beverages (whiskey, primary, rum), wine, beer, vinegar and baker's yeast • Describe the process to prepare curd, yogurt, tempeh, tofu and miso, sauerkraut. • Summarize the sources, microorganism, process, nutritive value and advantages and limitations of single cell protein.
PO3: Recall and demonstrate quality skills in routine and repetitive in narrow range of applications using appropriate rules and tools	• Understand the working environment of industries. • Take necessary safety precautions and measures. • Work in team for solving industrial problems. • Develop competencies and skills required by relevant industries. • Apply different methods like canned meat, cured and smoked meat, meat sausage, meat pickles • Discuss the working and use of manometer and pumps in food industries. • Explain mode of heat transfer, working of heat exchanger, evaporator and mass transfer • Explain the basic concept and use of Pasteurizer, Autoclave, Dryers. • Explain the basic concept of boiler, blancher and discuss importance of selection and maintenance of equipments • Apply different bread making methods. • Use different methods to prepare biscuits and crackers.

	• Describe preparation methods of bakery products: rusks, buns, pizza base. • Identify and define confectionery products, confectionery ingredients, sugar and liquid sweeteners, Reaction of sugar, sugar boiled, chocolate and Indian confectionary
PO4: Write and speak with required clarity and show basic understanding of social and natural environment.	• Develop writing, speaking and presentations skills • Communicate effectively with an increased confidence; read, write and speak in English language fluently. • Comprehend special features of format and style of formal communication through various modes. • Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews • Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonalrelationships. • Create writing and communication skills. • Develop Presentation skills.
PO5: Perform tasks with responsibility for own work and learning.	• Apply the process to make Jam, Jellies, Marmalade, Fruit Juices and canning of fruits and vegetables. • Apply processes to prepare different tomato products Like Ketchup, Sauce, Puree and Paste. • Use dehydration, freezing process, canning process and recent developments for fruits and vegetables preservation • Describe Concept, objectives and need of Quality, Statistical Quality Control, TQM and TQC.

	• Demonstrate sampling techniques and requirements of sampling. • Discuss sensory quality control objectives and interpretation of sensory results in statistical quality control. • Discuss different types and factors affecting the quality of condensed milk, Methods of drying milk. • Summarize the concept of ice cream preparation and cleaning and sanitation of dairy plant and equipment
PO6: Select multidisciplinary and open elective of own interest to develop self-learning through MOOCs	• State the basic concepts and principles of multidisciplinary and open elective subject. • Perform in a better way in the professional world. • Learn the subject related to own interest. • Explore latest developments in the multidisciplinary and open elective field. • Develop the habit of self-learning. • Display analytical and research abilities. • Integrate multiple knowledge domains. • Enhance the scope and depth of learning.

17. SUBJECTS & CONTENTS

(SECOND YEAR)

THIRD SEMESTER

3.1 INDUSTRIAL / IN–HOUSE TRAINING-I

L	P
-	2

RATIONALE

Industrial training / In – house training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Understand the working environment of industries
CO2: Take necessary safety precautions and measures.
CO3: Learn about present and future requirement of industries.
CO4: Work in team for solving industrial problems
CO5: Develop competencies and skills required by relevant industries.
CO6: Develop writing, speaking and presentations skills.

PRACTICALEXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training / In – house training report and their presentation using Power Point about the knowledge and skills gained during the training. The

Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation.

The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial / In-house assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

3.2 TECHNOLOGY OF NON-ALCOHOLIC BEVERAGES

L	P
2	4

RATIONALE

Non-alcoholic industries are one of the fast growing industries in India. Therefore, this subject is introduced with the basic objective to impart knowledge and skills of process techniques and equipment used for the production of these beverages, to the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain scope and status of beverage industry in India and water quality
CO2: Identify and use ingredients of food beverages and their quality
CO3: Discuss mineral water processing and its specifications and standards
CO4: Summarize the basic concept of carbonated beverage preparation, inspection, quality control and machinery.
CO5: Explain technology behind preparation of tea, instant tea, coffee, fruit juice-based beverages, synthetic beverages

DETAILED CONTENTS

UNIT I

Introduction-Definition, scope and status of beverage industry in India
Water: Sources, quality, treatment

UNIT II

Ingredients of food beverages; sweeteners, emulsifiers, coloring agents, flavoring agents, stabilizers, water and their quality

UNIT III

Mineral water and its specifications and standards

UNIT IV

Carbonated Beverages-Equipment and machinery for carbonated beverages, water treatment, syrup preparation, containers and closures. Cleaning, carbonation, filling, inspection and quality control

UNIT V

Non-carbonated beverages-Technology, specification, equipment and machinery for instant and normal tea and coffee, fruit juice-based beverages, synthetic beverages

PRACTICAL EXERCISES

1. Preparation of carbonated beverages and their evaluation
2. Preparation of instant coffee
3. Preparation of tea
4. Preparation of Ready To Serve beverages (RTS beverages)
5. Preparation of squash
6. Determination of water quality parameters; hardness, pH, turbidity, E-coli Test, DO, BOD, COD
7. Preparation of flavoured milk
8. Analysis of a spurious liquor sample
9. Determination of CO2 level carbonated beverages
10. Visit to carbonated and non-carbonated beverage industry

RECOMMENDED BOOKS

1. “Technology of Carbonated Beverage”, AVI Publications.
2. AJ Mitchel, “Formulation and Production of Carbonated Soft Drinks”, Blackie Publishers.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com/
5. https://www.brainkart.com/

6. https://web.iitd.ac.in
7. http://ecoursesonline.iasri.res.in/

INSTRUCTIONAL STRATEGY

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the food beverage, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject contains five units of equal weight age.

3.3 TECHNOLOGY OF CEREALS AND PULSES

L	P
2	4

RATIONALE

This subject is aimed at imparting knowledge and skills related to the processing techniques, value addition, and handling of processing equipment of cereals and pulses to the students, as the understanding of these aspects is essential for diploma holders in food technology to perform efficiently and effectively in the industry.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain wheat Structure, types of wheat, composition, wheat milling technology, pasta and extruded products.
CO2: Describe varieties of rice, various physical parameters, parboiling, milling of rice.
CO3: Explain structure, milling of maize
CO4: Explain structure of Barley, technology of malt production, milling, malting and popping of sorghum.
CO5: Describe chemical composition, processing and utilization of millets and Pretreatment, milling of pulses.

DETAILED CONTENTS

UNIT I

Status, production and major growing areas of cereals and pulses in India and world
Wheat: Structure, types of wheat, composition, wheat milling technology, pasta and extruded products

UNIT II

Rice: Varieties of rice, classification of rice based on various physical parameters, parboiling, milling of rice, and factors affecting quality of rice products

UNIT III

Maize: Classification of maize, dry and wet milling of corn, preparation of corn flakes

UNIT IV

Barley and sorghum: Grain characteristics, technology of malt production, milling, malting and popping of sorghum

UNIT V

Different millets and their chemical composition, processing and utilization. Pulses- Pretreatment of pulses for milling, milling of major pulses.
Anti-nutritional factors wherever applicable

PRACTICAL EXERCISES

1. Determination of physical characteristics of rice.
2. Determination of physical characteristics of wheat.
3. Determination of physical characteristics of pulses.
4. Determination of physical characteristics of maize
5. Determination of physical characteristics of barley and sorghum
6. Milling of wheat to study its effect on various physical-chemical properties
7. Estimation of Gluten.
8. Estimation of Ash.
9. Estimation of Water Absorption Power (WAP).
10. Estimation of Sedimentation Test.
11. Estimation of Maltose Value.
12. Estimation of Pelshenke Value
13. Parboiling and milling of rice
14. Pre-treatment and milling of pulses
15. Preparation of Pasta products – Noodles, Macroni, Vermicelli (Sevian)
16. Preparation of ready-to-eat (RTE) food products by extrusion cooking technology
17. Visits to flour mill, Rice Mill/Rice Sheller, Dhal Mill, Milling and Brewing Units

RECOMMENDED BOOKS

1. Kent, “Cereal Technology”, CBS Publishers, Delhi
2. Y Pomeranz, “Wheat Chemistry and Technology”, AACC.
3. AC Chakraborty, “Post-Harvest Technology of Cereals Pulses and Oilseeds” by, IBH Publications, Delhi.
4. Julian, “Rice Chemistry and Technology”, AACC.
5. Matz, “Chemistry of Technology of Cereals as Food and Feed”.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://readsoftcopy.blogspot.com/
3. https://gpadampur.wordpress.com/
4. https://www.egyankosh.ac.in/
5. http://ecoursesonline.iasri.res.in/
6. https://agrimoon.com/
7. https://www.brainkart.com/

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teachers should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students to visit various industries. Students may also be exposed to various National, BIS and international standards. Visits to the relevant industry for demonstrating various operations involved in the cereal, pulses, and oilseed processing is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may +be provided to the students. Wherever relevant, students may be made aware about safety aspects.
Wherever equipment is not available students may be demonstrated on that topic relevant industry or in any other institutions. This subject contains five units of equal weightage.

3.4 TECHNOLOGY OF MEAT, FISH AND POULTRY PRODUCTS

L	P
2	4

RATIONALE

This subject is included in the curriculum to impart basic knowledge and skills of various technologies and equipment used for production of raw as well as processed meat, fish and poultry products, in the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain the structure, composition and nutritive value of meat and meat products and ante-mortem and postmortem changes and factors affecting the quality of meat produced and different slaughter methods.

CO2: Apply different methods like canned meat, cured and smoked meat, meat sausage, meat pickles.

CO3: Summarize chemical composition and nutritive value of poultry meat, Inspection and Dressing of poultry birds, factors affecting the quality

CO4: Summarize structure, chemical composition and nutritive value of egg and spoilage and preservation of eggs, preparation of egg powder

CO5: Explain composition and nutritive value of fish, processing and preservation of fish-Canning, Salting, Freezing, Drying and Smoking, Fish products like fish meal, fish protein concentrate, fish liver oil; by-product utilization in meat, poultry and fish industry.

DETAILED CONTENTS

UNIT I

Introduction to Indian meat, fish and poultry industry. Introduction to structure, composition and nutritive value of meat tissue, Introduction to post postmortem changes (loss of homeostasis, postmortem glycolysis and pH decline, rigor mortis), Factors affects meat quality, Introduction to meat quality parameters (Meat Colour, Water Holding Capacity, Marbling)**,** Different types of slaughtering methods (scientific and ritual), Antemortem inspection and post-mortem inspection of animal/slaughtered animal

UNIT II

Abattoir – Definition and construction; Basic preparatory procedures (comminution, emulsification, pre-blending), Meat processing- Curing of meat (objective of curing, ingredients and their function), Methods of curing (dry, brine and combination curing), Smoking of Meat (objective and type of smoking), Sausage (classification, processing steps), Canned meat, Meat pickles

UNIT III

Chemical composition and nutritive value of poultry meat, Characteristics of Poultry Meat**,** Pre slaughter handling, Inspection and Dressing of poultry birds, factors affecting the quality

UNIT IV

Egg and Egg Products- Structure, chemical composition and nutritive value, grading of eggs, spoilage of eggs and preservation of whole egg, preparation of egg powder

UNIT V

- Classification of fish, composition and nutritive value, judging the freshness of fish, Methods of processing and preservation of fish- Canning, Salting, Freezing, Drying and Smoking. Fish products – fish meal, fish protein concentrate, fish liver oil; Fish processing industries in India.
- Frozen Storage of fresh and processed meat, poultry and fish

PRACTICAL EXERCISES

1. Demonstration of slaughtering and different cuts in meat at a slaughterhouse
2. Preparation of different types of meat products and their quality evaluation
3. Demonstration of meat cutting and different meat cuts
4. Preparation of sausages and evaluation for acceptability and cost of preparation.
5. To perform calculation of shape and size index of egg
6. Preparation of ready to cook poultry and evaluation for acceptability and cost of preparation.
7. Demonstration of retail cuts of dressed chicken
8. To perform calculation of the haugh unit of egg.
9. To perform measurement of the air cell of the egg.
10. To perform candling for internal quality evaluation of eggs.

11. Determination of effect of temperature on coagulation of egg protein
12. Preparation of egg powder and evaluation for acceptability and cost of preparation.
13. Preparation of fish, meat and egg pickle and evaluation for acceptability and cost of preparation.
14. Demonstration of filtering & staking of fish
15. Determination of Iron sulfide formation in cooked eggs.
16. Preservation of whole egg
17. Determination of moisture and solid content of different egg constituents
18. Determination of specific gravity of eggs
19. Visit to slaughter houses and abattoir

RECOMMENDED BOOKS

1. Lawrie, “Meat Science”, Heinemann Educational Books Ltd., London.
2. Mountney, “Egg Science and Technology”, AVI Publish Co., Westport.
3. William J Stadelman, Owen J. Cotterill, Debbie Newkirk, Lynne Newby “Egg Science and Technology”, Publisher Taylor & Francis.
4. PC Pande, “Egg Science and Technology”, Vikas Publishing House (P) Ltd, New Delhi
5. CL Cutting, “Fish Processing and Preservation”, Agro Botanical Publisher.
6. Parkursht and Mountney, “Poultry, Meat and Egg Products”, CBS Publishers.
7. Jhari Sahoo, Manish Kumar Chatli, “Textbook on Meat, Poultry and Fish Technology”, NPCS Board of Consultants & Engineers.
8. “The Complete Technology Book On Meat, Poultry And Fish Processing”, NIIR Project Consultancy Services.
9. AL Winton, “Fish and Fish Products”, Hill *Book* Company U.K.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17064
5. http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=5955
6. https://agrimoon.com/wp-content/uploads/Fish-Products-Byproducts-Technology.pdf
7. https://www.brainkart.com/article/Fish_33976/

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teachers should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students to visit various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the fermentation of food, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject contains five units of equal weightage.

3.5 FRUIT AND VEGETABLES TECHNOLOGY

L	P
2	4

RATIONALE

This subject is aimed to develop an understanding in processing techniques and skills in handling equipment/machines used for preservation and value addition of perishables like fruits and vegetables. After this, the students will be able to explain the composition, nutritive value and characteristics of fresh fruits and vegetables

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain the composition, nutritive value and characteristics of fresh fruits and vegetables.
CO2: Summarize different preparatory operations like Cleaning, Sorting, Grading, Peeling and Blanching.
CO3: Apply the process to make Jam, Jellies, Marmalade, Fruit Juices and canning of fruits and vegetables.
CO4: Apply processes to prepare different tomato products Like Ketchup, Sauce, Puree and Paste.
CO5: Use dehydration, freezing process, canning process and recent developments for fruits and vegetables preservation.

DETAILED CONTENTS

UNIT I

1. Status and scope of fruits and vegetables industry in India, classification, composition and nutritive value of fruits and vegetables. Introduction to the ripening process of fruits.
2. Preparatory Operations (Cleaning, Sorting, Grading, Peeling and Blanching methods)

UNIT II

1. Ingredients and processes for the manufacture of: (i) James, Jellies and Marmalades. Preserves (ii) Pickles, Defects and factors affecting the quality of above
2. Chemistry and preparation of pectin

UNIT III

1. Tomato Products (Puree, Paste, Ketchup, Sauce)- Ingredients and their role, process for the manufacture.
2. Canning of fruit and vegetable (history, types of containers and their selection, spoilage of canned foods)

UNIT IV

1. Sun Drying, Dehydration process of fruits (plums, apricot, apple, fig, grapes, peach), Vegetables (Onion**,** peas, cauliflower, potato, methi, mushroom, tomato**),** Factor affecting drying**,** Advantages and limitation of drying.
2. Concentration and drying of fruit juices (Introduction, Methods, Advantages and limitation)
3. Osmo-dehydration – basic concept and applications

UNIT V

1. Freezing- Freezing process of selected fruits and vegetables: peas, beans, cauliflower, mushroom – changes during freezing, factors affecting, advantages and limitations of freezing. Introduction to thawing.
2. Recent development in fruits and vegetables processing.

PRACTICAL EXERCISES

1. Orientation to different processing equipment, their functions and uses
2. To perform peeling by different methods.
3. To perform estimation of pectin content.
4. Preparation of jam and evaluation for acceptability and cost of preparation.
5. Preparation of jelly and evaluation for acceptability and cost of preparation.
6. Preparation of marmalade and evaluation for acceptability and cost of preparation.
7. Preparation of preserves and evaluation for acceptability and cost of preparation.
8. Preparation of pickles by various methods and evaluation for acceptability and cost of preparation.
9. Preparation of tomato sauce and evaluation for acceptability and cost of preparation.
10. Preparation of tomato ketchup and evaluation for acceptability and cost of preparation.
11. To perform extraction of tomato juice by hot and cold break methods.
12. To perform Extraction of juice by various methods
13. To perform Bottling and processing of fruit juice.

14. Preparation of tomato puree/paste and evaluation for acceptability and cost of preparation.
15. Preparation of syrup and brine solutions and evaluation for acceptability and cost of preparation.
16. To perform dehydration of peas, potatoes.
17. To perform dehydration of grapes and apples.
18. Preparation of potato wafers and evaluation for acceptability and cost of preparation.
19. To perform freezing of peas.
20. Preparation of tomato powder and evaluation for acceptability and cost of preparation.
21. Visits to different fruit and vegetable processing industries

RECOMMENDED BOOKS

1. Girdhari Lal and Sidappa, "Fruits and Vegetable Preservation", ICAR, New Delhi.
2. Srivastava, "Preservation of Fruits and Vegetable", IBD Co., Lucknow.
3. Vijaya Khader, "Preservation of Fruits and Vegetable", Kalyani Publication.
4. Y LR Verma and VK Joshi, "Post Harvest Technology of Fruits and Vegetables – Handling, Processing, Fermentation and Waste Management".
5. Somogyi, "Processing Fruits: Science & Technology Vol 1-2".
6. Somogyi, "Processing Vegetables: Science & Technology Vol 1-2".
7. Desrosier, "The Technology of Food Preservation".
8. Potter, "Food Science".
9. "Basic Food Preparation", Manual.
10. Woodroof, "Commercial Vegetable Processing".

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://readsoftcopy.blogspot.com/
3. https://gpadampur.wordpress.com/
4. https://www.egyankosh.ac.in/
5. http://ecoursesonline.iasri.res.in/
6. https://agrimoon.com/
7. https://www.brainkart.com/

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teachers should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students to visit various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in fruits and vegetables processing, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge about pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject containsfive units of equal weight age.

3.6 FOOD FERMENTATION TECHNOLOGY

L	P
2	4

RATIONALE

This subject is developed with an objective to impart knowledge and skills related to process technologies and equipment used for the production of various fermented food products to the students

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain the fermentation process, type of fermentation and nutritive value of fermented food.
CO2: Explain the working and different parts of the fermenter.
CO3: Summarize the process to prepare distilled beverages (whiskey, primary, rum), wine, beer, vinegar and baker's yeast
CO4: Describe the process to prepare curd, yogurt, tempeh, tofu and miso, sauerkraut.
CO5: Summarize the sources, microorganism, process, nutritive value and advantages and limitations of single cell protein.

DETAILED CONTENTS

UNIT I
Introduction to Fermentation

Definition of fermentation, Classification of fermentation
Advantages and limitations of fermentation
Nutritive value of fermented food products

UNIT II
Substrates for fermentation process

Growth media and its types (Natural and synthetic), advantages and limitation
Composition of media (molasses, corn steep liquor, precursors, buffer, antifoaming agent

UNIT III

Fermenter/ Bioreactor

Design of a fermenter, Body construction: construction material
Main Parts of fermenter (agitator, sparger and baffles)
Functions and maintenance of fermenter

UNIT IV

Alcoholic beverages

Definition, types (wine and beer).
Process for production of wine and beer

Distilled beverages

Distillation process
Types of distilled spirits (whisky, brandy and rum)
Process for production of whisky, brandy and rum

UNIT V

Fermented products

Production technology of curd, yogurt, tempeh, miso, tofu, natto, vinegar, baker's yeast, sauerkraut

Single cell protein

Sources, micro-organism, process, nutritive value and advantages and limitations

PRACTICAL EXERCISES

1. Demonstration and study of fermenters and its functioning.
2. Preparation of wine
3. Preparation of beer
4. Preparation of vinegar
5. Preparation of Baker's yeast.
6. Preparation of milk based traditional fermented food: curd.
7. Preparation of milk based traditional fermented food yoghurt.

8. Preparation of soy based traditional fermented product: tempeh.
9. Preparation of cabbage based traditional fermented food: Sauerkraut.
10. Preparation of gingerale.
11. To determine alcohol content in alcoholic beverages
12. Visit to beverages and distillery (whiskey, Brandy, Rum)

RECOMMENDED BOOKS

1. Prescott and Don, "Industrial Microbiology", *CBS* Publishers and distributors Pvt. Ltd, New Delhi.
2. Casida, "Industrial Microbilogy" Inc., New York, Lester Earl Casida.
3. VK Joshi and Ashok Pandey, "Biotechnology: Food Fermentation", AVI Publish Co., Westport.
4. SS Marwaha, "Biotechnology – Food Processing Application", Asiatech Publishers Inc., New Delhi.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com
5. https://www.brainkart.com
6. https://web.iitb.ac.in
7. https//ecourseonline.iasri.res.in

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teachers should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students to visit various industries. Students may also be exposed to various national and international standards. Visits to the relevant industry for demonstrating various operations involved in the food beverage, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge about pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject contains five units of equal weightage.

3.7 MULTIDISCIPLINARY ELECTIVE

L	P
2	-

RATIONALE

Multidisciplinary electives are very important and play major role in implementation of National Education Policy. Multidisciplinary is a subject which is useful for two or more disciplines in which students are asked to understand the concept of multidisciplinary or interdisciplinary. It will help the students to gain an arsenal of skills that are easily transferable across work environments.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: Apply critical thinking problem solving.
CO2: Demonstrate self and time management.
CO3: Display analytical and research abilities.
CO4: Integrate multiple knowledge domains.
CO5: Enhance the scope and depth of learning.

LIST OF MULTIDISCIPLINARY ELECTIVES

(The list is indicative and not exhaustive)

1. Introduction to Internet of Things
2. Introduction to Robotics
3. Introduction to Embedded System Design
4. Fundamentals of Artificial Intelligence
5. Digital Image Processing
6. Introduction to Machine Learning
7. Fundamentals of Artificial Intelligence
8. The Joy of Computing Using Python
9. Cloud Computing
10. Introduction to Industry 4.0
11. Industrial Internet of Things
12. Object Oriented System Development using UML, Java and Patterns

GUIDELINES

Multidisciplinary Elective shall be offered preferably in online mode. Online mode multidisciplinary elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of multidisciplinary electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online multidisciplinary electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline multidisciplinary electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs multidisciplinary elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline multidisciplinary elective shall be internal and external. The offline multidisciplinary elective internal assessment of 40 marks shall be based on internal sessional tests, assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

FOURTH SEMESTER

4.1 ENGLISH AND COMMUNICATION SKILLS - II

L	P
2	2

RATIONALE

Communication II moves a step further from Communication Skills I and is aimed at enhancing the linguistic competency of the students. Language as the most commonly used medium of self-expression remains indispensable in all spheres of human life – personal, social and professional. This course is intended to make fresh ground in teaching of Communicative English as per the requirements of National Skill Quality Framework.

COURSE OUTCOMES

After undergoing this course, the learners will be able to:

CO1: Communicate effectively with an increased confidence; read, write and speak in English language fluently.
CO2: Comprehend special features of format and style of formal communication through various modes.
CO3: Write a Report, Resume, make a Presentation, Participate in GDs and Face Interviews
CO4: Illustrate use of communication to build a positive self-image through self-expression and develop more productive interpersonal relationships.

DETAILED CONTENTS

UNIT I
Reading

1.1 Portrait of a Lady - Khushwant Singh
1.2 The Doctor's Word by R K Narayan
1.3 Speech by Dr Kiran Bedi at IIM Indore2007 Leadership Concepts
1.4 The Bet - by Anton Chekov

UNIT II

Effective Communication Skills

2.1 Modern means of Communication (Video Conferencing, e- mail, Teleconferencing)
2.2 Effective Communication Skills: 7 C's of Communication
2.3 Non-verbal Communication – Significance, Types and Techniques for Effective Communication
2.4 Barriers and Effectiveness in Listening Skills
2.5 Barriers and Effectiveness in Speaking Skills

Unit III

Professional Writing

3.1 Correspondence: Enquiry letters, placing orders, complaint letters
3.2 Report Writing
3.3 Memos
3.4 Circulars
3.5 Press Release
3.6 Inspection Notes and tips for Note-taking
3.7 Corrigendum writing
3.8 Cover Letter

UNIT IV

Grammar and Vocabulary

4.1 Prepositions
4.2 Conjunctions
4.3 Punctuation
4.4 Idioms and Phrases: A bird of ill omen, A bird's eye view, A burning question, A child's play, A cat and dog life, A feather in one's cap, A fish out of water, A shark, A snail's pace, A snake in the grass, A wild goose chase, As busy as a bee, As faithful as dog, Apple of One's eye, Behind one's back, Breath one's last, Below the belt, Beat about the bush, Birds of a feather flock together, Black Sheep, Blue blood, By hook or crook, Chicken hearted, Cut a sorry figure ,Hand in glove, In black and white, In the twinkling, In full swing ,Is blind as a bat, No rose without a thorn, Once in a blue moon, Out of the frying pan in to the fire, know no bounds ,To back out, To bell the cat, To blow one's

trumpet, To call a spade a spade, To cut one's coat according to one's cloth, To eat humble pie, To give ear to, To have a thing on one's finger tips, To have one's foot in the grave, To hold one's tongue, To kill two birds with one stone, To make an ass of oneself, To put two and two together, To the back bone, Turn coat, ups and downs.

4.5 Pairs of words commonly misused and confused: Accept-except, Access-excess, Affect-effect, Artificial- artful, Aspire-expire, Bail-bale, Bare-bear, Berth-birth, Beside-besides, Break-brake, Canvas-canvass, Course- coarse, Casual-causal, Council-counsel, Continual-continuous, Coma-comma, Cue- queue, Corpse- corps-core, Dairy-diary, Desert-dessert, Dual-duel, Dew- due, Die-dye, Draft- draught-drought, Device-devise, Doze-dose, Eligible-illegible, Emigrant- immigrant, Envelop-envelope, Farther-further, Gate-gait, Goal-goal, Human-humane, Honorable-honorary, Hail-hale, Hair-heir-hare, Industrial-industrious, Impossible- impassable, Idle-idol-ideal, Lose-loose, Later-latter, Lesson-lessen, Main-Mane, Mental-mantle, Metal-mettle, Meter-metre, Oar-ore, Pray-prey, Plain-plan, Principal - principle, Personal- personnel, Roll- role, Route-rout- roote, Stationary-stationery, Union- unity, Urban- urbane, Vocation- vacation, Vain- vein-vane, Vary- very.

4.6 Translation of Administrative and Technical Terms in Hindi or Mother tongue: Academy, Abandon, Acting in official capacity, Administrator, Admission, Aforesaid, Affidavit, Agenda, Alma Master, Ambiguous, Appointing Authority, Apprentice, Additional, Advertisement, Assistant, Assumption of charge, Assurance, Attested copy, Bonafide, Bond, Cashier, Chief Minister, Chief Justice Clerical error, Commanding ,Officer, Consent, Contractor, corruption, Craftsman, Compensation, Code, Compensatory allowance, Compile, Confidential letter, Daily Wager, Data, Dearness allowance, Death - Cum Retirement, Dispatch, Dispatch Register, Disciplinary, Disciplinary Action, Disparity Department, Dictionary, Director, Director of Technical Education, Earned Leave, Efficiency Bar, Estate, Exemption, Executive Engineer, Extraordinary, Employment Exchange, Flying Squad, General Body, Head Clerk, Head Office, High Commission, Inconvenience, Income Tax, Indian Assembly Service, Justify, Legislative Assembly, Negligence, Officiating ,Office Record, Office Discipline, On Probation, Part Time, Performance, Polytechnic, Proof Reader Precautionary, Provisional, Qualified, Regret, Responsibility, Self-Sufficient, Senior, Simultaneous ,Staff, Stenography ,Superior, Slate, Takeover, Target Data Technical Approval, Tenure, Temporary, Timely Compliance, Under Investigation, Under Consideration, Verification, Viva-voce, Write off, Working Committee, Warning, Yours Faithfully , Zero Hour.

UNIT V

Employability Skills

5.1 Presentation Skills: How to prepare and deliver a good presentation
5.2 Telephone Etiquettes
5.3 Importance of developing employable and soft skills
5.4 Resume Writing: Definition, Kinds of Resume, Difference between Bio-data and Curriculum Vitae and Preparing a Resume for Job/ Internship
5.5 Group discussions: Concept and fundamentals of GD, and learning Group Dynamics.
5.6 Case Studies and Role Plays

PRACTICAL EXERCISES

1. Reading Practice of the above lessons in the Lab Activity classes.
2. Comprehension exercises of unseen passages along with the given lessons.
3. Vocabulary enrichment and grammar exercises based on the above selective readings.
4. Situational Conversation: Requesting and responding to requests; Expressing sympathy and condolence.
5. Warning; Asking and giving information.
6. Getting and giving permission.
7. Asking for and giving opinions.
8. A small formal and informal speech.
9. Seminar.
10. Debate.
11. Interview Skills: Preparing for the Interview and guidelines for success in the Interview and significance of acceptable body-language during the Interview.
12. Written Drills will be undertaken in the class to facilitate a holistic linguistic competency among learners.
13. Participation in a GD, Functional and Non-functional roles in GD, Case Studies and Role Plays
14. Presentations, using audio-visual aids (including power-point).
15. Telephonic interviews, face to face interviews.
16. Presentations as Mode of Communication: Persuasive Presentations using multi-media aids.
17. Practice of idioms and phrases on: Above board , Apple of One's eye , At sea, At random, At large, A burning question, A child's play, A wolf in sheep's clothing, A deal, Breath

one's last, Bid fair to, Beat about the bush, Blue Blood, Big Gun, Bring to Book, Cut a sorry figure, Call names, Carry weight, Dark Horse, Eat Humble pie, Feel small, French leave, Grease the palm, Go against the grains, Get One's nerves, Hard and Fast, Hue and Cry, Head and ears, In full swing, Jack of all trades, know no bounds, kiss the dust, Keep an eye on, Lion's share, learn by rote, Null and void, on the cards, Pull a long face, Run amuck, Right and Left, Rain on Shine, Small talk, Take to one's heels, Tooth and nail, to take by storm, , Wet blanket, Yearn for.

RECOMMENDED BOOKS

1. Alvinder Dhillon and Parmod Kumar Singla, "Text Book of English and Communication Skills Vol – 1, 2", M/s Abhishek Publications, Chandigarh.
2. J Sethi, Kamlesh Sadanand & DV Jindal, "Course in English Pronunciation", PHI Learning Pvt. Ltd., New Delhi.
3. Wren and Martin, "High School English Grammar and Composition" .
4. NK Aggarwal and FT Wood, "English Grammar, Composition and Usage", Macmillan Publishers India Ltd., New Delhi.
5. RC Sharma, and Krishna Mohan, "Business Correspondence & Report Writing", (4^{th} Edition), by Tata MC Graw Hills, New Delhi.
6. Varinder Kumar, Bodh Raj & NP Manocha, "Business Communication Skills", Kalyani Publisher, New Delhi.
7. Kavita Tyagi & Padma Misra, "Professional Communication", PHI Learning Pvt. Ltd., New Delhi.
8. Nira Konar, "Communication Skills for Professionals", PHI Learning Pvt. Ltd., New Delhi.
9. Krishna Mohan & Meera Banerji, "Developing Communication Skills", (2^{nd} Edition), Macmillan Publishers India Ltd., New Delhi.
10. M. Ashraf Rizwi, "Effective Technical Communication", Tata MC Graw Hills, New Delhi.
11. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi.

INSTRUCTIONAL STRATEGY

This is practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required communication skills in the students. Emphasis should be given on practicing of communication skills. This subject contains five unit of equal weightage.

4.2 PRINCIPLES OF FOOD ENGINEERING

L	P
2	2

RATIONALE

This subject is aimed to develop in the students the knowledge and skills related to various operations of process equipment used in food processing industry.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Differentiate units of measurement and their conversion, different physical, thermal and rheological properties.
CO2: Discuss the working and use of manometer and pumps in food industries.
CO3: Explain mode of heat transfer, working of heat exchanger, evaporator and mass transfer
CO4: Explain the basic concept and use of Pasteurizer, Autoclave, Dryers.
CO5: Explain the basic concept of boiler, blancher and discuss importance of selection and maintenance of equipments

DETAILED CONTENTS

UNIT I

Introduction to units and measurement: Measurement in science, fundamental quantities and units, derived units, systems of units (CGS, FPS, MKS and SI: Base units, SI prefixes),
Definition of Physical properties like colour, size, shape, density, specific gravity, thousand grain weight/bulk density, porosity, Rheological properties of food materials and their importance. Thermal conductivity, specific heat, thermal diffusivity and other physical properties of foods

UNIT II

Manometers- Types and uses, Introduction to Reynolds number, fluid flow characteristics, pumps – principles, types and working of pumps (Centrifugal pumps, Diaphragm pumps, Gear pumps, Diaphragm pumps, Piston Pumps) used in food industry

UNIT III

1. Heat Transfer during food processing – Modes of heat transfer i.e. conduction, convection and radiation. Heat exchangers-Definition, Classification, construction and operation of Shell and tube heat exchanger, Spiral type, PHE, Extended Surface, scraped surface, Fluidized bed heat exchanger,
2. Evaporators (pan/batch type, forced circulation, falling film, rising film, rising and falling-film, Multiple-effect),
3. Mass Transfer during food processing- Principle of mass transfer, diffusion.

UNIT IV

Definition, construction, operation, types, viz. pasteurizer, autoclave, driers;

1. Definition, working and construction of Pasteurizer
2. Definition, working and construction of AutoClave
3. Definition, working and construction of dryers (Tray/Cabinet Dryers, Tunnel Dryers, Roller or Drum Dryers, Fluidized Bed Dryers, Spray Dryers, Pneumatic Dryers, Rotary Dryers, Vacuum Dryers, Freeze Dryers, Kiln Dryer, Tunnel drier),

UNIT V

1. Definition, working and construction of Blanchers (Steam and water)
2. Definition, working and construction of Boilers (simple vertical boiler, Babcock and Wilcox boiler, Fluidized Bed Boiler)
3. Introduction to selection and periodical maintenance of equipment used in the food industry.

PRACTICAL EXERCISES

1. Determination of physical properties like size, shape, roundness, sphericity of the food products
2. Determination of Bulk density of a given food sample.
3. Determination of true density of a given food sample.
4. Determination of thermal conductivity of a given food sample.
5. Determination of viscosity of a given food sample.
6. Determination of angle of repose of grains
7. Procedure of using a simple U-tube manometer.
8. How do you calculate Reynolds Number?

9. Constructional and working details of centrifugal pumps.
10. Constructional and working details of pasteurizer.
11. Constructional and working details of plate type heat exchanger.
12. Constructional and working details of tubular type heat exchanger.
13. Constructional and working details of pan type evaporator.
14. Constructional and working details of spray dryers.
15. Constructional and working details of drum dryers.
16. Constructional and working details of blanchers.
17. Constructional and working details of the boiler.
18. Reading and interpretation of psychro-metric charts
19. Use of steam tables and their interpretation.
20. Visits to different food processing industries use equipment (dryers, boilers, evaporators, autoclave etc.)

RECOMMENDED BOOKS

1. AC Chakraborty, "Post Harvest Technology of Cereal, Pulse and Oil Seeds", CBS Publishers, Delhi.
2. Singh and Sahay, "Unit Operations in Agriculture Processing", Vikas Publishing House (P) Ltd, New Delhi.
3. Brennen, "Fundamentals of Food Engineering", AVI Publishing Co., Westport.
4. Romeo T Toledo, "Fundamentals of Food Processing Engineering", AVI Publishing Co., Westport.
5. Henderson and Perry, "Agricultural Process Engineering", John Wiley and Sons, Inc., New York.
6. CJ GeanKoplis, "Transfer Processes and Unit Operation", McGraw-Hill Book Co., New York.
7. NK Mohsenin, "Physical Properties of Plants and Animal Materials", Gordon and Breach Science Publishers, New York, USA.
8. TE Charm, "Principles of Food Engineering", McGraw-Hill Book Co., New York.
9. RP Singh and DR Heldmann, "Introduction to Food Engineering", McGraw Hill Book Co., New York.
10. McCabe, Smith and Others, "Unit Observation in Chemical Engineering", McMillan Publishing Company, New York.
11. Earlle, "Unit Operation in Food Processing", Woodhead Publishing Limited, Cambridge, England.

SUGGESTED WEBSITE

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com/wp-content/uploads/Fish-Products-Byproducts-Technology.pdf
5. https://www.brainkart.com/article/Fish_33976/
6. https://web.iitd.ac.in/~pmvs/courses/mel709/classification-hx.pdf
7. http://ecoursesonline.iasri.res.in/ mod/page/view.php?id=17092

INSTRUCTIONAL STRATEGY

This being one of the most basic subjects for the students of food technology, the teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. The students should be given appropriate tutorial exercises. Teachers should make use of charts and other appropriate media to support classroom instruction. Emphasis during the practical session should be on performance by individual students and teachers should develop instructional manuals for various exercises to facilitate the students. Visits to some of the local industries may be arranged to demonstrate various equipment used in food processing Industries and cold stores to the students. Experts may be invited to deliver lecturers on latest developments in the field.

Whenever the required equipment is not available students may be demonstrated on that topic in industry or other institutions or industry. This subject contains five units of equal weightage.

4.3 BAKERY AND CONFECTIONERY TECHNOLOGY

L	P
2	4

RATIONALE

This subject is aimed at developing an understanding of process technology and skills in handling equipment involved for the preparation of bakery products in diploma students of food technology.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain bakery ingredients and their functions and describe use of bakery ovens.
CO2: Apply different bread making methods.
CO3: Use different methods to prepare biscuits and crackers.
CO4: Describe preparation methods of bakery products: rusks, buns, pizza base.
CO5: Identify and define confectionery products, confectionery ingredients, sugar and liquid sweeteners, Reaction of sugar, sugar boiled, chocolate and Indian confectionary.

DETAILED CONTENTS

UNIT I

Introduction – Status of Bakery industry in India. Historical Background of Baking. Bakery terms (Baking, Dough, Kneading, Baking Oven, Batter), Bakery ingredients and their functions (flour, sugar, shortening, yeast, salt, leavening agents, emulsifiers and antioxidant as raw material for bakery products and FSSAI specifications of these raw materials. Introduction to equipment (Baking Oven, humidity cabinet, Mixer, Slicer etc.) used in bakery industry, operation and maintenance of bakery equipment.

UNIT II

Different types of bread and preparation of bread using different methods: (Straight dough method, Sponge and dough method, Activated Dough Development (ADD), No dough time method, Chorleywood Bread Process (CBP). Characteristics of good bread: Internal characters; external characters.

UNIT III

Introduction and history of biscuit, Classification of biscuits and preparation of biscuits, using different methods, quality evaluation of biscuits, Preparation methods for crackers

UNIT IV

Different types of cakes, preparation of cakes using different methods, quality evaluation of cakes

Preparation of other bakery products: rusks, buns, pizza base.

Layout, setting up of units and hygienic conditions required in bakery plant

UNIT V

Confectionery Products- Introduction, classification of confectionery products, confectionery ingredients like starch, fats, colours, flavours additives. Brief account of sweeteners like Gur, refined sugar, beet sugar, white sugar and liquid sweeteners like Molasses, corn syrup, high fructose syrup, maple syrup.

Reaction of sugar like caramelization, hydrolysis sand crystallization, sugar boiled, chocolate and Indian confectionary

PRACTICAL EXERCISES

1. Demonstration of equipment used in the bakery industry.
2. Quality analysis of raw materials used in bakery and confectionery industry according to FSSAI standards.
3. Functional test bakery industry (Dough raising capacity, Gulten quality estimation).
4. Preparation, evaluation for acceptability and cost of preparation of bread.
5. Preparation, evaluation for acceptability and cost of preparation of cakes.
6. Preparation, evaluation for acceptability and cost of preparation of biscuits.
7. Preparation, evaluation for acceptability and cost of preparation of cookies.
8. Preparation, evaluation for acceptability and cost of preparation of multigrain cookies.
9. Preparation, evaluation for acceptability and cost of preparation of egg less cakes.
10. Preparation, evaluation for acceptability and cost of preparation of dry cake.
11. Preparation, evaluation for acceptability and cost of preparation of buns.
12. Preparation, evaluation for acceptability and cost of preparation of Pizza Base.
13. Preparation, evaluation for acceptability and cost of preparation of Candy like ginger
14. Study and analysis of the production charts used for different products by bakery industries.

15. Visits to bakery and confectionery industry

RECOMMENDED BOOKS

1. Matz, “Bakery Engineering and Technology - Vol. I and II”, CBS.
2. “Bakery Products”, SIRI.
3. Kent, “Cereal Technology”, CBS.
4. Y Pomeranz, “Wheat Chemistry and Technology”.
5. SC Dubey, “Basic Baking”.
6. William Sultan, “Practical Baking - Vol. I and II”.
7. “Practical Handbook of Bakery”, US Wheat Associates.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com
5. https://brainkart.com
6. https://web.iitd.ac.in
7. https://ecourseonline.iasri.res.in

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the Bakery and Confectionery processing is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject contains five units of equal weightage.

4.4 FOOD ANALYSIS AND QUALITY CONTROL

L	P
2	4

RATIONALE

In the production of processed foods, one of the important aspects is to assure quality. This subject is introduced in the curriculum to impart knowledge and skills in the students related to various food quality parameters/systems, techniques of food analysis, food laws and standards.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Explain Principle behind different methods of proximate analysis.
CO2: Describe Concept, objectives and need of Quality, Statistical Quality Control, TQM and TQC.
CO3: Demonstrate sampling techniques and requirements of sampling.
CO4: Discuss sensory quality control objectives and interpretation of sensory results in statistical quality control.
CO5: Summarize the concept of GMP, GHP, GLP, HACCP, TACCP, VACCP, HARPC.

DETAILED CONTENTS

UNIT I

1. Introduction
1.1. Principle behind different methods of proximate analysis of,
    1.1.1. Moisture
    1.1.2. Ash
    1.1.3. Crude Fat
    1.1.4. Crude Protein
    1.1.5. Crude Fibre
    1.1.6. Total Carbohydrates

UNIT II

Quality

2.1.1 Concept, objectives and need of:

2.2.1 Quality

2.2.2 Quality control and

2.2.3 Quality assurance

2.2.4 Statistical Quality Control

2.2.4 TQM (Total Quality Management)

2.2.5 TQC (Total Quality Control)

2.2.6 Plan and methods of quality control

UNIT III

Sampling

3.1 Definition of sampling,

3.2 Purpose,

3.3 Sampling techniques requirements and

3.4 Sampling procedures for

- 3.4.1 liquid,
- 3.4.2 powdered and
- 3.4.3 granular materials

Physicochemical and mechanical properties

3.5 Colour,

3.6 Gloss,

3.7 Flavour,

3.8 Consistency,

3.9 Viscosity,

3.10 Texture and their relationship with food quality

UNIT IV

Sensory quality control

4.1 Definition,

4.2 Objectives,

4.3 Panel selection and their training,

4.4 Subjective and objective methods,

4.5 Interpretation of sensory results in statistical quality control,

4.6 Consumer preferences and acceptance

UNIT V

Concepts of

5.1 GMP (Good Manufacturing Practices)
5.2 GHP (Good Hygienic Practices)
5.3 GLP (Good Laboratory Practices)
5.4 HACCP (Hazard Analysis andCritical Control Point)
5.5 TACCP (Threat Assessment and Critical Control Point)
5.6 VACCP (Vulnerability Assessment and Critical Control Point)
5.7 HARPC (Hazard Analysis and Risk- Based Preventive Control)

PRACTICAL EXERCISES

1. Proximate analysis of marketed food products
   1.1. Moisture
   1.2. Ash
   1.3. Crude Fat
   1.4. Crude Protein
   1.5. Crude Fibre
   1.6. Carbohydrates
2. Detection of different adulterants in food.
3. Detection of basic tastes and their threshold values
4. Statistical analysis of sensory data
5. Visits to the quality control laboratories of the food industry, educational institutions and testing centres.

RECOMMENDED BOOKS

1. Suzzane Nielsen, “Food Analysis”.
2. “ISI Handbook of Food Analysis- (18 Volumes in 5 parts)”, BIS.
3. “AOAC- 18th Edition- (CD ROM Edition)”.
4. S Ranganna, “Hand Book of Analysis of Fruits and Vegetables”, (THM).
5. Pomeranz and Meloan, “Food Analysis Theory and Practices”, (AVI).
6. Kramer and Twigg, “Quality Control for the Food Industry (Vol. I and II)”, (AVI).
7. Larmond, “Laboratory Methods of Sensory Evaluation”.
8. Piggot, “Sensory Analysis”.
9. S.N. Mahindru, “Hand Book of Food Analysis”.
10. Jacobs, “The Chemical Analysis of Food and Food Products”.
11. AK Sathe, “A First Course in Food Analysis”.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com
5. https://www.brainkart.com
6. https://web.iitd.ac.in
7. http://ecourseonline.iasri.res.in

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the food evaluation and quality control is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. This subject contains five units of equal weightage.

4.5 TECHNOLOGY OF MILK AND MILK PRODUCTS

L	P
2	4

RATIONALE

This subject is aimed at developing an understanding of various process technologies and handling of equipment used in the processing and value addition of milk and milk products in the students.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: Explain status, composition, physical and chemical properties of milk, Physico-chemical properties of milk, Quality control tests
CO2: Describe Fluid Milk Processing.
CO3: Demonstrate the process of preparing coagulated Milk Products, Cream/Butter/Ghee.
CO4: Discuss different types and factors affecting the quality of condensed milk, Methods of drying milk.
CO5: Summarize the concept of ice cream preparation and cleaning and sanitation of dairy plant and equipment.

DETAILED CONTENTS

UNIT I

Introduction – Status and scope of dairy industry in India Fluid Milk Definition of milk, composition, physical and chemical properties of milk constituents and nutritive value of milk, factors affecting composition of milk, types of milk, Physico-chemical properties of milk: Colour, flavour, taste, specific gravity, & density, boiling and freezing point, refractive index, acidity and pH, viscosity, surface tension, thermal conductivity. Basis for pricing of milk Quality control tests. Platform tests like-smell, appearance, temp, sediment, acidity, lactometer reading Chemical/Laboratory test: Acidity, PH, alcohol, fat, SNF, etc. Microbiological: SPC, MBRT, Resazurin tests etc

UNIT II

Fluid Milk Processing

Receiving, Filtration and clarification, straining, standardization Homogenization and its effects, Pasteurization: and various systems of Pasteurization; LTLT, HTST, UHT methods, Pasteurizers (Heating system, cooling system, flow controller, regenerator, flow diversion valve) sterilization, packaging of fluid milk.

UNIT III

Coagulated Milk Products

Channa, paneer, classification and manufacturing process of cheese

Cream/Butter/Ghee – Manufacture and storage of butter and ghee

UNIT IV

Condensed Milk

Types and factors affecting the quality of condensed milk, storage of condensed milk

Dry Milk Products

Methods of drying milk (Drum and Spray drying), factors affecting the quality of dry milk.

Introduction to instant non-fat dry milk packaging of dry milk products

UNIT V

Frozen Products

Manufacturing of and ice cream; factors affecting the quality of frozen products

Cleaning and sanitation of dairy plant and equipment

PRACTICAL EXERCISES

1. To conduct platform test of milk
2. Determination of SNF (Solids Not Fat), specific gravity, total solids of milk.
3. Testing efficacy of pasteurized milk
4. Determination of moisture & fat content of milk poweder
5. Study of familiarization with various parts and working of cream separator
6. Preparation of Khoa

7. Detection of adulterants in milk like water, urea, neutralizers, preservatives, sucrose starch
8. Preparation of channa and paneer
9. Preparation of ice cream
10. Visits to different dairy plants
11. To perform sampling of milk
12. Determination of titrable acidity of milk
13. Determination of fat by gerber method
14. Analysis of milk with the help of electronic milk tester

RECOMMENDED BOOKS

1. Eckles and Eckles, "Milk and Milk Products", Tata McGraw-Hill Education Pvt. Limited.
2. Sukmar De, "Outlines of Dairy Technology", Oxford University Press, India.
3. Tufail Ashmed, "Dairy Plant System and Layout", McGraw-Hill Education (India) Pvt Ltd.
4. Woarner, "Principles of Dairy Technology", Oxford University Press, India.
5. Forvall, "Dairy Engineering".
6. "Milk & Milk Products", CBSE, Oxford and IBH Publishing Co., New Delhi.
7. Atherton Newlander, "Chemistry & Testing of Dairy Products", John Alvin Newlander Publisher: Westport.

SUGGESTED WEBSITES

1. www.societyoffoodtech.com
2. https://gpadampur.wordpress.com/
3. https://www.egyankosh.ac.in/
4. https://agrimoon.com
5. https://www.brainkart.com
6. https://web.iitd.ac.in
7. http://ecourseonline.iasri.res.in

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National, BIS and international standards. Visits to the relevant industry for demonstrating various operations involved in the dairy technology, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge about pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects. Wherever the required equipments are not available students may be demonstrated that topic the industry or other. This subject contains five units of equal weightage.

4.6 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open electives are very important and play major role in implementation of National Education Policy. These subjects provide greater autonomy to the students in the curriculum, giving them the opportunity to customize it to reflect their passions and interests. The system of open electives also encourages cross learning, as students pick and choose subjects from the different streams.

COURSE OUTCOMES

At the end of the open elective, the students will be able to:

CO1: State the basic concepts and principles about the subject of interest.
CO2: Perform in a better way in the professional world.
CO3: Select and learn the subject related to own interest.
CO4: Explore latest developments in the field of interest.
CO5: Develop the habit of self-learning through online courses.

LIST OF OPEN ELECTIVES

(The list is indicative and not exhaustive)

1. Computer Application in Business
2. Introduction to NGO Management
3. Basics of Event Management
4. Event Planning
5. Administrative Law
6. Introduction to Advertising
7. Moodle Learning Management System
8. Linux Operating System
9. E-Commerce Technologies
10. NCC
11. Marketing and Sales
12. Graphics and Animations

13. Digital Marketing
14. Human Resource Management
15. Supply Chain Management
16. TQM

GUIDELINES

Open Elective shall be offered preferably in online mode. Online mode open elective shall preferably be through Massive Open Online Courses (MOOCs) from Swayam, NPTEL, Upgrad, Udemy, Khan Academy or any other online portal to promote self-learning. A flexible basket of large number of open electives is suggested which can be modified depending upon the availability of courses at suggested portals and requirements. For online open electives, department coordinators shall be assigned to monitor and guide the group of students for selection of minimum 20 hours duration online course of their choice. For offline open electives, a suitable relevant subject shall be offered by the respective department to the students with minimum 40% of the total class strength as per present and future requirements.

Assessment of MOOCs open elective shall be based on continuous evaluation by the respective coordinator. The coordinator shall consider the submitted assignments by the students from time to time during the conduct of MOOCs. The MOOCs assessment shall be conducted by the coordinator along with one external expert by considering submitted assignments out of 100 marks.

In case, no suitable open elective is available online, only then the course may be conducted in offline mode. The assessment of offline open elective shall be internal and external. The offline open elective internal assessment of 40 marks shall be based on internal sessional tests; assignments etc. and external assessment of 60 marks shall be based on external examination at institute level.

SUGGESTED WEBSITES

1. https://swayam.gov.in/
2. https://www.udemy.com/
3. https://www.upgrad.com/
4. https://www.khanacademy.org/

NOTE

The students enrolled under NCC will compulsorily undertake NCC as an open elective subject.

4.7 MINOR PROJECT

L	P
-	6

RATIONALE

Minor project work will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in Minor Project Work in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the minor project according to the need of industry.
CO2: Work as a team member for successful completion of minor project.
CO3: Write the minor project report effectively.
CO4: Present the minor project report using PPT.

GUIDELINES

Depending upon the interest of the students, they can develop minor projects as per present and future demand of the industry. The supervisors may guide the students to identify their minor project work and chalk out their plan of action well in advance. As a minor project activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the minor project.

The supervisor shall evaluate the students along with one external expert by considering the following parameters:

	Parameter	**Weightage**
i	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

THIRD YEAR

NSQF LEVEL - 5

18. STUDY AND EVALUATION SCHEME

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
5.1	Industrial Training – II	-	2	0+1= 1	-	40	40	-	60	60	100
5.2	Food Packaging Technology	2	4	2+2= 4	40	40	80	60	60	120	200
5.3	Food Additives, Spices and Condiments	2	4	2+2= 4	40	40	80	60	60	120	200
5.4	Computer Applications in Food Technology	-	4	0+2= 2	-	40	40	-	60	60	100
5.5	Health & Functional Foods	2	2	2+1= 3	40	40	80	60	60	120	200
5.6	Technology of Oils and Fats	2	4	2+2= 4	40	40	80	60	60	120	200
5.7	Programme Elective -I	3	-	3+0= 3	40	-	40	60	-	60	100
# Student Centered Activities(SCA)		-	4	-	-	-	-	-	-	-	-
	Total	**11**	**24**	**21**	**200**	**240**	**440**	**300**	**360**	**660**	**1100**

Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Programme Electives I: 5.7.1 Snacks and Extruded Food Products 5.7.2 Food Hygiene and Sanitation
5.7.3 Advances in Food Technology

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week		Credits (C) L+P = C	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	P		Th	Pr	Tot	Th	Pr	Tot	
6.1 *	Entrepreneurship Development and Management	3	-	3+0= 3	40	-	40	60	-	60	100
6.2	Food Laws and Standards	2	-	2+0= 2	40	-	40	60	-	60	100
6.3	Waste Management in Food Industry	2	2	2+1= 3	40	40	80	60	60	120	200
6.4	Programme Elective -II	3	-	3+0= 3	40	-	40	60	-	60	100
6.5	Major Project/ Industrial Training	-	20	0+10= 10	-	40	40	-	60	60	100
# Student Centered Activities(SCA)		-	3	-		-	-	-	-	-	-
	Total	10	25	21	**160**	**80**	**240**	**240**	**120**	**360**	**600**

* Common with other Diploma Courses

\# Student Centered Activities will comprise of co-curricular activities like extension lectures on Constitution of India, Electoral Literacy, Motor Vehicles (Driving) Regulations 2017 etc., games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

Programme Electives II: 6.4.1 Food Auditing and Certifications 6.4.2 Food By-products Utilization

6.4.3 Instrumentation and Process Control

19. HORIZONTAL AND VERTICAL ORGANISATION OF SUBJECTS

Sr. No.	Subjects/Areas	Hours Per Week	
		Fifth Semester	Sixth Semester
1.	Industrial Training – II	2	-
2.	Food Packaging Technology	6	-
3.	Food Additives, Spices and Condiments	6	-
4.	Computer Applications in Food Technology	4	-
5.	Health & Functional Foods	4	-
6.	Technology of Oils and Fats	6	-
7.	Programme Elective -I	3	-
8.	Entrepreneurship Development and Management	-	3
9.	Food Laws and Standards	-	2
10.	Waste Management in Food Industry	-	4
11.	Programme Elective -II	-	3
12.	Major Project/ Industrial Training	-	20
13.	Student Centered Activities	4	3
	Total	**35**	**35**

20. COMPETENCY PROFILE & EMPLOYMENT OPPORTUNITIES

Government and private sectors related to **Food Technology** require **supervisors** having well developed skills with clear choice of procedures. They are expected to have complete knowledge and practical skills related to food technology field. They shall be able to communicate clearly with others. Diploma holders after passing level 5 shall have understanding of desired mathematical skills and understanding of social and natural environment. They are expected to collect, organize and communicate information effectively.

Work requiring knowledge, skills and aptitudes at level 5 will also be carried out in familiar situations, but also ones where problems may arise. Job holders will be able to make choices about the best procedures to adopt to address problems where the choices are clear. Individuals in jobs which require level 5 qualifications will normally be responsible for the completion of their own work and expected to learn and improve their performance on the job. They will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others' work and learning.

Food Technology diploma pass out students will be expected to understand what constitutes quality in the occupation and will distinguish between good and bad quality in the context of their work. They will be expected to operate hygienically and in ways which show an understanding of environmental issues. They will take account of health and safety issues as they affect the work they carry out or supervise. They are expected have good theoretical and practical knowledge of various food processes to work efficiently in food technology related companies. They might find work with various food technology related companies.

They will have scope of wage/self-employment in the following major areas:

1. Wage employment
   - Fruit and vegetable processing
   - Bakery and confectionery
   - Beverages
   - Dairy
   - Oil and fat
   - Meat, fish and poultry
   - Health and specialized food
   - Grain milling
   - Convenience food
   - Quality control
   - Educational institutions
   - KVIC etc.

2. Self-employment
   - Fruit and vegetable processing
   - Bakery and confectionery

- Dairy
- Milling of grains and spices
- Oil expelling units
- Snacks
- Service units to larger industry/ ancillary units

21. PROGRAMME OUTCOMES

The programme outcomes are derived from five domains of NSQF Level – 5 namely Process, Professional Knowledge, Professional Skill, Core Skill, Responsibility. After completing this level, the student will be able to:

PO1: Perform task that require well developed skills with clear choice of procedures.

PO2: Acquire knowledge of facts, principles and processes related to food technology.

PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.

PO4: Develop skills to collect, organize and communicate information.

PO5: Accomplish own work and supervise others work.

22. ASSESSMENT OF PROGRAMME AND COURSE OUTCOMES

Programme Outcomes to be assessed	Assessment criteria for the Course Outcomes
PO1: Perform task that require well developed skills with clear choice of procedures.	• Explain the definition, importance, and scope of food packaging. • Identify and classify traditional and modern packaging materials. • Evaluate packaging materials based on their characteristics and properties. • Define the status and scope of health and functional foods in India. • Describe the types and importance of nutraceuticals. • Identify various types of health and functional foods and their properties. • Explain the functional effects of different food constituents such as anti-carcinogenic, hypo cholesterol emic, and hypoglycemic foods. • Evaluate the importance of fibre in health and disease prevention. • Demonstrate understanding of snack production processes • Apply food safety and quality control measures • Develop innovative snack products • Utilize snack processing equipment • Analyze snack market trends to make informed decisions in snack product development and marketing. • Describe advanced food processing technologies and their applications in food production. • Explain advanced food safety measures to ensure the quality and safety of food products. • Explain emerging trends in functional foods and their role in promoting health and wellness.

	• Discuss regulatory and ethical considerations in food technology and apply them in food product development and production. • Describe instruments used for miscellaneous measurements including viscosity, humidity, PH value, TSS, and industrial weighing systems. • Describe the automatic control system and its types.
PO2: Acquire knowledge of facts, principles and processes related to food technology.	• Explain the definition, importance, and scope of food packaging. • Identify and classify traditional and modern packaging materials. • Evaluate packaging materials based on their characteristics and properties. • Define the status and scope of health and functional foods in India. • Describe the types and importance of nutraceuticals. • Identify various types of health and functional foods and their properties. • Explain the functional effects of different food constituents such as anti-carcinogenic, hypo cholesterol emic, and hypoglycemic foods. • Evaluate the importance of fibre in health and disease prevention. • Describe principles of food safety, including microbiological hazards and contamination sources. • Explain effective sanitation practices, including cleaning and sanitizing procedures, in food production and processing facilities. • Summarise and comply with national and international food safety regulations and standards. • Manage food safety management systems, such as Hazard Analysis and Critical Control Points (HACCP).

	• Discuss foodborne illnesses through proper hygiene, sanitation, and control measures. • Describe the Food Safety and Standards Act and Rules and select appropriate regulations as per the requirement. • Discuss the provisions of various Food Acts. • Explain the types of waste generated in different food processing industries and the importance of waste management in maintaining environmental sustainability. • Describe the various parameters of waste and their role in waste management techniques. • Summarize the legal and regulatory framework governing the waste management in India.
PO3: Demonstrate cognitive and practical skills to complete tasks and solve problems.	• Demonstrate knowledge of various packaging techniques such as vacuum packaging, MAP, and aseptic packaging. • Apply packaging principles to the different food products including cereals, dairy, meats, bakery, fruits, and vegetables. • Demonstrate the functions, classification, and applications of food additives, and their importance in enhancing the quality and shelf-life of food products. • Identify, recognize and categorize various spices and condiments used in Indian cuisine. • Evaluate the legal and regulatory framework governing the use of food additives in India. • Describe the principles and methods of sensory evaluation. • Develop new food products, enhance flavours, and improve the overall quality of food products by applying their knowledge of food additives, spices, and condiments. • Explore the production and processing of animal fats, including margarine, lard, and fish oil.

	• Examine the production and processing methods for various vegetable oils, such as soybean oil, mustard oil, and palm oil. • Demonstrate the working of various effluent treatment techniques. • Dispose solid waste generated in food processing industries for sustainable waste management practices. • Apply national and international food safety regulations to ensure compliance. • Prepare documents for food audits and certifications according to industry standards. • Apply various processing techniques to extract valuable components from by-products. • Formulate innovative food products using by-product derived ingredients.
PO4: Develop skills to collect, organize and communicate information.	• Understand the working environment of industries • Learn about present and future requirement of industries. • Develop writing, speaking and presentations skills. • Observe technological developments as per present and future needs of industries. • Collect, communicate and manage the data from connected devices. • Comprehend the importance of entrepreneurship and its role in nation's development. • Classify the various types of business and business organizations. • Identify the various resources / sources and / or schemes for starting a new venture. • Explain the principles of management including its functions in an organisation. • Conduct market survey and prepare project report. • Define the problem statement of Major project /Industrial training according to the need of industry.

	• Write Major project/Industrial training report effectively. • Present Major project/Industrial training report using PPT.
PO5: Accomplish own work and supervise others work.	• Use sensory evaluation software to design sensory tests, collect data, and analyze results to assess the quality of food products. • Apply CAD/CAM software for designing food processing equipment and simulation software for optimizing processes and solving industry-related problems. • Take necessary safety precautions and measures. • Work in team for solving industrial problems • Develop competencies and skills required by relevant industries. • Define the problem statement of the Major project /Industrial training according to the need of industry. • Work as a team member for successful completion of Major project /Industrial training. • Write the Major project /Industrial training report effectively. • Present the Major project /Industrial training project report using PPT.

23. SUBJECTS & CONTENTS

(THIRD YEAR)

FIFTH SEMESTER

5.1 INDUSTRIAL TRAINING - II

L	P
-	2

RATIONALE

Industrial training will help the students to understand the working environment of relevant industries. The student will learn to work in team to solve the industrial problems. It will also give exposure about the present and future requirements of the relevant industries. This training is very important for development of required competencies and skills for employment and start– ups.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

CO1: Understand the working environment of industries

CO2: Take necessary safety precautions and measures.

CO3: Learn about present and future requirement of industries.

CO4: Work in team for solving industrial problems.

CO5: Develop competencies and skills required by relevant industries.

CO6: Develop writing, speaking and presentations skills.

PRACTICAL EXERCISES

1. Report writing based on industrial training.
2. Preparation of Power Point Slides based on industrial training and presentation by the candidate.
3. Internal Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.
4. External Evaluation based on quality of Report, PPT preparation, PPT presentation and answer to queries.

GUIDELINES

Students will be evaluated based on Industrial training report and their presentation using Power Point about the knowledge and skills gained during the training. The Head of the Department will depute faculty coordinators by assigning a group of students to each. The coordinators will mentor and guide the students in preparing the PPTs for final presentation. The following performance parameters are to be considered for assessment of the students out of 100 marks:

	Parameter	**Weightage**
i	Industrial assessment of the candidate by the trainer	40%
ii	Report Writing	20%
iii	Power Point Presentation	20%
iv	Viva-voce	20%

5.2 FOOD PACKAGING TECHNOLOGY

L	P
2	4

RATIONALE

The main objective of this subject is to impart knowledge and skills related to designing packaging systems in food products and developing skills in handling packaging equipment in the students. The students will be imparted knowledge of various packaging techniques such as vacuum packaging, MAP, and aseptic packaging.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Explain the definition, importance, and scope of food packaging.
CO2: Identify and classify traditional and modern packaging materials.
CO3: Evaluate packaging materials based on their characteristics and properties.
CO4: Demonstrate knowledge of various packaging techniques such as vacuum packaging, MAP, and aseptic packaging.
CO5: Apply packaging principles to the different food products including cereals, dairy, meats, bakery, fruits, and vegetables.

DETAILED CONTENTS

UNIT I

Introduction

a) Definition, importance and scope of packaging of foods, principles of packaging, function of packaging.

UNIT II

Packaging Materials

a) Classification of packages and packaging materials: traditional and modern packaging materials, primary packaging material and secondary packaging material, Classification of packaging components.

b) General characteristics and properties of packaging materials.
c) Classification based on packaging techniques: Vacuum packaging, gas packaging,
d) MAP, CAP, active packaging, aseptic packaging, edible packaging, shrink packaging

UNIT III
Brief Introduction to

a) Thickness, The basis weight for paper or paper board, bursting strength, tensile strength, Water Vapour Transmission Rate (WVTR), Gas Transmission Rate (GTR), Grease resistance, Tearing strength, Drop test, Puncture test, Impact test etc.

UNIT IV
Packaging of different products

a) Cereals and pulses based products
b) Milk and dairy products
c) Meat, fish, poultry, eggs
d) Bakery and confectionary products
e) Fresh fruits and vegetables

UNIT V
Packaging Machinery

a) Form fill and seal machines, vacuum packs unit, shrink pack unit, tetra pack unit.
b) Packaging laws and regulations.

PRACTICAL EXERCISES

1. Identification of different types of packaging and packaging materials.
2. Determination of tensile strength of given material.
3. To perform different destructive tests for glass containers.
4. To perform non-destructive tests for the glass containers such as physical examination.
5. Determination of wax weight.
6. Determination of tearing strength of paper.
7. Measurement of thickness of packaging materials.
8. To perform grease-resistance test in plastic pouches.
9. Determination of bursting strength of packaging material.
10. Determination of water-vapour transmission rate for paper.

11. Demonstration of can-seaming operation.
12. Testing of chemical resistance of packaging materials.
13. Determination of drop test of food package.
14. Visit to relevant industries.
15. Introducing the students to the latest trends in packaging by consulting the websites and magazines.

RECOMMENDED BOOKS

1. Packaging techniques for processed food products by N.C. Saha, Meenakshi Garg.
2. A Handbook on Food Packaging by P. Jacob John.
3. Food Packaging: Principles and Applications by Kshitiz Kumar, Pravin M Ganorkar & Vijay S Sharanagat.
4. Handbook of Packaging by Paine and Paine; Morgan-Grampian Publishing Co., New York.
5. Food Packaging: Principles and Practice by Gordon L Robertson.
6. Food Packaging: Advanced Materials, Technologies, and Innovations : Rangappa, Sanjay Mavinkere, Jyotishkumar, Parameswaranpillai, Thiagamani, Senthilkumar Krishnasamy, Suchart Siengchin.
7. Food Packaging Technology by Richard Coles, Derek McDowell, Mark J. Kirwan.

SUGGESTED WEBSITE

1. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/food-packaging.
2. https://www.packagingdigest.com/materials/packaging-materials-and-their-properties.
3. https://www.packworld.com/issues/package-materials.
4. https://en.wikipedia.org/wiki/Vacuum_packing.
5. https://www.packagingstrategies.com/articles/90223-modified-atmosphere-packaging-the-basics.
6. https://www.sciencedirect.com/topics/food-science/active-packaging.
7. https://en.wikipedia.org/wiki/Aseptic_packaging.
8. https://www.sciencedirect.com/topics/food-science/edible-packaging.
9. https://www.thomasnet.com/articles/packaging/shrink-packaging.
10. https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-rules-guidance-industry.
11. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teachers should emphasize developing a basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry to demonstrate various operations involved in food packing technology are a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge of pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware of safety aspects. Wherever the necessary equipment is not available the students may be acquainted with that topic in the relevant industry or any other institute. This subject contains five unit of equal weightage.

5.3 FOOD ADDITIVES, SPICES AND CONDIMENTS

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RATIONALE

The food additives, spices, and condiments course is essential for Diploma in Food Technology students as it provides comprehensive knowledge and skills required for the food industry. Understanding food additives is crucial for food product development, preservation, and quality enhancement. Knowledge of spices and condiments is fundamental for flavour profiling and product formulation. Sensory evaluation techniques are essential for assessing the quality of food products. This course prepares students for careers in food processing, quality control, and product development.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Demonstrate the functions, classification, and applications of food additives, and their importance in enhancing the quality and shelf-life of food products.
CO2: Identify, recognize and categorize various spices and condiments used in Indian cuisine.
CO3: Evaluate the legal and regulatory framework governing the use of food additives in India,
CO4: Describe the principles and methods of sensory evaluation.
CO5: Develop new food products, enhance flavours, and improve the overall quality of food products by applying their knowledge of food additives, spices, and condiments.

DETAILED CONTENTS

UNIT I

Introduction to Food Additives

a) Definition, classification, and functions of food additives.
b) Legal and regulatory aspects of food additives in India.
c) Safety considerations and toxicological aspects of food additives.
d) Commonly used food additives and their roles in food processing and preservation.

UNIT II

Food Additive Groups

a) E-number/ International Numbering System for Food Additives (INS).
b) Emulsifiers, stabilizers, and thickeners: functions, sources, and applications.
c) Antioxidants and preservatives: mechanisms of action, types, and applications.
d) Sweeteners: natural and artificial, properties, and usage in food products.
e) Colourants: natural and synthetic, regulations, and effects on food quality.
f) Generally Regarded As Safe (GRAS) additives.
g) Class-I and Class-II Preservatives.

UNIT III

Spices and Condiments

a) Definition, classification, and importance of spices and condiments.
b) Commonly used spices and condiments in Indian cuisine.
c) Processing techniques for spices and condiments.
d) Quality control and storage of spices and condiments.

UNIT IV

Sensory Evaluation of Spices and Condiments

a) Principles and methods of sensory evaluation.
b) Application of sensory evaluation in assessing the quality of spices and condiments.
c) Factors affecting the sensory properties of spices and condiments.
d) Sensory analysis techniques for spices and condiments.

UNIT V

Applications of Food Additives, Spices, and Condiments

a) Use of food additives in various food products (e.g., bakery, dairy, beverages).
b) Incorporation of spices and condiments in food product development.
c) Importance of flavour profiling and enhancement in food products.
d) Emerging trends and innovations in the use of food additives, spices, and condiments.

PRACTICAL EXERCISES

1. To identify the given samples of different food additives (Monographs from Food Chemicals Codex (FCC).
2. To prepare different spice mixes for different food products.
3. To perform sensory evaluation of the given samples of the spices and spice blends.
4. To use emulsifiers and stabilizers in the processing of different food products.
5. To preserve different food products using spices.
6. To find colour variation in different varieties of spices.
7. To perform flavour profiling of different spices.
8. To perform quality control of different spices.
9. To develop new products using different spices, additives and condiments.
10. Study of regulatory compliance of the spices and additives industry.

RECOMMENDED BOOKS

1. Food Additives Data Book by Jim Smith and Lily Hong-Shum.
2. Handbook of Spices, Seasonings, and Flavorings by Susheela Raghavan.
3. Food Chemicals Codex by Committee on Food Chemicals Codex.
4. Sensory Evaluation Techniques by Morten Meilgaard, Gail Vance Civille, and B. Thomas Carr.
5. Spice: The History of a Temptation by Jack Turner.

SUGGESTED WEBSITE

1. Food Safety and Standards Authority of India (FSSAI) - https://www.fssai.gov.in/
2. International Food Additives Council (IFAC) - https://ifac-global.org/
3. Spices Board India - http://www.indianspices.com/
4. Flavor and Extract Manufacturers Association (FEMA) - https://www.femaflavor.org/
5. American Spice Trade Association (ASTA) - https://www.astaspice.org/
6. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

This course Food Additives, Spices and Condiments is designed to be interactive, hands-on, and multidisciplinary. It includes lectures and presentations to introduce theoretical concepts, case studies to illustrate practical applications, and practical demonstrations to teach skills such as spice mixture preparation and sensory evaluation. Group projects encourage teamwork and creativity, while guest lectures provide real-world insights. Field visits offer practical exposure, and a variety of assessments including quizzes, assignments, and practical exams evaluate student understanding. Interactive discussions and online resources supplement classroom learning, fostering critical thinking and self-study. Regular feedback supports student progress and reflection. This subject contains five unit of equal weightage.

5.4 COMPUTER APPLICATIONS IN FOOD TECHNOLOGY

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RATIONALE

The main objective of introducing this subject in the diploma course of food technology is to expose the student to fundamental knowledge of hardware and software of computers. It will also impart knowledge related to the applications of computation in food industries. The relevant theory instructions may be imparted along with practical exercises.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Use advanced features of MS Excel for data analysis, graphical representation, and process optimization in food processing.

CO2: Use statistical packages and add-in tools for analyzing sensory data, quality control, and statistical process control in food technology.

CO3: Use sensory evaluation software to design sensory tests, collect data, and analyze results to assess the quality of food products.

CO4: Apply CAD/CAM software for designing food processing equipment and simulation software for optimizing processes and solving industry-related problems.

CO5: Comprehend the use of computers in various processes of the food industry.

PRACTICAL EXERCISES

1. Introduction

a) Introduction to computer and related hardware used in the food industry (Touch Screens, Handheld Devices, Palm Tops, Barcode Printers and Scanners, RFID Tags, etc.)

2. Application of MS Excel (latest version) to solve the problems of Food Technology

a) MS Excel Basics

b) Introduction to different menus, commands and functions commonly used in solving problems.

c) Use of Add-In Tools like MegaStat, etc. for statistical data analysis.

3. Computer Applications in. Food Technology: Use of Spreadsheets in Graphical, Statistical, and Process Analysis

a. Chemical kinetics in food processing
   i. Determining rate constant of zero order reaction
   ii. First order rate constant and half-life of reactions

b. Microbial destruction in the thermal processing of foods
   i. Determining decimal reduction time from microbial survival data

c. Statistical quality control in food processing
   i. Control Charts

d. Sensory evaluation of foods
   i. Statistical descriptors of a population estimated from sensory data obtained for a sample.

e. Mechanical transport of liquid foods
   i. Measuring the viscosity of liquid foods using a capillary tube viscometer

f. Steady-state heat transfer in food processing
   i. Reducing heat transfer through a wall using insulation

g. Transient heat transfer in food processing
   i. Predicting temperature in a liquid food heated in a steam-jacketed kettle.

h. Refrigeration, freezing and cold chain
   i. Pressure-temperature relations for ammonia used as a refrigerant in a vapour compression refrigeration system
   ii. Loss of quality in the cold chain

4. Use of Food Safety Plan Builder (FSPB) and Food Defense Plan Builder (FDPB) for preparation of Food Safety Plan and Food Defense Plan of any food industry.

5. Use of word processing software (like MS Word) for creating reports and technical papers with the help of reference managers (like EndNote, Reference Manager, RefWorks, Mendeley, etc.)
6. Use of search engines and online research databases for research on food-related topics.
7. Use of statistical packages (MS Excel, MegaStat Excel Add-In (Free Add-In), Graphpad InStat, Graphpad StatMate, Statistica, SPSS, Matlab, etc.) for analysis of data.
8. Use of Generative AI and Chat GPT by using suitable prompts for content generation and specific searches
9. Using of Content Management Systems (CMS) like Word press, Drupal, Joomla, etc. for making interactive and dynamics websites
10. Working with chemical and biological structures drawing software programs (like ChemBio Office, Chem Draw, etc.)
11. Use of graphics manipulation tools like Adobe Illustratrator, E-Draw Max, MS Publisher, etc. for making posters, flyers, etc.
12. Use of social media platforms and tools like YouTube, Facebook, Instagram, WhatsApp, etc. to promote product and brands.
13. Computational Fluid Dynamics (CFD) simulation and visualisation using AnSys, Autodesk CFD, Open FOAM, COMSOL Multiphysics, SolidWorks, FlexSim, MATLAB Simulink, etc.
14. Demonstration of sensory analysis using sensory analysis software (like Compusense, SIMS Sensory Quality Panel Software , Red Jade Sensory Evaluation Software, XLSTAT Sensory, Senso TASTE, etc.).
15. Basic Introduction to CAD (Computer Aided Designing), CAM (Computer Aided Manufacturing), CIM (Computer Integrated Manufacturing) and CAE (Computer Aided/ Assisted Engineering) and application of different software programs (like AutoCAD, Pro-E, Sketchup, etc.) in the same.
16. Basic Introduction to the Application of Computers in instrumentation and process control of the food industry (PLC, SCADA, etc.), inventory control and management in the food industry using computers.
17. Familiarization with software related to the food industry (like SAP, justFoodERP, etc.).
18. Familiarization with the application of computers in some common food industries, (like milk plants, bakeries, fruit and vegetable processing, etc.) starting from the receiving of raw material up to the storage and dispatch of finished products with relevant case studies.
19. Visit to the industries & knowledge of computer application in the same.

RECOMMENDED BOOKS

1. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis by R. Paul Singh, AP.
2. Statistical Quality Control for the Food Industry by Merton R. Hubbard (Kluwer Academic)
3. MS Excel Video Tutorials on http://www.youtube.com (Recommended channel is ExcelIs Fun).
4. MS Excel for Dummies.
5. Manuals of MS Office
6. "Excel Basics to Blackbelt: An Accelerated Guide to Decision Support Designs" by Elliot Bendoly
7. "Statistical Quality Control" by Eugene L. Grant and Richard S. Leavenworth
8. "Sensory Evaluation Techniques" by Morten C. Meilgaard, Gail Vance Civille, and B. Thomas Carr
9. "Heat Transfer in Food Processing: Recent Developments and Applications" edited by S. S. Sablani, S. M. Al-Saqer, and Q. T. Pham
10. "Refrigeration Systems and Applications" by Ibrahim Dincer and Yunus A. Cengel
11. "Food Safety Management: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld

SUGGESTED WEBSITE

1. https://edu.gcfglobal.org/en/ - Free tutorials on computer basics, Microsoft Office applications, and more.
2. https://www.excel-easy.com/ - Excel tutorials for beginners and advanced users.
3. https://www.youtube.com/playlist?list=PL6gx4Cwl9DGBsvRxJJOzG4r4k_zLKrnxl - YouTube playlist with Microsoft Access tutorials.
4. https://www.computerhope.com/ - Computer help and tips, including tutorials on operating systems and software.
5. https://www.tutorialspoint.com/ - Tutorials on various programming languages, database management, and more.
6. https://www.techonthenet.com/ - Resources for learning SQL, Excel functions, and other technical topics.
7. https://www.khanacademy.org/ - Courses on computer programming, computer science, and more.

8. https://www.w3schools.com/ - Tutorials on web development technologies like HTML, CSS, and JavaScript.
9. https://www.codecademy.com/ - Interactive coding lessons for programming languages and web development.
10. https://support.office.com/ - Official Microsoft Office support site with articles and tutorials.
11. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

This is a practical-oriented subject. The teacher should emphasize giving hands-on practice on computers to the students. The latest software in food technology may be procured and students should be given demonstrations and practice on the same. The relevant theory may be given along with practical exercises. Some of the experts from industries may be invited to deliver lectures and demonstrations. For a demonstration of the use of different software, videos from different relevant websites may be used.

5.5 HEALTH & FUNCTIONAL FOODS

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RATIONALE

Health and functional foods are comparatively new concepts in the food industry. Some of the students may find employment in the industries engaged in the processing of health and functional food. Understanding of different aspects related to health and functional foods is essential for these diploma holders. They will be able to evaluate the importance of fibre in health and disease prevention after undergoing through this subject.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Define the status and scope of health and functional foods in India.

CO2: Describe the types and importance of nutraceuticals.

CO3: Identify various types of health and functional foods and their properties.

CO4: Explain the functional effects of different food constituents such as anti-carcinogenic, hypo cholesterol emic, and hypoglycemic foods.

CO5: Evaluate the importance of fibre in health and disease prevention.

DETAILED CONTENTS

UNIT I

Introduction to Health and Functional Foods

a) Definition, status, and scope of health and functional foods in India.
b) Types and importance of nutraceuticals.
c) Overview of various health and functional foods and their properties.

UNIT II

Functional Food Components and Effects

a) Study of food constituents responsible for functional effects, including anti-carcinogenic, hypo cholesterol emic, and hypoglycemic foods.

b) Understanding antioxidants and their role in health.
c) definition and importance of fortified, enriched, bio fortified, probiotic, prebiotic, synbiotic, high protein, high and low energy, and geriatric foods.

UNIT III

Fibre in Health and Disease Prevention

a) Importance of fibre in maintaining health and preventing diseases.
b) Types of fibre and their impact on health.
c) Recommended daily intake of fibre and its sources.

Unit IV

Fortification and Enrichment of Foods

a) Definition and importance of fortification and enrichment.
b) Study of fortified foods such as salts, atta, and oil, and enriched foods like juices and health drinks.
c) Guidelines and regulations related to fortification and enrichment.

Unit V

Organic and Genetically Modified (GM) Foods

a) Understanding organic foods and their health benefits.
b) Study of genetically modified foods and their potential health risks.
c) Regulations and labeling requirements for organic and GM foods about health.

PRACTICAL EXERCISES

1. Preparation of high-fibre bread
2. Preparation of high-fibre biscuits
3. Preparation of high-fibre cake
4. Preparation of nutritious beverages
5. Preparation of functional foods for obese persons
6. Preparation of functional foods for aged persons
7. Preparation of hypocholesterolemic foods
8. Preparation of diets for anaemic patients
9. Preparation of low-sodium foods

10. Preparation of malt-based drink
11. Preparation of foods for under-weight persons
12. Preparation of high-caloric diet for sportsmen
13. Preparation of high protein diet for sportsmen
14. Preparation of fortified atta
15. Preparation of probiotic food

RECOMMENDED BOOKS

1. "Functional Foods: Concept to Product" by Maria Saarela and Fulvio Mattivi
2. "Nutraceutical and Functional Food Components: Effects of Innovative Processing Techniques" by Charis M. Galanakis
3. "Handbook of Nutraceuticals and Functional Foods" by Robert E. C. Wildman
4. "Functional Foods, Nutraceuticals, and Degenerative Disease Prevention" by Ramesh C. Gupta
5. "Bioactive Food as Dietary Interventions for Liver and Gastrointestinal Disease" by Ronald Ross Watson and Victor R. Preedy
6. "Nutraceutical and Functional Food Regulations in the United States and Around the World" by Debasis Bagchi and Anand Swaroop
7. "Functional Foods and Nutraceuticals in Metabolic and Cardiac Diseases" by Ronald Ross Watson and Victor R. Preedy
8. "Handbook of Functional Beverages and Human Health" by Fereidoon Shahidi

SUGGESTED WEBSITE

1. http://www.nin.res.in/
2. https://www.fssai.gov.in/
3. https://www.who.int/nutrition/en/
4. https://foodinsight.org/functional-foods/
5. https://www.nutrition.gov/subject/whats-in-food/functional-foods
6. https://nutrition.org/
7. https://www.eufic.org/en/healthy-living/functional-foods
8. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

Utilize a blended approach to instruction, combining lectures, case studies, and guest lectures to provide a comprehensive understanding of health and functional foods. Encourage student engagement through group projects and interactive discussions, fostering critical thinking and application of concepts. Incorporate hands-on learning experiences, such as lab demonstrations and field visits, to enhance practical skills and contextualize theoretical knowledge. Supplement learning with online resources for deeper exploration of specific topics. Evaluate student comprehension through a variety of assessments to ensure learning outcomes are met. This subject contains five unit of equal weightage.

5.6 TECHNOLOGY OF OILS AND FATS

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RATIONALE

This subject is aimed at imparting thorough knowledge and skills related to the extraction and processing techniques of oils & fats and their nutritional and qualitative effects on food. the students will be imparted the knowledge of production and processing methods for various vegetable oils, such as soybean oil, mustard oil, and palm oil.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Explain the definition, types, and components of oils and fats, including fatty acids and triglycerides.
CO2: Identify the functions of oils and fats in foods, such as tenderness, texture, and flavour, and recognize the importance of essential fatty acids.
CO3: Describe the processing techniques used for oils and fats, including pretreatments, extraction methods, and refining processes.
CO4: Explore the production and processing of animal fats, including margarine, lard, and fish oil.
CO5: Examine the production and processing methods for various vegetable oils, such as soybean oil, mustard oil, and palm oil.

DETAILED CONTENTS

UNIT I

Introduction to Oils and Fats

a) Definition of oils, fats, esters, acids, triglycerides, glycerol, fatty acids, monoglycerides, diglycerides, visible fat, invisible fat, shortenings, and trans fats.
b) Types of fatty acids (saturated, unsaturated, MUFA, PUFA), essential fatty acids, importance of essential fatty acids, omega fatty acids, free fatty acids;
c) Composition, sources, physical and chemical properties, and nutritive value of oils and fats.

UNIT II

Functions of Oils and Fats in Foods

a) Functions of oils and fats in foods including tenderness, texture, flavour, and emulsion.

UNIT III

Processing of Oils and Fats

a) Pretreatments, extraction methods from oilseeds and animal tissues.
b) Degumming, refining, bleaching, deodorizing, hydrogenation, fractionation, winterization, plasticizing, and packaging.

UNIT IV

Production and Processing of Animal Fats

a) Margarine, lard, and fish oil production and processing.

UNIT V

Production and Processing of Vegetable Oils

a) Production and processing methods for soybean oil, mustard oil, groundnut oil, sunflower oil, olive oil, and palm oil.

PRACTICAL EXERCISES

1. To determine the smoke point, flash point and fire point of the given sample.
2. To determine the acid value of the given sample.
3. To determine the iodine value of the given sample.
4. To determine the saponification value of the given sample.
5. Determination of rancidity of given sample..
6. To determine the melting point of the given sample.
7. To determine the oil content of a given sample by Soxhlet apparatus.
8. Detection of adulteration in fats/oils.
9. Visit to the oil processing industry.

RECOMMENDED BOOKS

1. "Fats and Oils Handbook" by Michael Bockisch.
2. "Oils and Fats Authentication: v. 5 (Chemistry and Technology of Oils and Fats)" by David Firestone.
3. "The Lipid Handbook" by Frank D. Gunstone.
4. "Edible Oil Processing" edited by Wolf Hamm and Richard J. Hamilton.
5. "Oils and Fats in the Food Industry: Food Industry Briefing Series" by Frank D. Gunstone.
6. "Vegetable Oils in Food Technology: Composition, Properties and Uses" by Frank D. Gunstone.
7. "Handbook of Oils and Fats" by Casimir C. Akoh and David B. Min.
8. Food Science: Norman. N. Potter CBS Publication, CBS Publishers and distributors Pvt. Ltd, New Delhi.
9. Food Oils & Fats: Lawson Harry-CBS Publication, CBS Publishers and distributors Pvt. Ltd, New Delhi.
10. Food Oils & Fats: Bailey Publication, Oxford & IBH Publishing Co., New Delhi.
11. Bailey's Industrial Oil and Fat Products by Daniel Swern, Interscience Publishers, New York.
12. The Chemical Analysis of Food and Food Products by Jacobs, Morris B Jacobs Publisher: New York,
13. A First Course in Food Analysis by A.K. Sathe, New Age Publications, New Delhi.
14. Standards for Fats & Oils by Lawson, AVI Publishing Company, Westport.

SUGGESTED WEBSITE

1. https://www.aocs.org/
2. http://www.fao.org/fats-and-oils/en/
3. http://ninindia.org/oil%20and%20fat.html
4. https://foodinsight.org/food-choices/oils-and-fats/
5. https://www.eurofedlipid.org/
6. https://link.springer.com/journal/11746
7. https://www.who.int/nutrition/topics/FFA_summary_rec_conclusion.pdf
8. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

Utilize a combination of lectures, demonstrations, and hands-on activities to engage students in the study of oils and fats. Incorporate case studies and real-world examples to demonstrate the application of theoretical concepts in the production, processing, and utilization of oils and fats in various food products. Encourage active participation through group discussions and projects, allowing students to explore specific topics of interest within the field. Use multimedia resources and online platforms to supplement learning and provide additional insights into the subject. Assess student understanding through quizzes, assignments, and practical assessments to ensure mastery of key concepts and principles. This subject contains five unit of equal weightage.

5.7 PROGRAMME ELECTIVE -I

5.7.1 SNACKS AND EXTRUDED FOOD PRODUCTS

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RATIONALE

The Snacks and Extruded Food Products course is designed to meet the growing demand for convenient and nutritious snack options in the food industry. Snacks play a significant role in the diet of people worldwide, providing quick energy and satisfying cravings. This course aims to provide students with in-depth knowledge of the ingredients, processing techniques, and quality control measures involved in snack production. By understanding the principles of snack processing and product development, students will be equipped to meet consumer preferences and industry standards. Additionally, the course emphasizes the importance of food safety and quality control, ensuring that students are prepared to maintain high standards in snack manufacturing. Overall, this course prepares students for careers in the snack industry, where they can contribute to the development of innovative and safe snack products.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Demonstrate understanding of snack production processes

CO2: Apply food safety and quality control measures

CO3: Develop innovative snack products

CO4: Utilize snack processing equipment

CO5: Analyze snack market trends to make informed decisions in snack product development and marketing.

DETAILED CONTENTS

UNIT I

Introduction to Snacks and Extruded Food Products

a) Overview of snacks and extruded food products.
b) Importance of snacks in the food industry.
c) Market trends and consumer preferences in snacks.

UNIT II

Ingredients Used in Snacks and Extruded Food Products

a) Common ingredients used in snacks and extruded food products.
b) Functionality of ingredients in snacks (e.g., starches, proteins, fats).
c) Selection and quality control of ingredients.

UNIT III

Snack Processing Technologies

a) Overview of snack processing technologies (e.g., frying, baking, extrusion).
b) Principles of extrusion technology and its application in snack production.
c) Equipment used in snack processing.

UNIT IV

Quality Control and Food Safety in Snack Production

a) Importance of quality control in snack production
b) Hazard analysis and critical control points (HACCP) in snack manufacturing
c) Food safety regulations and standards for snacks

Unit V

Product Development and Innovation in Snacks

a) New product development process for snacks
b) Innovation in snack products and packaging
c) Marketing and consumer testing of new snack products

RECOMMENDED BOOKS

1. "Extrusion Cooking: Techniques, Applications, and Recipes" by R. Guy Cassavaugh - This book provides comprehensive coverage of extrusion technology, including its applications in snack production.
2. "Food Extrusion Science and Technology" by Jozef L. Kokini, Chi-Tang Ho, and Mukund V. Karwe - This textbook covers the science and technology behind food extrusion, including its application in snack manufacturing.

3. "Handbook of Food Powders: Processes and Properties" edited by Bhesh Bhandari, Nidhi Bansal, and Min Zhang - This handbook includes information on the processing and properties of food powders used in snack production.
4. "Food Packaging Science and Technology" by Dong Sun Lee - This book covers the principles and practices of food packaging, including its role in snack product quality and shelf life.
5. "Food Process Engineering and Technology" by Zeki Berk - This textbook provides an overview of food process engineering principles, including those relevant to snack production.
6. "Food Safety Management: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld - This guide covers food safety management practices, including those applicable to snack manufacturing.
7. "Snack Foods Processing" by Edmund W. Lusas and Lloyd W. Rooney - This book provides a comprehensive overview of snack food processing, including extrusion and frying techniques.
8. "Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices" by Michael M. Cramer and Frederick J. Francis - This book covers sanitation practices in food processing plants, including those relevant to snack production.
9. "Food Analysis" by S. Suzanne Nielsen - This textbook covers methods for analyzing food products, including those used in quality control of snack products.
10. "Snack Foods: Processing and Product Development" by Edmund W. Lusas and Lloyd W. Rooney - This book covers the processing and product development aspects of snack foods, providing insights into snack product innovation and quality control.

SUGGESTED WEBSITE

1. https://www.snackfood.com/
2. https://www.sciencedirect.com/topics/food-science/extrusion-technology
3. https://www.foodsafetymagazine.com/signature-series/food-safety-and-quality-control-in-snack-food-manufacturing/
4. https://www.packagingstrategies.com/keywords/3477-snack-food-packaging
5. https://www.elsevier.com/books/food-processing-technology/fellows/978-0-12-810448-4
6. https://www.springer.com/gp/book/9781461460283
7. https://www.sciencedirect.com/book/9780123116321/food-packaging-and-shelf-life
8. https://www.crcpress.com/Food-Product-Development-From-Concept-to-the-Marketplace/Earle-Anderson/p/book/9781420065525
9. https://www.wiley.com/en-us/Food+Processing+Handbook-p-9783527306190

10. https://www.who.int/foodsafety/publications/food-hygiene-manual/en/
11. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

The instructional strategy for the Snacks and Extruded Food Products course will integrate theoretical knowledge with practical applications. It will include lectures to provide foundational understanding, hands-on sessions for practical skills development, and industry visits to observe real-world snack production processes. Students will engage in product development projects and case studies to apply their knowledge to practical scenarios. Assessment will be done through a combination of exams, projects, and presentations to ensure comprehensive learning and skill acquisition in snack production. This subject contains five unit of equal weightage.

5.7.2 FOOD HYGIENE AND SANITATION

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RATIONALE

The course in Food Hygiene and Sanitation is essential for Diploma in Food Technology students to develop a thorough understanding of the principles and practices that ensure food safety. In the food industry, maintaining high standards of hygiene and sanitation is crucial to prevent foodborne illnesses and ensure consumer safety. This course will equip students with the knowledge and skills needed to identify and control foodborne hazards, implement effective cleaning and sanitizing practices, and comply with food safety regulations. By emphasizing the importance of food hygiene and sanitation, the course aims to prepare students for careers where they can contribute to the production of safe and high-quality food products.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Describe principles of food safety, including microbiological hazards and contamination sources.

CO2: Explain effective sanitation practices, including cleaning and sanitizing procedures, in food production and processing facilities.

CO3: Summarise and comply with national and international food safety regulations and standards.

CO4: Manage food safety management systems, such as Hazard Analysis and Critical Control Points (HACCP).

CO5: Discuss foodborne illnesses through proper hygiene, sanitation, and control measures.

DETAILED CONTENTS

UNIT I

Introduction to Food Hygiene and Sanitation

a) Importance of food hygiene and sanitation in the food industry
b) Basic principles of microbiology related to food safety
c) Common foodborne illnesses and their causes

d) FSSAI initiatives for food hygiene and sanitation (Schedule 4 of Food Safety and Standards (Licensing and Registration of Food Businesses) Regulation, 2011

UNIT II

Foodborne Hazards and Control Measures

a) Biological, chemical, and physical hazards in food
b) Control measures to prevent food contamination
c) Personal hygiene practices for food handlers

UNIT III

Cleaning and Sanitizing Practices

a) Principles of cleaning and sanitizing food equipment and facilities
b) Types of cleaning agents and sanitizers
c) Cleaning schedules and procedures in food establishments

UNIT IV

Food Safety Management Systems

a) GMP, 5s, Six Sigma, GHP, etc.
b) Overview of food safety management systems (e.g., HACCP)
c) Implementation of HACCP principles in food establishments
d) Monitoring and verification of food safety practices
e) Case study of HACCP implementation in a food industry

UNIT V

Regulatory Requirements and Compliance

a) National and international food safety regulations
b) Role of regulatory agencies in ensuring food safety
c) Compliance requirements for food establishments

RECOMMENDED BOOKS

1. "Food Safety: Theory and Practice" by Paul L. Dawson - Provides a comprehensive overview of food safety principles and practices.

2. "Essentials of Food Safety and Sanitation" by David McSwane et al. - Covers the basics of food safety and sanitation in the food industry.
3. "Principles of Food Sanitation" by Norman G. Marriott and Robert B. Gravani - Offers detailed information on food sanitation practices and principles.
4. "Food Microbiology: Fundamentals and Frontiers" by Michael Doyle et al. - Covers microbiological aspects related to food safety and sanitation.
5. "Food Safety Management: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld - Provides practical guidance on food safety management and sanitation.
6. "Food Safety and Quality Systems in Developing Countries: Volume One" by A. O. Oluwatayo and S. O. Olatunji - Focuses on food safety and quality systems in developing countries.
7. "Food Hygiene and Sanitation" by S. R. Patel - A comprehensive guide to food hygiene and sanitation practices.
8. "Handbook of Hygiene Control in the Food Industry" edited by H. L. M. Lelieveld et al. - Covers various aspects of hygiene control in the food industry.
9. "Food Safety and Quality Assurance: Foods of Animal Origin" edited by William T. Hubbert - Focuses on food safety and quality assurance for foods of animal origin.
10. "Food Safety Management Systems: A Practical Guide for the Food Industry" by Debby L. Newslow - Offers practical guidance on implementing food safety management systems in the food industry.

SUGGESTED WEBSITE

1. https://www.fssai.gov.in/
2. https://www.who.int/health-topics/food-safety#tab=tab_1
3. https://www.fda.gov/food/food-safety
4. https://www.foodsafetymagazine.com/
5. https://www.cdc.gov/foodsafety/
6. https://www.foodsafetynews.com/
7. https://www.efsa.europa.eu/en
8. http://www.fao.org/food-safety/en/
9. https://www.ifsqn.com/
10. https://www.fsis.usda.gov/wps/portal/fsis/home
11. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

The instructional strategy for the Food Hygiene and Sanitation course will involve a combination of theoretical learning and practical application. Students will engage in lectures, discussions, and case studies to understand the principles of food hygiene and sanitation. Hands-on training will be provided in cleaning and sanitizing practices, as well as personal hygiene. Field visits to food establishments and interactions with industry experts will provide real-world insights into food safety practices. The course will also emphasize the importance of regulatory compliance and adherence to food safety standards. This subject contains five unit of equal weightage.

5.7.3 ADVANCES IN FOOD TECHNOLOGY

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RATIONALE

The course in Advances in Food Technology is designed to equip students with the latest knowledge and skills required to meet the evolving demands of the food industry. By focusing on advanced processing technologies, food safety measures, and emerging trends in functional foods, the course prepares students to innovate and excel in food product development. Additionally, the emphasis on sustainable practices and regulatory compliance ensures that students are equipped to address current and future challenges in the field. Overall, the course aims to produce graduates who are well-versed in cutting-edge food technologies and capable of driving positive change in the food industry.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Describe advanced food processing technologies and their applications in food production.
CO2: Explain advanced food safety measures to ensure the quality and safety of food products.
CO3: Explain emerging trends in functional foods and their role in promoting health and wellness.
CO4: Discuss regulatory and ethical considerations in food technology and apply them in food product development and production.

DETAILED CONTENTS

UNIT I

Introduction to Advances in Food Technology

a) Overview of recent advancements in food technology
b) Importance of innovation in the food industry
c) Trends and prospects in food technology

UNIT II

Food Processing Technologies

a) Advances in food processing technologies (e.g., High-Pressure Processing, High-Pressure Homogenization, Pulsed Electric Fields, Ultrasound Technology (Uses in emulsification, extraction, and microbial inactivation), Ohmic Heating, Microwave Processing, Cold Plasma Technology, Ozone Treatment, etc.
b) 3D, 4D and 5D printing of food.
c) Application of nanotechnology for improved nutrient delivery, packaging material and food safety

UNIT III

Plant-Based Foods and Alternative Sources of Proteins

a) Plant-Based Meat Alternatives like tofu, tempeh, edamame and seitan.
b) Quinoa, Chia Seeds, Spirulina, Nutritional Yeast.
c) Plant based dairy alternative, plant based egg, plant based seafoods.
d) Insect Protein and Single-Cell Protein.

Unit IV

Food Safety and Quality Assurance

a) Advances in food safety management systems (e.g., blockchain technology, DNA barcoding).
b) Application of Artificial Intelligence (AI) and machine vision in food processing.
c) Quality control techniques for ensuring food safety and quality.
d) Rapid methods for the detection of foodborne pathogens.
e) Bio-sensors and E-sensors.

UNIT V

Sustainable Food Technology

a) Sustainable practices in food production and processing.
b) Advances in food packaging for sustainability.
c) Role of biotechnology and genetic engineering in sustainable food production.

d) Application of Blockchain Technology in Food Industry.

RECOMMENDED BOOKS

1. "Food Processing Technology: Principles and Practice" by P.J. Fellows - Provides an overview of food processing technologies and their applications.
2. "Emerging Food Packaging Technologies: Principles and Practice" edited by Kit L. Yam and Dong Sun Lee - Covers emerging technologies in food packaging.
3. "Functional Foods: Concept to Product" edited by Maria Saarela - Discusses the development and production of functional foods.
4. "Handbook of Food Processing Equipment" edited by George D. Saravacos and Athanasios E. Kostaropoulos - Provides information on various food processing equipment and their applications.
5. "Food Nanotechnology: Principles and Applications" edited by Debasis Bagchi, Sreejayan Nair, and Chandan K. Sen - Discusses the application of nanotechnology in food science.
6. "Food Safety: Theory and Practice" by Paul L. Dawson - Covers the principles of food safety and their practical applications.
7. "Food Quality Assurance: Principles and Practices" by Inteaz Alli - Discusses quality assurance principles in food production.
8. "Sustainable Food Processing" edited by Ricardo Simpson and Jeyamkondan Subbiah - Covers sustainable practices in food processing.
9. "Handbook of Food Processing: Food Safety, Quality, and Manufacturing Processes" edited by Theodoros Varzakas, Athanasios E. Kostaropoulos, and John A. Henr - Provides comprehensive coverage of food processing technologies.
10. "Food Preservation Techniques" edited by Brijesh K. Tiwari and Aoife Gowen - Covers various techniques used in food preservation.

SUGGESTED WEBSITE

1. https://www.ift.org/
2. https://www.ift.org/news-and-publications/food-technology-magazine
3. https://onlinelibrary.wiley.com/journal/13652621
4. https://www.ifis.org/fsta
5. https://www.journals.elsevier.com/journal-of-food-engineering
6. https://www.foodsafetymagazine.com/

7. https://foodinsight.org/
8. https://www.foodqualityandsafety.com/
9. https://www.foodprocessing-technology.com/
10. https://www.eufic.org/en
11. https://gpadampur.wordpress.com/exppage/
12. https://gfi.org/

INSTRUCTIONAL STRATEGY

The instructional strategy for the Advances in Food Technology course will involve a blend of theoretical knowledge and practical applications. It will include lectures by industry experts, case studies on innovative food products, and hands-on laboratory sessions on advanced food processing techniques. Students will also engage in research projects to explore emerging trends and technologies in the field. The course will emphasize critical thinking and problem-solving skills through group discussions and presentations. Additionally, industry visits and guest lectures will provide students with real-world insights and industry perspectives. This subject contains five unit of equal weightage.

SIXTH SEMESTER

6.1 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

CO1: Comprehend the importance of entrepreneurship and its role in nation's development.
CO1: Classify the various types of business and business organizations.
CO3: Identify the various resources / sources and / or schemes for starting a new venture.
CO4: Explain the principles of management including its functions in an organisation.
CO4: Conduct market survey and prepare project report.

DETAILED CONTENTS

UNIT I

Entrepreneurship: Concept and definitions, classification and types of entrepreneurs, entrepreneurial competencies, Traits / Qualities of entrepreneurs, manager v/s entrepreneur, role of Entrepreneur, barriers in entrepreneurship, Sole proprietorship and partnership forms of business organizations, small business vs startup, critical components for establishing a start-up, Leadership: Definition and Need, Manager Vs leader, Types of leadership

UNIT II

Definition of MSME (micro, small and medium enterprises), significant provisions of MSME Act, importance of feasibility studies, technical, marketing and finance related problems faced by new enterprises, major labor issues in MSMEs and its related laws, Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yogna (PMMY) , Make in India, Start-up India,

Stand up India , National Urban Livelihood Mission (NULM); Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

UNIT III

NATURE AND FUNCTIONS OF MANAGEMENT: Definition, Nature of Management, Management as a Process, Management as Science and Art, Management Functions, Management and Administration, Managerial Skills, Levels of Management; Leadership.

PLANNING AND DECISION MAKING: Planning and Forecasting - Meaning and definition, Features, Steps in Planning Process, Approaches, Principles, Importance, Advantages and Disadvantages of Planning, Types of Plans, Types of Planning, Management by Objective. Decision Making-Meaning, Characteristics.

UNIT IV

ORGANISING AND ORGANISATION STRUCTURE: Organizing Process - Meaning and Definition, Characteristics Process, Need and Importance, Principles, Span of Management, Organisational Chart - Types, Contents, Uses, Limitations, Factors Affecting Organisational Chart.

STAFFING: Meaning, Nature, Importance, Staffing process. Manpower Planning, Recruitment, Selection, Orientation and Placement, Training, Remuneration.

CONTROLLING AND CO-ORDINATION Controlling - Meaning, Features, Importance, Control Process, Characteristics of an effective control system, Types of Control. Co-ordination - characteristics, essentials.

UNIT V

Market Survey and Opportunity Identification, Scanning of business environment, Assessment of demand and supply in potential areas of growth, Project report Preparation, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report.

RECOMMENDED BOOKS

1 BS Rathore and Dr. JS Saini, "A Handbook of Entrepreneurship", Aapga Publications, Panchkula (Haryana).

2 Entrepreneurship Development, Tata McGraw Hill Publishing Company Ltd., New Delhi.

3 CB Gupta and P Srinivasan, "Entrepreneurship Development in India", Sultan Chand and Sons, New Delhi.

4 Poornima M Charantimath, "Entrepreneurship Development - Small Business Enterprises", Pearson Education, New Delhi.

5 David H Holt, "Entrepreneurship: New Venture Creation", Prentice Hall of India Pvt. Ltd., New Delhi.

6 PM Bhandari, "Handbook of Small Scale Industry".

7 L M Prasad, "Principles and Practice of Management", Sultan Chand & Sons, New Delhi.

SUGGESTED WEBSITES

1. https://ipindia.gov.in/

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organizations on visit. Approach extracted reading and handouts may be provided. In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organized. This subject contains five units of equal weightage.

6.2 FOOD LAWS AND STANDARDS

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RATIONALE

The course food laws and standards acquaint with the national and international food laws and standards to develop an enabling environment to have safe and quality food for everyone. The objective of this course is to develop an understanding of the basic aspects of the Indian food regulatory regime; global scenario; export and import laws and regulations; other laws and standards and related agencies.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Describe the Food Safety and Standards Act and Rules and select appropriate regulations as per the requirement.
CO2: Discuss the provisions of various Food Acts.
CO3: Summarize the functions of Ministry of Food Processing Industries (MoFPI).
CO4: Illustrate the functioning, standards and guidelines of ISO, WTO, FAO and various International Reference organisations in relation to global food businesses.

DETAILED CONTENTS

UNIT I

a) Introduction legal system
b) Law Making Procedure in India, Difference between Draft, Bill, Act, Rule, Regulations, Order and Direction.
c) Historical background of food laws in India.
d) Food Safety and Standards Act (FSSA), 2006
   i. Food Safety and Standards Authority of India (FSSAI)
   ii. Food Safety and Standards Rule, 2011
   iii. Food Safety and Standards Regulations with latest amendments

UNIT II

a) Food Safety Modernization Act (FSMA), 2011
b) The Legal Metrology Act, 2009
    i. The Legal Metrology (Packaged Commodities) Rules, 2011
c) The Essential Commodities Act, 1955
d) The Export (Quality Control and Inspection) Act, 1963
    i. Export Inspection Council (EIC)
    ii. Export Inspection Agencies (EIAs)
e) The Environment (Protection) Act, 1986
f) Plastic Waste Management Rules, 2016

UNIT III

a) Consumer Protection Act, 2019
b) Insecticides Act, 1968
c) AGMARK Standards, Directorate of Marketing and Inspection, Ministry of Agriculture and Farmers Welfare, Government of India
d) Advertising Standards Council of India (ASCI)
e) Bureau of Indian Standards (BIS)
f) Ministry of Food Processing Industries (MoFPI), Government of India
g) Ministry of Health & Family Welfare, Government of India

UNIT IV

a) International Organisation for Standardization (ISO)
    i. ISO 9001 Quality Management
    ii. ISO 14001 Environmental Management
    iii. ISO 17025 Competence of Testing/Calibration Laboratories
    iv. ISO 22000 Food Safety Management
    v. ISO 45001 Occupational Health and Safety
    vi. ISO 50001 Energy Management
b) FSSC 22000
c) Occupational Safety and Health Administration (OSHA)

UNIT V

a) World Trade Organisation (WTO)
    i. Agreement on Technical Barriers to Trade (TBT)

ii. Agreement on Sanitary and Phytosanitary (SPS) Measures

b) Food and Agricultural Organisation (FAO)
c) World Health Organisation (WHO)
d) Codex Alimentarius Commission (CAC)
e) International Standards and Reference Organisations
   i. OIE- Office International des Epizooties- World Organisation for Animal Health
   ii. International Plant Protection Convention (IPPC)
   iii. AOAC International
   iv. ASTM International
   v. British Retail Consortium (BRC)
   vi. Global Food Safety Initiative (GFSI)
   vii. Food Safety and Preventive Control Alliance (FSPCA)

RECOMMENDED BOOKS

1. "Food Safety and Standards Act, 2006: Compendium of Regulations, Standards and Guidelines" by FSSAI.
2. Legal Metrology Act, 2009 (Bare Act) by Universal Law Publishing.
3. Consumer Protection Laws (Bare Acts) by Professional.
4. AGMARK Standards (Bare Act) by Legal Ease Publications.
5. Advertising Council of India Codes handbook.
6. ISO 22000 Food Safety Management Systems: Requirements for Any Organization in the Food Chain by International Organization for Standardization (ISO).
7. Occupational Safety and Health Administration (OSHA) Regulations (29 CFR 1910) by MANCOMM.

SUGGESTED WEBSITE

1. https://www.fssai.gov.in/ - Food Safety and Standards Authority of India (FSSAI) website.
2. https://elearning.fao.org/course/view.php?id=800 (Various Free course on codex)
3. http://consumeraffairs.nic.in/legal-metrology-act-2009 - Information on the Legal Metrology Act, 2009.
4. http://consumeraffairs.nic.in/consumer-protection-act-2019 - Details of the Consumer Protection Act, 2019.
5. https://www.bis.gov.in/ - Bureau of Indian Standards (BIS) website.
6. https://www.iso.org/home.html - International Organization for Standardization (ISO) website.

7. https://www.wto.org/ - World Trade Organization (WTO) website.
8. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

The Food Laws and Standards course will focus on a combination of theoretical study, case studies, practical applications, and industry interactions. Lectures will provide the foundation, covering legal frameworks, standards, and regulations. Case studies will illustrate the application of laws and standards in real-world scenarios. Practical exercises will involve analyzing and interpreting legal documents and standards. Guest lectures from industry experts and visits to regulatory bodies will provide practical insights. Assessments will include research projects and presentations to ensure a deep understanding of food laws and standards. This subject contains five unit of equal weightage.

Note:

1. Summary of the acts, rules and regulations is to be taught concerning the food business, not the bare act.
2. Agencies mentioned here are to be introduced to the students for their structure and functions.
3. The standards need to be summarized and discussed, adhering to their functions in the food processing industries.

6.3 WASTE MANAGEMENT IN FOOD INDUSTRY

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RATIONALE

This course on Waste Management in Food Industries is essential to address the significant environmental impact and sustainability challenges faced by the food processing sector. It aims to educate students about the types and magnitude of waste generated in food industries, as well as the principles and practices of effective waste management and effluent treatment. By understanding the environmental regulations and standards applicable to food processing, students will learn to implement sustainable waste management strategies, including waste characterization, treatment, and utilization. This knowledge is crucial for promoting eco-friendly practices, minimizing environmental pollution, and ensuring the long-term viability of the food industry.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Explain the types of waste generated in different food processing industries and the importance of waste management in maintaining environmental sustainability.
CO2: Describe the various parameters of waste and their role in waste management techniques.
CO3: Summarize the legal and regulatory framework governing the waste management in India.
CO4: Demonstrate the working of various effluent treatment techniques.
CO5: Dispose solid waste generated in food processing industries for sustainable waste management practices.

DETAILED CONTENTS

UNIT I

Introduction to Waste Management in Food Technology

a) Overview of waste generation in food technology processes, including types and sources of waste.
b) Importance of effective waste management for environmental, economic, and social implications of food waste.
c) Introduction to the concept of waste management hierarchy and the principles of waste

reduction, reuse, and recycling.

d) Overview of relevant environmental regulations and standards governing waste management in the food industry.
e) Role of AI for waste Management.

UNIT II

Food Waste Parameters

a) Importance of dissolved oxygen, oxygen demand: biochemical oxygen demand, chemical oxygen demand, total oxygen demand.
b) Introduction to the temperature, suspended solids and flow of waste generated from food industries and their effect on waste management techniques.
c) Other parameters: pH, acidity and alkalinity, oil and grease, chloride, nutrients, and brief about the toxic compounds.

UNIT III

Effluent Treatment

a) Need of effluent treatment plants (ETP) and Pre-treatment techniques: flow equalization, screening, and skimming.
b) Primary treatment methods: sedimentation, floatation and complete primary system.

UNIT IV

Effluent Treatment

a) Secondary treatments:
    i. Anaerobic systems: ponds and filters.
    ii. Aerobic systems: stabilization ponds, aerated lagoons, activated sludge, activated biological filter (ABF), rotating biological contactor (RBC), trickling filters.
b) Tertiary (Advanced) treatments:
    i. Chemical Precipitation and Sedimentation, Filtration, Carbon Adsorption, Ion Exchange, RO, Chlorination.

UNIT V

Solid Waste Management

a) Assessment, treatment, and disposal of solid waste generated in food processing industries.
b) Introduction to vermicomposting and biogas generation as sustainable waste management practices.

PRACTICAL EXERCISES

1. Determine the temperature of the waste sample.
2. Determine the pH level of the waste sample.
3. Estimate the concentration of suspended and dissolved solids in the wastewater sample.
4. Determine the turbidity of the wastewater sample.
5. Measure the amount of biological oxygen demand of wastewater sample.
6. Determine the chemical oxygen demand of the waste sample.
7. Estimate the remaining chlorine content in the treated waste.
8. Evaluate the impact of lime treatment on BOD levels.
9. Assess the effect of lime treatment on COD levels.
10. Determine the effect of lime treatment on solids concentration.
11. Evaluate the impact of lime treatment on phosphate levels.
12. Study the waste management practices at nearby food processing unit/student mess.
13. Visit to Biogas Plant.
14. Visit to Vermiculture Center.
15. Visit to Effluent Treatment Plant.

RECOMMENDED BOOKS

1. "Waste Management in the Food Industry: A Practical Approach" by Ioannis S. Arvanitoyannis
2. "Waste Management and Co-Product Recovery in Food Processing: An Overview" by Keith W. Waldron
3. "Handbook of Waste Management and Co-Product Recovery in Food Processing" by Keith W. Waldron
4. "Waste Management Practices: Municipal, Hazardous, and Industrial" by John Pichtel
5. "Food Industry Wastes: Assessment and Recuperation of Commodities" by Maria Kosseva and Colin Webb
6. "Sustainable Food Waste-to-Energy Systems" by Thomas Trabold and Callie W. Babbitt

7. "Biological Waste Treatment" by G. Reed and P. J. Stainer
8. "Food and Beverage Wastewater Treatment" by Ioannis S. Arvanitoyannis and Athanasios I. Liakos
9. Gina Cybulska; (2000). Waste Management in the Food Industry; Publisher: Campden & Chorleywood Food Research Association
10. Wastewater Engineering: Treatment, Disposal and Reuse" by Metcalf and Eddy, (1995). Tata McGraw Hill Publishing Company Ltd., New Delhi
11. Robert R. Zall; (2004). Managing Food Industry Waste: Common Sense Methods for Food Processors; 1st edition Publisher: Wiley-Blackwell;

SUGGESTED WEBSITE

1. http://www.fao.org/fao-who-codexalimentarius/en/
2. https://www.epa.gov/
3. http://www.fsis.usda.gov/
4. http://www.foodwastealliance.org/
5. https://www.foodmanufacture.co.uk/
6. https://www.food.gov.uk/
7. https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/sustainable-food-systems
8. https://www.who.int/news-room/fact-sheets/detail/food-safety
9. https://gpadampur.wordpress.com/exppage/
10. https://pecb.com/article/waste-management-in-food-industry
11. https://ebooks.inflibnet.ac.in/hsp06/chapter/waste-disposal/
12. https://pecb.com/pdf/articles/34-pecb_waste-management-in-food-industry.pdf
13. https://p2infohouse.org/ref/31/30495.pdf
14. https://egyankosh.ac.in/bitstream/123456789/12399/1/Unit-17.pdf

INSTRUCTIONAL STRATEGY

Pollution control and waste utilization are important in food technology. Teacher should design suitable tutorial exercises for the students. Experts may be invited to deliver lectures on various themes. Students may be taken to some effluent treatment plant and industries engaged in requirements-cycling and utilization of wastes. Students may be given sufficient exposure to various national and international standards for quality parameters required for safe disposal of waste. This subject contains five unit of equal weightage.

6.4 PROGRAMME ELECTIVE -II

6.4.1 FOOD AUDITING AND CERTIFICATIONS

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RATIONALE

The course in Food Auditing and Certifications is designed to meet the growing demand for professionals skilled in auditing food safety and quality management systems. In today's globalized food industry, ensuring food safety and quality is paramount, and certifications play a crucial role in demonstrating compliance with regulatory requirements and industry standards. This course aims to equip students with the knowledge and skills required to conduct effective food audits, evaluate compliance with food safety regulations, and implement quality management systems. By focusing on auditing principles, standards, and documentation, the course prepares students for careers in food safety management, quality assurance, and regulatory compliance.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Describe the principles and practices of food auditing.
CO2: Explain food safety management systems (FSMS) standards and their implementation.
CO3: Audit quality management systems (QMS) for continuous improvement.
CO4: Apply national and international food safety regulations to ensure compliance.
CO5: Prepare documents for food audits and certifications according to industry standards.

DETAILED CONTENTS

UNIT I

Introduction to Food Auditing

a) Overview of food auditing principles and practices.
b) Importance of food auditing in ensuring food safety and quality.
c) Regulatory requirements and standards for food auditing.

UNIT II

Food Safety Management Systems (FSMS)

a) Introduction to FSMS standards (e.g., ISO 22000, FSSC 22000).
b) Requirements of FSMS standards and their implementation.
c) Auditing techniques for evaluating FSMS effectiveness.

UNIT III

Quality Management Systems (QMS)

a) Overview of QMS standards (e.g., ISO 9001).
b) Principles of QMS and their application in the food industry.
c) Auditing QMS for continuous improvement.

UNIT IV

Food Safety Regulations and Compliance

a) National and international food safety regulations (e.g., FSSAI, FSMA, Codex Alimentarius).
b) Compliance requirements for food businesses.
c) Auditing for regulatory compliance.

UNIT V

Food Certification and Audit Documentation

a) Different Types of food certifications like:
    i. GHP
    ii. GMP
    iii. HACCP
    iv. BIS Certifications
    v. AGMARK Certification
    vi. Food Safety Training and Certification (FoSTAC)
    vii. Food Safety System Certification 22000
    viii. Safe Quality Food (SQF) Certification through Safe Quality Food Institute (SQFI)
    ix. British Retail Consortium Global Standards (BRCGS) Certification
    x. Certified Professional-Food Safety (CP-FS)

xi. Certified Food Manager (CFM)
xii. Organic Certification
xiii. Halal Certification
xiv. Kosher Certification
xv. Satvik Certification - Satvik, Vegetarian Food, Vegan Food

b) Documentation requirements for food audits and certifications
c) Audit reporting and follow-up actions.
d) Case studies related to objections and their remedial actions.

RECOMMENDED BOOKS

1. "Food Safety Management: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld - Provides practical guidance on food safety management systems and auditing.
2. "ISO 22000 Food Safety Management Systems Handbook" by Josep Bernabeu-Mestre - A comprehensive guide to understanding and implementing the ISO 22000 standard.
3. "The Certified HACCP Auditor Handbook, Third Edition" by John G. Surak and Steven Wilson - Covers the principles and practices of auditing Hazard Analysis and Critical Control Points (HACCP) systems.
4. "Food Safety Auditing: A Practical Guide" by Ronald H. Schmidt and Debby L. Newslow - Offers practical insights into conducting food safety audits in various food industry sectors.
5. "The ISO 9001:2015 Implementation Handbook: Using the Process Approach to Build a Quality Management System" by Milton P. Dentch - Focuses on implementing and auditing quality management systems based on the ISO 9001 standard.
6. "Food Safety Management Systems: A Practical Guide for the Food Industry" by Yasmine Motarjemi and Huub Lelieveld - Provides a practical approach to implementing food safety management systems and conducting audits.
7. "Auditing Food Safety Management Systems: A Practical Guide" by Ron Kill - Offers practical guidance on auditing food safety management systems, including sample checklists and audit plans.

SUGGESTED WEBSITE

1. https://www.fssai.gov.in/
2. https://www.iso.org/home.html

3. https://www.foodsafetymagazine.com/
4. https://www.brcgs.com/
5. https://www.sqfi.com/
6. https://asq.org/
7. http://www.fao.org/home/en/
8. https://mygfsi.com/
9. https://www.fda.gov/
10. https://www.efsa.europa.eu/en
11. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

The instructional strategy for the Food Auditing and Certifications course will focus on a combination of theoretical knowledge and practical application. Students will engage in lectures and discussions to understand the principles of food auditing, including regulatory requirements and industry standards. Practical exercises, such as case studies and mock audits, will provide hands-on experience in conducting food audits and evaluating compliance. Guest lectures from industry experts and visits to food manufacturing facilities will offer real-world insights into food auditing practices. The course will also emphasize the importance of communication skills in reporting audit findings and recommendations. This subject contains five unit of equal weightage.

6.4.2 FOOD BY-PRODUCTS UTILIZATION

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RATIONALE

The course in Food By-Products Utilization is designed to address the increasing need for sustainable practices in the food industry by focusing on the efficient use of by-products. By-products are often rich in valuable components such as fibers, proteins, and bioactive compounds, which can be extracted and utilized in food products. This course aims to equip students with the knowledge and skills to identify, process, and innovate with by-products, thereby reducing waste and environmental impact. Additionally, understanding the functional and nutritional aspects of by-products will enable students to develop new, value-added food products, contributing to both economic and environmental sustainability in the food industry.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Describe the sources, composition, and characteristics of food by-products.
CO2: Apply various processing techniques to extract valuable components from by-products.
CO3: Formulate innovative food products using by-product derived ingredients.
CO4: Explain the principles of sustainability in food production and apply waste minimization strategies.
CO5: Assess the environmental impact of by-product utilization using life cycle assessment tools.

DETAILED CONTENTS

UNIT I

Introduction to Food By-Products Utilization

a) Overview of food by-products and their sources.
b) Importance of by-products utilization in the food industry.
c) Challenges and opportunities in by-product utilization.

UNIT II

Processing Techniques for By-Products

a) Extraction techniques for valuable components (e.g., oils, proteins, fibres).
b) Fermentation and bioprocessing of by-products.
c) Thermal and non-thermal processing methods for by-products.

UNIT III

Functional and Nutritional Aspects of By-Products

a) Functional properties of by-product components.
b) Nutritional value and bioactive compounds in by-products.
c) Health benefits and applications of by-product-derived ingredients.

UNIT IV

Product Development and Innovation

a) Formulation of by-product-based food products.
b) Sensory Evaluation and consumer acceptance of by-product-derived foods.
c) Case Studies and success stories in by-products utilization.

UNIT V

Sustainability and Environmental Impact

a) Environmental benefits of by-product utilization.
b) Waste minimization strategies in food processing.
c) Life cycle assessment and eco-efficiency of by-product utilization.

RECOMMENDED BOOKS

1. "Food Waste to Valuable Resources: Applications and Management" by S. Muthukumarappan and J. S. Sidhu - Provides comprehensive coverage of food waste utilization techniques.

2. "Handbook of Waste Management and Co-Product Recovery in Food Processing: Volume 1" edited by Keith W. Waldron - Offers insights into the utilization of by-products in the food industry.
3. "Food Industry Wastes: Assessment and Recuperation of Commodities" edited by Maria Kosseva and Colin Webb - Focuses on the assessment and recovery of valuable components from food industry wastes.
4. "Sustainable Food Systems: Building a New Paradigm" edited by Terry Marsden et al. - Discusses sustainable practices in the food industry, including by-products utilization.
5. "Valorization of Food Processing By-Products" edited by M. Chandrasekaran - Provides information on the valorization and utilization of food processing by-products.
6. "Waste to Wealth: The Circular Economy Advantage" by Peter Lacy and Jakob Rutqvist - Explores the concept of circular economy and its application in transforming waste into valuable resources.
7. "Bioactive Compounds from Marine Foods: Plant and Animal Sources" edited by Se-Kwon Kim - Covers bioactive compounds present in marine foods, which can be utilized in food by-products.

SUGGESTED WEBSITE

1. http://www.fao.org/food-loss-and-food-waste/en/
2. https://www.usda.gov/foodwaste
3. https://ec.europa.eu/environment/circular-economy/
4. https://www.foodwastealliance.org/
5. https://www.epa.gov/recycle/reducing-wasted-food-home
6. https://sustainablefoodtrust.org/key-issues/food-waste/
7. https://foodtank.com/news/tag/food-waste/
8. https://www.biobasedworldnews.com/tag/food-waste
9. https://gpadampur.wordpress.com/exppage/

INSTRUCTIONAL STRATEGY

The instructional strategy for the Food By-Products Utilization course will focus on a combination of theoretical knowledge and practical application. Students will engage in lectures, case studies, and discussions to understand the principles of by-products utilization. Hands-on laboratory sessions and field visits to food processing facilities will provide practical experience in processing techniques. Group projects and presentations will encourage creativity in product

development using by-products. The course will also emphasize the importance of sustainability and environmental impact assessment in by-products utilization. This subject contains five unit of equal weightage.

6.4.3 INSTRUMENTATION AND PROCESS CONTROL

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RATIONALE

After studying the course, the students will be able to identify different types of sensors and transducers and their applications in the field of instrumentation and process control used in the food industry. The students will be able to select appropriate transducers relating to a process and will also get the relevant technical know-how about the conditioning of a signal from a transducer for control. This course will also enable the students to study in detail the different types of control systems used in instrumentation and will provide an understanding of basic control loops.

The objective of this course is to give the knowledge of various instruments and skills in handling them, which control the process parameters and various operations in any food industry.

COURSE OUTCOMES

After undergoing this course, the student shall be able to:

CO1: Explain the importance of instruments in process industries and classify them.

CO2: Identify and describe the instruments used for temperature measurement.

CO3: Explain the different types of pressure and working principles of instruments used for pressure, flow, and liquid level measurement.

CO5: Describe instruments used for miscellaneous measurements including viscosity, humidity, PH value, TSS, and industrial weighing systems.

CO5: Describe the automatic control system and its types.

DETAILED CONTENTS

UNIT I

a) Introduction:
   i. Overview of Instrumentation, Process control, fundamental measuring process.
   ii. Measuring methods: Direct method, indirect method, primary, secondary, and tertiary measurements.
   iii. Brief about routine calibration and importance of accurate measurements in industrial processes.
b) Classification of Instruments.
c) Deflection and Null Types, Manually Operated and Automatic Types, Analog, and Digital Types, Self-Generating and Power-Operated Types, Contacting and Non-Contacting Types, Dumb and Intelligent Types.
   i. Mechanical instruments, Electrical instruments, electronics instruments
d) Static and Dynamic Characteristics of Instruments.
   i. Understanding static characteristics: accuracy, precision, sensitivity, linearity, reproducibility, repeatability, resolution, threshold, drift, stability, tolerance, range, or span.
   ii. Basic dynamic characteristics: speed of response, measuring lag, fidelity, dynamic error.

UNIT II

a) Temperature Measurement:
   i. Introduction to temperature, heat, zeroth law of thermodynamics and different thermal scales
b) Classification of temperature measuring instruments:
   i. Nonelectrical methods
   ii. Bimetallic thermometer, Liquid in glass thermometer, Pressure thermometer
c) Electrical methods:
   i. Electrical Resistance Thermometers/Thermistors
   ii. Metallic Resistance Thermometers / RTDS
   iii. Thermo-Electric Sensors/Thermocouple thermometer
d) Radiation methods
   i. Disappearing filament optical pyrometer
   ii. Infrared pyrometer
   iii. Fiber optic temperature sensors

UNIT III

a) Introduction to pressure:
   i. Absolute pressure, gauge pressure, vacuum pressure, atmospheric pressure
b) Pressure Measurement methods.
   i. Types, construction and working principles of bourdon tubes, diaphragms, capsules, and bellows.
c) Types, construction and working principles of manometers.
d) Liquid Level Measurement
   i. Direct methods: dipstick method, Sight glass, hook gauge, float gauge, float, and shaft gauge
   ii. Indirect methods: hydrostatic pressure level sensor, bubbler or purge technique, Capacitance Level Sensor, Ultrasonic Level Sensor, nucleonic gauge
e) Flow Measurement Instruments
   i. Types of flow
   ii. Solid flow measurement methods
   iii. Liquid flow measurement methods
f) Restriction flow sensors: orifice, venture, nozzle flow sensors
g) Obstruction flow sensors: Rota meter, moving vane flow meter, turbine flow meter.
h) Magnetic flow meter, ultrasonic flow meter, pitot tube flow meter

UNIT IV

a) Miscellaneous Measurement Instruments:
   i. Viscosity Measurement: Concept of viscosity and its measurement (Capillary, john cup, vibrational and rotational viscometer).
b) Humidity and pH Measurement:
   i. Introduction to humidity, relative and absolute humidity, basic principle and types of hygrometers (Hair tension hygrometer, wet and dry bulb hygrometer, sling psychomotor).
   ii. Introduction to pH, importance in food industry and brief about its measurement (titration, calorimetric and electrochemical methods) meters.
c) TSS Measurement:
   i. Working of refract meter (abbe and hand).
d) Industrial Weighing Systems:
   i. Principles of operation and types of weighing scales (platform scales, load cells).

UNIT V

Control Systems

a) Automatic Process Control:
   i. Introduction to automatic control system.
   ii. Basic components of control system.

b) Classification of Control Systems:
   i. Working, advantages, disadvantages and examples of open loop and closed loop control system.

c) Types of Controllers and control actions:
   i. Classification of controllers: brief about Pneumatic, hydraulic, and electric controllers.
   ii. Classification of control actions: On-off controllers, proportional controllers, and composite control action.

RECOMMENDED BOOKS

1. "Process Control Instrumentation Technology" by Curtis D. Johnson
2. "Industrial Instrumentation and Control" by S. K. Singh
3. "Instrumentation for Process Measurement and Control" by Norman A. Anderson
4. A Course in Electronic Measurements And Instrumentation by A.K. Sawhney
5. "Principles of Industrial Instrumentation" by D. Patranabis
6. "Industrial Instrumentation" by Donald P. Eckman
7. "Handbook of Industrial Automation" by Richard L. Shell and Ernest L. Hall
8. "Process Control: Modeling, Design, and Simulation" by B. Wayne Bequette
9. "Fundamentals of Industrial Instrumentation and Process Control" by William C. Dunn

SUGGESTED WEBSITE

1. https://www.isa.org/
2. https://www.controlglobal.com/
3. https://www.invensys.com/
4. https://www.emerson.com/en-us
5. https://www.yokogawa.com/
6. https://gpadampur.wordpress.com/exppage/

7. https://agrimoon.com/wp-content/uploads/Instrumentation-and-Process-Control.pdf
8. https://instrumentationtools.com/process-control-instrumentation/
9. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCHA1503.pdf
10. https://www.eit.edu.au/resources/fundamentals-of-instrumentation-process-control-plcs-and-scada-for-plant-operators-and-other-non-instrument-personnel/
11. https://www.idc-online.com/technical_references/pdfs/electronic_engineering/Static_and_Dynamic_Characteristics_of_Measurement_System.pdf
12. https://www.mt.com/mt_ext_files/Editorial/Generic/8/Weigh_Uncertain_Number4_0x0003d6750003db6700091749_files/Elect_Weigh_Principles.pdf

INSTRUCTIONAL STRATEGY

In this course on Instrumentation and Process Control, a blended instructional strategy will be employed, combining theoretical concepts with hands-on practical experience. Lectures will cover the principles of instrumentation and control, supported by multimedia presentations to enhance understanding. Practical sessions will include laboratory experiments and demonstrations using various instruments such as thermometers, manometers, and flow meters. Case studies and real-world examples will be used to illustrate the application of instruments in process industries, enhancing students' problem-solving skills and industry relevance. This subject contains five unit of equal weightage.

6.5 MAJOR PROJECT / INDUSTRIAL TRAINING

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RATIONALE

Major project / Industrial training will help in developing the relevant skills among the students as per National Skill Qualification Framework. It aims at exposing the students to the present and future needs of various relevant industries. It is expected from the students to get acquainted with desired attributes for industrial environment. For this purpose, students are required to be involved in major project / industrial training in different establishments.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Define the problem statement of the Major project / Industrial training according to the need of industry.

CO2: Work as a team member for successful completion of Major project / Industrial training.

CO3: Write the Major project / Industrial training report effectively.

CO4: Present the Major project / Industrial training report using PPT.

GUIDELINES

Depending upon the interest of the students, they can go for Major project / Industrial training as per present and future demand of the industry. The supervisors may guide the students to identify their project work and chalk out their plan of action well in advance. As an Major project / Industrial training activity each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes/activities. The supervisor may create a group of 4-5 students as per their interest to work as a team for successful completion of the Major project / Industrial training. The supervisor shall evaluate the students along with one external industry / academic expert by considering the following parameters:

	Parameter	**Weightage**
I	Defining problem statement, focus and approach	20%
ii	Innovation / creativity	20%
iii	Report Writing	20%
iv	Power Point Presentation	20%
v	Viva - voce	20%

24. ASSESMENT TOOLS AND CRITERION

The assessment is carried out by conducting:

1. Formative assessments
2. Summative assessments

1. FORMATIVE ASSESSEMENT

The formative assessment will be evaluated on the basis of the internal assessments for theory subjects and practical by the concerned teachers for evaluating the knowledge and skill acquired by students and the behavioral transformation of the students. This internal assessment is primarily carried out by collecting evidence of competence gained by the students by evaluating them at work based on assessment criteria, asking questions and initiating formative discussions to assess understanding and by evaluating records and reports, and sessional marks are awarded to them.

2. SUMMATIVE ASSESSMENT

The summative assessment will include end semester examination for theory part for each candidate and practical examination with viva voice. Each Performance Criteria will be assigned marks proportional to its importance and proportion of marks for Theory and Skills Practical for each subject should be laid down. The following assessment tools are used for effective student evaluation:

1. Theory
2. Practical
3. Minor &Major Project
4. Massive Open Online Courses(MOOCs)
5. VivaVoce
6. Industrial / In House Training
7. Professional Industrial Training

1. Theory Assessment

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems.

The formative evaluation for theory subjects may be caused through

i. Sessional/class-tests,
ii. Quizzes,
iii. Assignments,
iv. Seminars /Presentations
v. Attendance
vi. Case Studies

For Summative evaluation of theory, the question paper may comprise of three sections.

i. It should contain objective type question and multiple choice questions. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

ii. It should contain short answer questions.

iii. Descriptive type questions, with some internal choice of the questions set may be given in this section

2. Practical Assessment

Evaluation of students performance in practical work (Laboratory experiments, Workshop practical /field exercises) aims at assessing students ability to apply or practice the concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. This will comprise of a creation of mock environment, wherever applicable in the skill lab which is equipped with all required equipment for development of desired skills. Candidate's soft skills, communication, aptitude, safety consciousness, quality consciousness etc. will be ascertained by observation and will be marked in observation checklist along with the assessment of Job carried out in labs and maintenance of Lab Record Files.

Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the

relevant subject. The end product will be measured against the specified dimensions and standards to gauge the level of skill achievements

3. Minor and Major Project Assessment

The purpose of evaluation of project work is to assess student's ability to apply, in an integrated manner, knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The project work assigned should be of relevance to the core skill, state of the art topics and the project areas that are pertaining to enhance job skill and enhance occupational opportunities. For both, minor and major project, Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, nature and relevance of project and general behavior.

The formative assessment should include the continuous assessment based on the work allocated and mid semester viva voice or presentation. The final assessment will be the combination of the project undertaken, report submission and should be followed by viva- voce of the relevant subject.

In case of the assessment of this component, the team of examiners should be constituted and half of the examiners in the team should be invited from outside of the institute as expert for conducting the examination.

4. Massive Open Online Courses (MOOCs) Assessment

Open Elective and Multi-Disciplinary Elective may be covered through Massive Open Online Courses (MOOCs) to promote self-learning. These platforms promise open, online courses to massive numbers of students as they are free to join; they provide a wide range of courses. They allow for space and time flexibility and their participants can benefit from various online communication tools and access to quality content.

The coordinating Department/Centre/Office shall monitor every student to adopt the courses online of their choice and preference on Swayam portal. The duration of courses will vary depending on the level and credit points. Courses offered in the duration of 4-10 weeks for 2 to 3 credits at diploma level are to be opted. Students can get a certificate after registering and attending the classes and submitting the assignments/quizzes and qualifying nationwide conducted written exam.

On successful completion of each course, the institution offering the MOOCs course would issue the certificate, along with the number of credits and grades, through which the student can get credits transferred into his marks certificate issued by the parent institution. There may be standard norms for the host Institution to conduct the course that may include continuous evaluation through assignments, online quizzes, case studies, online writing exercises, term examinations, student feedback, online forum management, etc. The coordinating Department/Centre/Office of the respective department shall monitor every student and submit to the Office of Examinations, a score sheet before the close of the even semester.

5. Viva Voce Assessment

This tool will be used to assess the conceptual understanding and the behavioral aspects as regards the job role and the specific task at hand. It will also include questions on safety, quality, environment and equipment's etc. Ask questions on non-prescribed tasks to ensure that the learners have complete knowledge on the assessment

6. Industrial / In-house Training Assessment

The two mandatory internships after First and Second Year of are to be assessed in 3rd and 5th semester subsequently. The training should be preferably done in the industry but can also be in house depending upon the stream and availability of resources in and around the institute. Faculty should be assigned each student and made responsible for the evaluation and assessment of the training. Formative assessment should be taken from the industry/institute/ department on the basis of performance, behavior and learning capabilities. Summative evaluation may comprise of weight ages on the basis of report submission / presentation followed by viva-voce of the relevant subject.

7. Professional Industrial Training Assessment

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. Formative and summative evaluation may comprise of weight ages to performance on task, quality of product, general behavior and it should be followed by viva-voce of the relevant subject.

The formative assessment should include the evaluation from the employer where the student is doing his training in the ratio of 40:60. The final assessment will be the combination of the employer assessment and evaluation by the faculty of the institute which shall include report

submission/ presentation/ seminar followed by viva-voce of the relevant subject.

SGPA AND CGPA ASSESSMENT

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the marks scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student i.e.

SGPA (Si) = $\sum$(Ci x Gi) / $\sum$Ci

where Ci is the number of credits of the ith course and Gi is the marks scored by the student in the its course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme,i.e.

CGPA = $\sum$(Ci x Si) / $\sum$ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

25. TEACHING LEARNING TOOLS FOR EFFECTIVE IMPLEMENTATION

For effective implementation of curriculum, the faculty and staff of institutions have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that only a proper mix of different teaching methods in all these places of instruction can bring the changes in students behaviour as stipulated in the curriculum document. It is important to understand curriculum document holistically and further be aware of intricacies of Teaching- Learning Tools for achieving curriculum objectives. Given below are certain recommendations which may help in carrying out teaching-learning effectively:

PROGRAMME LEVEL RECOMMENDATIONS

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared at institute level. The Head of the institute has a great role to play in its dissemination and percolation up to grass-root level.

3. Heads of Department are required to prepare academic plan at department level referring to institutional academic plan.

COURSE LEVEL RECOMMENDATIONS

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives. Teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practical's, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical's and field experiences. Teachers are also required to do all these activities within a stipulated period which is made available to them in the academic plan at Board level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers for effective utilization of Teaching Learning Tools to achieve the course objectives:

1. Teachers need to ensure attainment of course outcomes so as to help the students achieve program outcomes and also meet the desired learning outcomes in five domains of NSQF i.e. Process, Professional knowledge, Professional skills, Core skills and Responsibility.

2. Teachers are required to prepare a course plan, taking into account number of weeks available and courses to be taught.

3. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan.

4. Teachers are required to plan for expert lectures from field/industry. For this, necessary steps need to be taken such as planning in advance, identifying field experts, making correspondence to invite them, taking necessary budgetary approval etc.

5. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

6. Concept based industrial/field visits may be planned and executed for such contents of course which are abstract in nature and no other requisite resources are readily available in institute to impart themeffectively.

7. Lot of focus needs to be laid on skill development. There is need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning and experiential learning effectively. The development and use of lab manuals will enable the institutes to provide lab experiences effectively.

8. Emphasis should to laid on developing soft skills like communication skills, personality Development, self-learning, inter personal skills, problem solving, and creativity etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time. While teaching, the teacher should make extensive use of audio visual aids such as video films, power point presentations and IT tools.

10. Teachers may take an initiative in establishing liaison with industries and field organizations for imparting field experiences to the students.

11. To enhance digital learning, open electives and multi-disciplinary electives have been provided in the curriculum to be taken up in the form of MOOCs. For Open electives, some courses may be identified out of the prescribed list given in the curriculum keeping in mind the interest of students. Similarly, for multi-disciplinary electives, courses to be offered may be identified by considering their relevance and utility. Every year SWAYAM is notifying the list of courses which are going to be offered in forthcoming even and odd semester. The institute needs to select the courses that are offered on SWAYAM platform or any other online platform.

12. For effective implementation of Massive Open Online Courses (MOOCs), a faculty member in the department may be identified and given the responsibility to coordinate various activities related to MOOCs. The concerned faculty member will facilitate in registration of students for MOOCs. The faculty member will also be responsible for compiling the result of students on the completion of MOOCs and pass on the information to the concerned authority.

13. Flexibility has been provided in the curriculum for the students to choose a course related to the discipline as per their interest. For effective implementation of discipline-specific electives, the institute should identify some courses from the list of courses prescribed in the curriculum. The courses should be selected and offered keeping in mind the interest of students, infrastructure and expertise available in and around the institute related to the courses. Option for discipline-specific elective may be taken from students through a form and a course, with more than 10 students opting for it, may be run.

14. Students should be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

15. Any relevant contents beyond the syllabus may be covered by the teacher or experts in extra time.

16. Minor project should be identified and allocated taking into consideration the inputs from industry stake-holders, and departmental faculty. The minor project work should be such that it enhances the fundamental skill-sets of the students from industry perspective and subsequently helps them to handle major project.

17. For major project work, students may be given relevant and well thought out problems, which are purposeful and develop practical skills. This will help the students in developing creativity and confidence for their gainful employment.

18. A Project bank may be developed in consultation with related industry, research institutes and other relevant field organizations. It may be ensured that that the students take up some live problems being faced by industry as part of project work.

26. LIST OF EXPERTS

1. Controller of Examination, Haryana State Board of Technical Education, Panchkula.
2. Controller of Admn. & Finance, Haryana State Board of Technical Education, Panchkula.
3. Joint Secretary, Haryana State Board of Technical Education, Panchkula.
4. Deputy Secretary, Training & Placement, Haryana State Board of Technical Education, Panchkula.
5. Deputy Secretary, Examination, Haryana State Board of Technical Education, Panchkula.
6. Deputy Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
7. Assistant Secretary, Academic, Haryana State Board of Technical Education, Panchkula.
8. Mr. Ved Pal Yadav, Senior Lecturer, Department of Food Technology, Government Polytechnic, Adampur.
9. Mr. Bansi Lal, Lecturer, Department of Food Technology, Government Polytechnic, Bhiwani.
10. Mr. Rajesh Kumar, HOD, Department of Food Technology, Government Polytechnic, Bhiwani.
11. Mr. Pintu Choudhary, Lecturer, Department of Food Technology, Government Polytechnic, Bhiwani.
12. Mr. Mohit Jindal, Guest Lecturer, Department of Food Technology, Government Polytechnic, Adampur.
13. Prof. Paramjit S. Panesar, Dean & Professor, Department of Food Technology, SLIET, Longowal.
14. Prof. D.C. Saxena. Department of Food Technology, SLIET, Longowal.
15. Mr. LK Sharma, HR, Legacy Food, Baddi.
16. Mr. Sanjay Rohilla, Nestle, Moga.
17. Mr. Sandeep Singla, Director, Day Nite Bakers, Sirsa
18. Mr. Shukla, DP Chocolates, Legacy Food, Baddi.

19. Dr. Nidhi Aggarwal, Deputy Secretary (Academic), Haryana State Board of Technical Education, Panchkula.

20. Smt. Pushpa Rani, Senior Lecturer, Applied Science Department, Government Polytechnic, Sonipat, Haryana.

21. Smt. Krishna Bhoria, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

22. Smt. Preetpal Kaur, Guest Faculty, Applied Science Department, Government Polytechnic, Ambala, Haryana.

23. Ms. Monika, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

24. Dr Neena Sharma, English Department, MCM College, Chandigarh.

25. Mr. Satyawan Dhaka, Senior Lecturer, Applied Science Department, Government Polytechnic, Nilokheri.

26. Mrs. Sapna Sang, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.

27. Mr. Ravi Bansal, Lecturer, Applied Science Department, Government Polytechnic, Manesar.

28. Mrs. Kiran, Lecturer, Applied Science Department, Government Polytechnic, Sonepat.

29. Dr. Naveen Jha, Assistant Professor, Department of Mathematics, Government Engineering College, Bharatpur.

30. Dr. KC Lachhwani, Assistant Professor, Applied Science, NITTTR, Chandigarh.

31. Dr. Bhajan Lal, Lecturer, Applied Science Department, Government Polytechnic for Women, Sirsa, Haryana.

32. Sh. Anil Nain, Lecturer, Applied Science Department, Government Polytechnic, Hisar, Haryana.

33. Dr. Sarita Mann, Lecturer, Applied Science Department, Government Polytechnic, Ambala, Haryana.

34. Smt. Bindu Verma, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla, Haryana.

35. Dr. Pankaj Sharma, Professor, Applied Science Department, NITTTR, Chandigarh.

36. Dr. Ashok Kumar, Associate Professor, Applied Science Department, NITTTR, Chandigarh.

37. Prof. KG Srinivasa, Professor, Information Management & Emerging Engineering, NITTTR, Chandigarh.

38. Dr. Vidhi Grover, Lecturer, Applied Science Department, Seth Jai Parkash Polytechnic, Damla.

39. Mr. Tavinder Singh, Lecturer, Applied Science Department, Government Polytechnic, Sirsa.

40. Ms. Sunita Rani, Lecturer, Applied Science Department, Government Polytechnic, Ambala

41. Dr. Rajesh Mehra, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh.

42. Dr. AB Gupta, Professor and Head, Education & Educational Management Department, NITTTR, Chandigarh.

43. Sh. PK Singla, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

44. Dr. S K Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.
Coordinator

45. Dr. Meenakshi Sood, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh.

27. APPENDIX

LIST OF EQUIPMENT

MICROBIOLOGY LABORATORY	
Sr. No.	**Item**
1.	Autoclave
2.	Balance (Electronics) (300 g. – 0.001 L.C.)
3.	Colony Counter
4.	Colorimeter (Big)
5.	DO Analyzer
6.	Fumigator
7.	Heating Mantle
8.	Incubator
9.	Incubator BOD
10.	Laminar Flow Bench
11.	Magnetic Stirrer (Hot Plate)
12.	Microscopes
13.	pH Meter
14.	Retort
15.	UV Cabinet
16.	Cooling Incubator
17.	Incubator Cum Shaker
18.	Centrifuge
19.	Vortex Mixing Machine
20.	Pressure Cooker 5, 10 litre
21.	Hot Air Oven/ Glass Ware Sterilizer
22.	Water Bath

CEREALS, PULSES AND OIL SEEDS LABORATORY	
Sr. No	**Item**
1.	Ball Grinding Mill
2.	Ribbon Blender
3.	Tray dryer
4.	Hammer mill
5.	Dehusker
6.	Grain Divider
7.	Grain Testing Mill
8.	Grinding Mill
9.	Plate Mill (Atta Chakki)
10.	Purity Work Board
11.	Seed Blower
12.	Universal Moisture Meter
13.	Wet and Dry Grinder
14.	Buhler Mill
15.	Rice Grader
16.	Pulse Milling Unit
17.	Popping Machine
18.	Noodle Press (Manual)
19.	Dehuller
20.	Polisher
21.	Gluten Press
22.	Vernier Calipers
23.	Screw Gauge
24.	Stone Mill
25.	Baking Oven
26.	Freezer (Ultra Low)
27.	Hot Air Oven
28.	Microwave Oven
29.	Mixer Grinder
30.	PASTA Making Machine
31.	Planetary Mixer

CEREALS, PULSES AND OIL SEEDS LABORATORY	
Sr. No	**Item**
32.	Refrigerator (Display)
33.	Refrigerator 4 Door
34.	Beam Balance
35.	Electronic Balance
36.	Fermentation Cabinet
37.	Sheeting-cum-moulding Unit
38.	Proofing Chamber
39.	Biscuits Making Unit
40.	Muffle Furnace
41.	Colour Grader (Kent Jones)
42.	Loaf Volume Meter
43.	Slicing Unit
44.	Heat Sealing Unit
45.	Microwave Oven

MEAT FISH AND POULTRY PRODUCTS LABORATORY	
Sr. No	**Item**
1.	Poultry slaughter unit (Lab Model)
2.	Meat Cutter
3.	Meat Mincer
4.	Emulsion Making Unit
5.	Deep fat Fryer
6.	Oven Toaster Grill
7.	Sausage filler
8.	Pressure Cooker 5 litre
9.	Hot Air Oven
10.	Deep Freezer
11.	Refrigerator
12.	Stainless Cook wares set
13.	Egg Candling unit
14.	Electronic Balance (500 gm.)
15.	Weighing Balance (10 Kg)

MILK AND MILK PRODUCTS LABORATORY	
Sr. No	**Item**
1.	Butter Churner
2.	Butter Moister Balance
3.	Butter Weighing Scale
4.	Centrifuge Gerber
5.	Butter Worker
6.	Centrifuge solubility Index
7.	Cream Separator
8.	Deep Freezer
9.	Densitometer Bulk
10.	Hot Plate
11.	Magnetic Stirrer
12.	Milk Tester
13.	Muffle Furnace
14.	Hand Refractometer (Complete set)
15.	Refractometer (Butyro)
16.	Softy Making Machine
17.	Solubility Index Mixer
18.	Water Bath (Circulating)
19.	Viscometer
20.	Infrared moisture meter
21.	pH meter (Bench Top Model)

FRUITS AND VEGETABLE TECHNOLOGY LABORATORY	
Sr. No.	**Item**
1.	Centrifuge
2.	Citrus Juicer
3.	Crown Corking Machine
4.	Food Processor
5.	Freezer
6.	Fruit Mill
7.	Gas Burner
8.	Hydraulic Juicer Press
9.	Juicer Screw
10.	Juicer (Vegetable)
11.	Microwave Oven
12.	Potato Peeling Machine
13.	PP Cap Sealing Machine
14.	Pulper 10 kg
15.	Refractometer (Tabletop)
16.	Sulphur Box
17.	Temperature Indicator Digital
18.	Tray Dryer
19.	Vacuum Filling Machine
20.	Peeling and Slicing Knives
21.	Stainless Steel Cookwares
22.	Bottling Unit (Filling and copping)
23.	pH meter
24.	Electronic Balances
25.	Hot Air Oven
26.	Carbonation Unit
27.	Hand Refractometer (full range) 0-32, 33-65, 66-90
28.	Steam Jacket Cattle (10 Kg capacity)
29.	Amla Pricking Machine

FOOD ANALYSIS AND QUALITY CONTROL LABORATORY	
Sr. No	**Item**
1.	Centrifuge
2.	Demineralizer
3.	Distillation Unit
4.	Divider Gammet Type
5.	Fire Point Apparatus
6.	Flash Point Apparatus
7.	Lovibond Tintometer
8.	Micro Kjeldhal Apparatus
9.	Photo Electric colorimeter
10.	Polarimeter 200 ml
11.	Rotary Vacuum Evaporator
12.	Smoke Point Apparatus
13.	Spectrophotometer
14.	Water Bulb Constant
15.	Electronic Balance
16.	Top Loading Balance
17.	Physical Balance
18.	pH meter
19.	Hot Air Oven
20.	Vacuum Oven
21.	Sample Grinder 1
22.	Digestion Assembly
23.	Magnetic Stirrer
24.	Soxhlet Apparatus Assembly
25.	Refrigerator 400 Litre
26.	Steam Bath

PACKAGING TECHNOLOGY LABORATORY	
Sr. No	**Item**
1.	Box Compression Tester
2.	Bursting strength tester
3.	Chain Metric
4.	Conductivity Meter
5.	Drop Tester
6.	Gauge Metal Dial Type
7.	Hygrometer
8.	Puncture Resistance Tester
9.	Refrigeration Tutor
10.	Seal and Shrink Packing Machine
11.	Static Tensile Tester
12.	Stop Watch
13.	Substance Indicator
14.	Vacuum Packaging Machine
15.	Tensile strength Unit
16.	Humidity Chamber (Temp and RH controlled)

PROJECT LABORATORY	
Sr. No	**Item**
1.	Cabinet Dryer
2.	Can Reformer and Flanger
3.	Exhaust Box
4.	Mono-Block Motor
5.	Seamer
6.	Seed Grader
7.	Beam Balance
8.	Drum Drier (small)
9.	Spray Drier (bench Model)
10.	Extruder (small)
11.	Vibrio Extractor
12.	Ice-cream Freezer
13.	Fluidized Bed Drier
14.	Spray Dryer
15.	Plate Heat Exchanger
16.	Freeze drier
17.	Twin Screw Food Extruder
18.	Fiber Estimation unit
19.	Automatic fat extraction unit


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