DEPARTMENT OF TECHNICAL EDUCATION (DIPLOMA SECTOR)
UTTAR PRADESH

CURRICULUM FOR DIPLOMA PROGRAMME
IN
FOOD TECHNOLOGY
(3rd to 4th Semester)

==========
Semester System
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(EFFECTIVE FROM YEAR 2025-26)

Prepared By:

INSTITUTE OF RESEARCH, DEVELOPMENT & TRAINING, U.P., KANPUR

CONTENTS

PREFACE

An important issue generally debated amongst the planners and educators' world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. Rapid industrialization and globalization have created an environment for free flow of information and technology through fast and efficient means. This has led to the shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and opens economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspects through developing human resources in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting a time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much-needed dynamism in the system.

F.R Khan
Director
Institute of Research, Development & Training

1. ACKNOWLEDGEMENTS

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2. Sh. F. R. Khan Director I.R.D.T. Kanpur continually motivating, guiding and taking keen interest in the review of the curriculum.

3. All the participants from Polytechnics and other technical institutions for their professional input during curriculum workshops.

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2. SALIENT FEATURES

1. Name of the Programme	➢ Diploma in Food Technology
2. Duration of the Programme	➢ Three years (Six Semesters)
3. Entry Qualification	➢ Matriculation or equivalent NEP-2020/NSQF Level 5 as Prescribed by State Board of Technical Education, U.P.
4. Pattern of the Programme	➢ Semester System
5. Ratio between theory and Practice	➢ 40% (Theory) / 60% (Practical)

1) <u>Industrial Training/Internship:</u>

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation. Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) <u>Audit & Pathways</u>:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge & Tradition, Indian Constitution, Entrepreneurship & Startup, subjects on Environmental Studies have been incorporated in the curriculum.

3) <u>Student Centered Activities</u>:

A provision of 4-8 hrs. per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise co– curricular activities such as expert lectures, classroom seminars, games, hobby club like photography, painting, singing etc. declamation contests, field visits, NCC, NSS and other cultural activities, etc.

4) <u>Project work:</u>

Micro/Mini/Major project work has been included in the curriculum to enable the student to get familiarized with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry

3. EMPLOYMENT OPPORTUNITIES

Employment opportunities for diploma holders in Food technology are visualized in following industries at various levels/positions:

Diploma in Food Technology Employment Areas

- Flight Kitchens
- Quality Control & Food Inspection Departments
- Academic Institutes
- Food Processing and Production Factories
- Food Analysis Laboratories
- Research & Development Centers

Diploma in Food Technology Job Types

- Hygiene Executive
- Analyst
- Small-Scale Entrepreneur
- Home Economist
- Product Development Executive
- Technical Marketing Personnel

Food, Chemical and Allied Industries like

- Food processing units
- Food industry
- Agro industry
- General processing industries
- Petroleum refinery and petrochemical industry
- Oil and natural gas corporation
- Cosmetic industry
- Sugar industry
- Mineral industry
- Pulp and Paper industry
- Polymer industry
- Pharmaceutical industry
- Distillery
- Soap & detergent industry
- Textile industry etc.
- Pesticide industry

In various functional areas like erection and commissioning of plant, plant operation, energy conservation, plant utilities, production, water treatment, maintenance and safety, quality control, inspection and testing, marketing and sales, consultancy services and areas concerning environmental protection.

- Entrepreneurs to small/tiny units especially food, agro and chemical industries such as paints, soap, detergents, equipment repairing etc.

- Academic Institutions (as technicians/instructors at all levels)
- Startups and new inventions in the field of food and chemical engineering.

Management Positions

- Plans and schedules for production
- Allocates duties to various workers.
- Imparts training to workers engaged in the unit.
- Supervises the work of various sections in the food plants.
- Estimates the unit cost of leather produced under his charge.
- Supervises the receiving, packing and forwarding of goods.
- Controls inventory of chemicals and raw materials and makes out a schedule of such materials to be kept in stock for continuous production.
- Accounting and maintaining records. Assists in ensuring working conditions in tanneries in accordance with labor and factory laws. Supervises labor welfare schemes. Marketing of food products.
- Assists in conducting techno-economic surveys and preparing project reports for starting tanneries.

Activities Connected with Research and Development

- Assists in research and development in the fields of: Curing and preservation; food manufacture; Auxiliaries; Utilization of bye-products Treatment of effluents; utilizing local resources.
- Research Organizations like CSIR laboratories, Defense laboratories, Atomic energy establishments etc.
- Boards and Corporations.

4. (A) PROGRAM OUTCOMES (POS)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals, and Food Technology.

PO2: Problem's Analysis and solution
Identify, analyze and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.
Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

4. (B) LEARNING OUTCOMES OF THE PROGRAM

After undergoing this program, students will be able to:	
1	Prepare and interpret drawings of engineering components and plants.
2	Read and interpret drawings related to plant layout, process equipment and components, process flow sheets and product manufacturing.
3	Imparting technical knowledge to develop human resources for food Processing sectors.
4	Imparting knowledge & technical skills for better processing and value Addition of Food& Agro-products through R&D.
5	Inculcating innovative thinking with the aim to support entrepreneurship and to develop state-of-art technologies for testing and consultancy to fulfill. The needs of food industry and society
6	Cultivating strong ethical values for sustainable modern and safe food to Society.
7	Calculate the quantity of raw materials, energy inputs, manpower
8	Control the process and quality of the products commensuration with laid specifications
9	Recognize the need for and have the ability to engage in lifelong learning
10	Conduct experiments, analyses, interpret data and synthesis valid conclusion.
11	Operate conventional machine for machining of components as per Specifications as an aid to function effectively in the process industry.
12	Use electrical and electronic instruments to measure various engineering parameters
13	Use various measuring and gauging instruments
14	Select material as per desired application
15	Understand the general design of process equipment and testing
16	Operate different utility plants
17	Understand different renewable sources of energy and their applications.
18	Understand different plants utilities and their generation and maintenance
19	Use various software tools for automation and process development.
20	Interpret factory acts, laws and taxes
22	Communicate effectively in English and local language in oral and written form with others
23	Manage resources effectively at workplace.
24	Plan and execute given task/project as a team member or leader.
25	Prepare detailed project proposal and report.
26	Use computer and IT tools for creating documents, making spread sheets and making presentation.
27	Solve real life problems by applying knowledge and skills.
28	Use energy conservation methods to manage energy efficiency.
29	Use appropriate practices for conservation and prevention of environmental pollution and safety in process industries.
30	Understand various unit operations, unit processes and processes instrumentation in food process industry

4. ABSTRACT OF CURRICULUM AREAS

a) PROGRAM CORE COURSES

Introduction To Food Technology

Food Fermentation Technology

Food Microbiology

Food Chemistry & Nutrition (Theory)

Food Chemistry & Nutrition (Lab)

Advance Skill Development (Open Elective-1)

Milk & Milk Products Technology

Fruit &Vegetables Technology (Lab)

Meat, Fish & Poultry Technology

Bakery & Confectionery Technology

Advance Skill Development (Open Elective-2)

Cereals & Pulses Technology

Principals of Food Processing & Preservations

Food Packaging Technology

Food Quality Control & Laws

Entrepreneurship and Start-ups

b) PROGRAM ELECTIVE COURSE

(Program Elective-1)

1. Unit Operations & Processes in Food Engineering
2. Modern Separation Technology

(Program Elective 2)

1. Plant Utilities
2. Waste Management in Food Processing

c) PROJECT WORK, SEMINAR & INTERNSHIP IN INDUSTRY

Internship / In-House Project/ Industrial Training

e) AUDIT COURSES

Essence of Indian Knowledge and Tradition

6. STUDY AND EVALUATION SCHEME FOR FOOD TECHNOLOGY (363)

THIRD SEMESTER **FOOD TECHNOLOGY (363)**

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	INTRODUCTION TO FOOD TECHNOLOGY	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.2	FOOD FERMENTATION TECHNOLOGY	PROGRAM CORE (PRACTICUM)	02	-	02	3	40	-	40	60	3	-	-	60	100
3.3	FOOD MICROBIOLOGY	PROGRAM CORE (PRACTICUM)	02	-	04	4	-	60	60	-	-	40	3	40	100
3.4	FOOD CHEMISTRY & NUTRITION	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.5	FOOD CHEMISTRY & NUTRITION (Lab)	PROGRAM CORE (PRACTICAL)	-	01	04	3	-	60	60	-	-	40	3	40	100
3.6	ADVANCE SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-1 (THEORY)	02	-	-	2	50	-	-	-	-	-	-	-	NA
		(Q) OPEN ELECTIVE-1 (Certification Course)					-	-	-	-	-	-	-	-	NA
3.7	SUMMER INTERNSHIP** (4 WEEKS)		-	-	-	2	-	50	50	-	-	-	-	-	50
#STUDENT CENTERED ACTIVITIES			-	-	13	-	-	50	50	-	-	-	-	-	50
Total			**12**	**01**	**23**	**20**	**120**	**220**	**340**	**180**	**-**	**80**	**-**	**260**	**600**

NOTE: -

1. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
2. Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

** Students will present a seminar on their summer internship along with certificate, project and report.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study.

STUDY AND EVALUATION SCHEME FOR FOOD TECHNOLOGY (363)

FOURTH SEMESTER **FOOD TECHNOLOGY (363)**

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	MILK & MILK PRODUCTS TECHNOLOGY	PROGRAM CORE (PRACTICUM)	02	-	02	3	40	-	40	60	3	-	-	60	100
4.2	FRUIT&VEGETABLES TECHNOLOGY (Lab)	PROGRAM CORE (PRACTICAL)	-	01	04	3	-	60	60	-	-	40	3	40	100
4.3	MEAT, FISH & POULTRY TECHNOLOGY	PROGRAM CORE (PRACTICUM)	02	-	02	3	-	60	60	-	-	40	3	40	100
4.4	PROGRAM ELECTIVE -1	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
4.5	PROGRAM ELECTIVE -2	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
4.6	BAKERY & CONFECTIONERY TECHNOLOGY	PROGRAM CORE (PRACTICUM)	02	-	02	3	-	60	60	-	-	40	3	40	100
4.7	ADVANCE SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-2 (THEORY)	2	-	-	2	50	-	-	-	-	-	-	-	NA
		(Q) OPEN ELECTIVE-2 (Certification Course)					-	-	-	-	-	-	-	-	NA
4.8	(Q)ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	AUDIT COURSE	02	-	-	-	50	-	50	-	-	-	-	-	NA
#STUDENT CENTERED ACTIVITIES			-	-	09	-	-	50	50	-	-	-	-	-	50
Total			**16**	**01**	**19**	**20**	**120**	**230**	**350**	**180**		**120**		**300**	**650**

1. (Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.
2. Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study.

OPEN ELECTIVE-1

SR.NO.	(Q) THEORY COURSES NAME
1.	ECONOMIC POLICIES IN INDIA (Course offered by Polytechnic Institute)
2.	PROJECT MANAGEMENT (Course offered by Polytechnic Institute)

SR.NO.	**CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc) (Annexure-1)
2.	COURSES CONDUCTED BY NPTEL OF MINIMUM 02 CREDITS
3.	COURSES CONDUCTED BY MOOCS THROUGH SWAYAM
4.	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
5.	COURSES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIT ETC.)
6.	COURSES CONDUCTED BY C-DAC.
7.	COURSES CONDUCTED BY ISRO E-LEARNING.
8.	COURSES CONDUCTED BY OTHER RELEVENT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE, NEILIT

OPEN ELECTIVE -2

SR.NO.	(Q) THEORY COURSES NAME
1	RENEWABLE ENERGY TECHNOLOGIES (Course offered by Polytechnic Institute)
2	ENERGY EFFICIENCY AND AUDIT (Course offered by Polytechnic Institute)

SR.NO.	**CERTIFICATE COURSES**
1	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc) (Annexure-1)
2	COURSES CONDUCTED BY NPTEL OF MINIMUM 02 CREDITS
3	COURSES CONDUCTED BY MOOCS THROUGH SWAYAM
4	COURSES CONDUCTED BY AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
5	COURSES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT,IIT ETC.)
6	COURSES CONDUCTED BY C-DAC.
7	COURSES CONDUCTED BY ISRO E-LEARNING.
8	COURSES CONDUCTED BY OTHER RELEVENT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE, NEILIT

ANNEXURE-1

LIST OF COURSES CONDUCTED BY TATA TECHNOLOGIES

1. Fundamentals of Innovation and Design Thinking
2. Product Design and Development
3. Product Verification and Analysis
4. Advanced Automobile
5. Electric Vehicle
6. Internet of Things
7. Advanced Manufacturing
8. Advanced Welding & Painting using Simulator
9. Industrial Automation and MES
10. Industrial Robotics
11. Inspection and Quality Control
12. Advanced Plumbing
13. AI and ML

PROGRAME ELECTIVE-1

SR.NO.	SUBJECT NAME
1.	UNIT OPEARTIONS & PROCESSES IN FOOD ENGINEERING
2.	MODERN SEPARATION TECHNOLOGY

PROGRAME ELECTIVE-2

SR.NO.	SUBJECT NAME
1.	PLANT UTILITIES
2.	WASTE MANAGEMENT IN FOOD PROCESSING

7. DETAIL CONTENTS OF VARIOUS SUBJECTS

THEORY	3.1 INTRODUCTION TO FOOD TECHNOLOGY	L	T	P
		3	-	-

COURSE OBJECTIVES

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

- The nature of micro-organisms found in food.
- Techniques to assess the growth of micro-organisms.
- Nature of useful micro-organisms.
- 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.

LEARNING OUTCOMES

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

- Understand the status of Indian Food Industry
- Understand the importance of nutrition, desirable & undesirable components present in food, and Recommended Dietary Allowances (RDA)
- Understated the characteristics of living cells, difference between plant and animal cells
- Understand the basics concepts of food biochemistry
- Understand the basics concepts of food microbiology
- Determine the basic composition of foods

COURSE CONTENTS

Unit-1: (06 Periods)

Basic Consideration: World food problems, Introduction to food chemistry, Basic knowledge of major Indian crops, their total production, losses in storage and opportunity available for their processing to augment availability throughout the year, Scope of food technology: Prerequisite and changes, desirable and potentially undesirable food constituents and their importance.

Unit-2: (09 Periods)

Basic Biochemistry: Energy transformation in living cells, Bioenergetics, Enzyme and Metabolic pathways, Regulation and control.

Unit-3: (12 Periods)

Characterization, classification and identification of micro-organisms, Microscopy, Microorganism Morphology and structure, Pure culture and cultural characteristics, Reproduction, growth and cultivation, Control of microorganisms, Beneficial uses of microbes in foods, Pure Culture of micro-organism-Streak plating, pour plating, spread plating, serial dilution technique, Isolation and preservation–l yophilization, slant method, liquid nitrogen method.

Unit-4: (09 Periods)

Microbial Growth curve and its different phases, Synchronous growth, factors affecting microbial growth, generation time-their significance Bacteria Structure size and shape. Types depending upon different requirements. Gram positive and negative bacteria. Mode of reproduction.

Unit-5: (06 Periods)

Fungi, Yeast and moulds –structure: their growth requirements, mode of reproduction, and its importance. General principles of food hygiene.

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. Teachers should give small assignments to the students related to subject and transfer industrial knowledge to students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

BOOKS RECOMMENDED

1. Industrial Microbiology by Prescott and Don, CBS Publishers and distributors Pvt. Ltd, New Delhi
2. Industrial Microbiology by Casida, Publishers, Inc., New York...by Lester Earlo Casida
3. Biotechnology: Food Fermentation by VK Joshi and Ashok Pandey, AVI Publisho co., West port
4. Biotechnology–Food Processing Application by S.S. Marwaha, Asia techno Publishers Inc., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	15
2	9	20
3	12	35
4	9	20
5	6	10
Total	**42**	**100**

PRACTICUM	3.2 FOOD FERMENTATION TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVES

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.

LEARNING OUTCOMES

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

- Understand the importance and production of common Indian traditional foods.
- Understand the concept of microbial culture selection for particular fermented product.
- Understand the processing of fermented milk, meat and fish products and analyse their qualities.
- Understand the effects of fermentation in food production and its influence on the microbiological quality and status of the food product.

COURSE CONTENTS

Unit-1: (04 Periods)

Introduction; Definition, advantages of fermentation and nutritive value of fermented food products.

Experiment:

1. Demonstration and study of fermenter and its functioning.

Unit-2: (06 Periods)

Type of fermentation processes; different substrates for fermentation process; pure cultures and their maintenance procedures.

Unit-3: (06 Periods)

Fermenter; Basic configuration, different parts–agitator/impellers, sparger, baffles, process control, functions.

Unit-4: (06 Periods)

Production of distilled beverages (whiskey, rum), wine, beer, vinegar and bakers' yeast

Experiments:

1. Preparation of wine
2. Preparation of beer
3. Preparation of vinegar

Unit-5: (06 Periods)

Fermented fods; production technology of curd, yogurt, idli, dosa, dhokla, srikhand, tempeh and miso, sauerkraut, butter milk, lassi, sausages.

Experiment:

1. Preparation of traditional fermented products

INSTRUCTIONAL STRATEGY

Teacher should explain each process industry and use of each and every equipment used. An industrial visit can be organized in various food processing & beverages industries. Audio-visuals should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Demonstration of practical by using experimental set-up.

RECOMMENDED BOOKS:

1. Industrial Microbiology by Prescott and Don, CBS Publishers and distributors Pvt.Ltd, New Delhi.
2. Industrial Microbilogy by Casida, Publishers, Inc., NewYork by Lester Earl Casida
3. Biotechnology: Food Fermentation byV.K. Joshi and Ashok Pandey, AVI Publish co.Westport
4. Biotechnology–Food Processing Application by S.S. Marwaha, Asiatech PublishersInc., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	20
2.	06	10
3.	06	15
4.	06	30
5.	06	25
Total	**28**	**100**

PRACTICUM	3.3 FOOD MICROBIOLOGY	L	T	P
		2	-	4

COURSE OBJECTIVES

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

LEARNING OUTCOMES

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

- Understand the relevant genera and species of microorganisms.
- Determining the microbiological quality and safety of food and environmental factors affecting microbiological stability/spoilage.
- Understand the microbiology of different types of food commodities.
- Understand the necessity of microbiological quality control programs in food production.

COURSE CONTENTS

Unit-1: (04 Periods)
Introduction–Definition, historical developments in the food microbiology and its significance, Microbiology of milk and milk products like cheese, butter, Ice-cream, milk powder.

Experiment:

1. Study of the microbiological quality of milk by MBR test

Unit-2 (08 Periods)
Microbiology of meat, fish, poultry and egg products. Microbiology of fruits and vegetable products like; jam, jelly, sauce, juice. Microbiology of cereal and cereal products like bread.

Experiment:

1. Estimation of total microbial bacterial plate count of food sample by direct microscopic and SPC method.
2. Estimation of total microbial count of (a) milk products (b) fruits and vegetable products(c) meat, fish and poultry products (d) water (e) surface (f) air (g) workers (h) canned foods.

Unit-3: (06 Periods)
Microbial spoilage of foods–Foodborne pathogens, food poisoning, food infection and intoxication

Experiment:

1. Estimation of total microbial bacterial plate count of food sample by direct microscopic and SPC method.

Unit-4: Concept of TDT, F, Z and D value (04 Periods)

Unit-5: Anti-microbial agents–physical and chemical agents –their mechanism of action (06 Periods)

Experiment:

1. Demonstration of effect of different anti-microbial agents i.e.

(a) High and low temperature (b) UV radiation and (c) Chemical preservatives on the growth of microbes

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. Teacher should explain each process industry and use of each and every equipment used. Audio-visuals should be used to teach.Visits to some of the local industries and quality control canters may be arranged to demonstrate various aspects of basic microbiology to the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Demonstration of practical by using experimental set-up.
- Viva-Voce.

BOOKS RECOMMENDED

1. Essentials of Microbiology by K.S. Bilgrami; CBS.
2. Food Microbilogy by W.C. Frazier; Tata McGraw Hill.
3. Modern Food Microbilogy by James M Jay; CBS.
4. Bacteriology by Sale.
5. Standard Methods for Wastewater Analysis by APHA.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	15
2.	08	35
3.	06	15
4.	04	10
5.	06	25
Total	**28**	**100**

THEORY	3.4 FOOD CHEMISTRY & NUTRITION	L	T	P
		3	-	-

COURSE OBJECTIVES

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.

LEARNING OUTCOMES

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

- Understand the chemistry of water and carbohydrate and their interaction with other food components.
- Understand the basic structure of lipid and reaction involved during processing.
- Understand the chemistry and properties of food proteins and modification of food proteins during processing.
- Determination and analysis of food constituents.
- Understand the basic concepts of food nutrition and RDI
- Understand the digestion of nutrients in the human body
- Formulate different diets
- Calculate calorific value of food
- Perform sensory analysis of food

COURSE CONTENTS

Unit-1: (06 Periods)

Introduction: Importance of food. Scope of food chemistry, Introduction to colloidal chemistry and its role in food production, Introduction to different food groups (cereals & pulses, meat & fish & poultry, milk & milk products, fats & oils, vegetables & fruits, sugar & jaggery, spices and condiments & their classification and importance.

Unit-2: (06 Periods)

Water: Structure of water molecule, types and properties of water, water activity and its importance.

Unit-3: (10 Periods)

Carbohydrates: Basic composition, classification, sources, nutritional and industrial importance.
Proteins –Basic composition, classification, sources, functional, nutritional and industrial importance.
Fats –Basic composition, classification, sources, nutritional and industrial importance.

Unit-4: (10 Periods)

Vitamins and Minerals: Function and sources of minerals calcium, iodine, zinc, iron, floride, fat soluble and water-soluble vitamins, effect of processing and storage on vitamins deficiency disorders and requirement of different nutrients (Calcium, Iodine, vitamin-A, iron, protein and calorie or energy.

Unit-5: (10 Periods)

Concept of balanced diet. Food Pigments Importance and plant sources of pigments (Chlorophyll, Anthocyanin, Carotenoids, Lycopene) Enzymes: Definitions, mode of action, importance sources, nomenclature and classification Food additives –definition and important types.

INSTRUCTIONAL STRATEGY

This is one of the basic subjects for the diploma holders in food technology. The teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. Teacher should explain each process industry and use of each and every equipment used. Audio-visuals should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

BOOKS RECOMMENDED

1. Essentials of Food and Nutrition by Swaminathan Vol.I and II, Health Kalyani publishers, New Delhi Food Chemistry by L.H. Meyer,Van Nostr and Reinhold Co. New York.
2. Handbook of Analysis of Fruits and Vegetables by S.Ranganna, Tata MeGraw Hill. Publishing Company, New Delhi.
3. Biochemistry by Mohinder Singh, Sejwal Publisher. New Delhi.
4. Introduction to Biochemistry by Braverman, Elsevier Scientific Publishing.
5. Food Chemistry by Linhinger, CBS Publishers, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	10
2.	06	10
3.	10	30
4.	10	25
5.	10	25
Total	**42**	**100**

PRACTICAL	3.5 FOOD CHEMISTRY & NUTRITION	L	T	P
		-	1	4

COURSE OBJECTIVE:

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.

LEARNING OUTCOMES:

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

- Understand the chemistry of water and carbohydrate and their interaction with other food components.
- Understand the basic structure of lipid and reaction involved during processing.
- Understand the chemistry and properties of food proteins and modification of food proteins during processing.
- Determination and analysis of food constituents.
- Understand the basic concepts of food nutrition and RDI.
- Understand the digestion of nutrients in the human body.
- Formulate different diets.
- Calculate calorific value of food.
- Perform sensory analysis of food.

COURSE CONTENTS

Unit 1:
Experiment:

1. Determination of moisture in a given food sample
2. Determination of protein in a given food sample
3. Determination of carbohydrates in a given food sample

Unit 2:
Experiment:

1. Determination of ash in a given food sample
2. Determination of fat in a given food sample
3. Determination of pH of a given sample

Unit 3:
Experiment:

1. Determination of acidity of given food sample / beverage
2. Determination of total non-reducing and reducing sugars
3. Determination of vitamin C in given food sample

Unit 4:
Experiment:

1. Determination of diastase enzyme activity
2. Identification of pigments in a given food sample
3. Effect of Baking Soda in CO2 production

Unit 5:

Experiment:

1. Detection of Saccharine in beverages
2. Visit to hospital/slide show on various nutritional deficiency disorders

INSTRUCTIONAL STRATEGY

This is one of the basic subjects for the diploma holders in food technology. The teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. Teacher should explain each process industry and use of each and every equipment used. Audio-visuals should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Presentation and viva-voce

RECOMMENDED BOOKS:

1. Essentials of Food and Nutrition by Swaminathan Vol.I and II, Health Kalyani publishers, New Delhi Food Chemistry by L.H. Meyer,Van Nostr and Reinhold Co. New York...
2. Handbook of Analysis of Fruits and Vegetables by S.Ranganna, Tata MeGraw Hill. Publishing Company, New Delhi.
3. Biochemistry by Mohinder Singh, Sejwal Publisher. New Delhi.
4. Introduction to Biochemistry by Braverman, Elsevier Scientific Publishing.
5. Food Chemistry by Linhinger, CBS Publishers, Delhi.
6. A Textbook of Biochemistry A.K. Berry, Narosa Publishing House.
7. Nutrition & Dietetics by Joshi, Tata McGraw- Hill Education, New Delhi.

THEORY	3.6 ECONOMIC POLICIES IN INDIA (OE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE:
The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

LEARNING OUTCOMES:
At the end of the course, the student will be able to:
- Understand Indian economics policy, planning strategies
- It will enable students to comprehend theoretical and empirical development across countries and region for policy purposes
- Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives
- Able to identify the problems and capable of deciding the application for future development
- Analyze economic issues and find solutions to complex economic problems and take correct economic judgment

COURSE CONTENTS

Unit-1: (6 Periods)
Basic features and problems of Indian Economy: Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

Unit-2: (5 Periods)
Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

Unit-3: (5 Periods)
Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

Unit-4: (7 Periods)
Economic Policies: Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India

Unit-5: (5 Periods)
External sector in India: - India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

INSTRUCTIONAL STRATEGY
- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT
- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

RECOMMENDED BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
   Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
1	06	20
2	05	20
3	05	17
4	07	23
5	05	20
Total	**28**	**100**

THEORY	3.6 PROJECT MANAGEMENT (OE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE:
A project plan starts by defining and confirming goals, then identifying tasks to achieve them. It also involves applying key project management skills like planning, organization, and time management to ensure successful execution.

LEARNING OUTCOMES:
At the end of the course, the student will be able to:
- Understand the importance of projects and its phases.
- Analyze projects from marketing, operational and financial perspectives.
- Evaluate projects based on discount and non-discount methods.
- Develop network diagrams for planning and execution of a given project.
- Apply crashing procedures for time and cost optimization.

COURSE CONTENTS

Unit-1: (5 Periods)
Concept of a project: Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time)project priority matrix- work break down structure.

Unit-2: (6 Periods)
Capital budgeting process: Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

Unit-3: (5 Periods)
Financial estimates and projections: Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability projected cash flow statement and balance sheet. Break even analysis.

Unit-4: (6 Periods)
Basic techniques in capital budgeting: Non discounting and discounting methods- payback period-Accounting rate of return-net present value-Benefit cost ratio-internal rate of return.
Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**

Unit-5: (6 Periods)
Project administration: progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off.
Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management softwares.

INSTRUCTIONAL STRATEGY
- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

RECOMMENDED BOOKS:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill
3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
4. Project Management – Gopala Krishnan – Mcmillan India Ltd.
5. Project Management- Harry-Maylor-Peason Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
I	05	14
II	06	14
III	05	24
IV	06	24
V	06	24
Total	**28**	**100**

PRACTICUM	4.1 MILK & MILK PRODUCTS TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVES

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.

LEARNING OUTCOMES

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

- Understands scenario of milk industry, compositional variability of milk and standards of milk and milk products
- Explain the market milk processing technology and defect in market milk during processing.

COURSE CONTENTS

Unit-1: (06 Periods)

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 and density, boiling and freezing point, refractive index, acidity and pH, viscosity, surface tension, thermal conductivity. Basis for pricing of milk.

Unit-2: (04 Periods)

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.

Experiment:

1. To conduct platform test of milk
2. Determination of SNF (Solids Not Fat), specific gravity, total solids of milk.

Unit-3: (06 Periods)

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 division valve) sterilization, packaging of fluid milk.

Experiment:

1. Testing efficacy of pasteurized milk
2. Determination of moisture and fat content of milk powder

Unit-4: (04 Periods)

Coagulated Milk Products Chhena, paneer, classification and manufacturing process of cheese Cream/Butter/Ghee–Manufacture and storage of butter and ghee

Experiment:

1. Study of familiarization with various parts and working of cream separator
2. Preparation of Khoa

Unit-5: (08 Periods)

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, Frozen Products Manufacturing of and ice cream; factors affecting the quality of frozen products.

Experiment:

1. Detection of adulterants in milk like water, urea, neutralizers, preservatives, sucrose starch
2. Preparation of Chhena and Paneer
3. Preparation of ice cream

INSTRUCTIONAL STRATEGY

This is one of the basic subjects for the diploma holders in food technology. The teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. Teachers should explain the working environment and principles of dairy industry and use of each and every equipment used. Audio-visuals should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Demonstration of practical by using experimental set-up.

RECOMMENDED BOOKS

1. Milk and Milk Products by Eckles and Eckles,Tata McGraw-Hill Education Pvt. Limited.
2. Outlines of Dairy Technology by Sukmar De, Oxford University Press,India.
3. Dairy Plant System and Layout by Tufail Ashmed, McGraw-Hill Education (India) Pvt. Ltd.
4. Principles of Dairy Technology by Woarner, Oxford University Press, India.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	15
2.	04	20
3.	06	15
4.	04	20
5.	08	30
Total	**28**	**100**

PRACTICAL	4.2 FRUIT & VEGETABLE TECHNOLOGY	L	T	P
		-	1	4

COURSE OBJECTIVE:

This subject is aimed at developing an understanding in processing techniques and skills in handling equipment/machines used for preservation and value addition of perishables like fruits and vegetables.

LEARNING OUTCOMES
After studying this course, the students will be able to:

- Discuss the factors affecting the shelf life of fruits and vegetables
- Understand the physiological changes in fruits after harvesting
- Understand the role and importance of preservation techniques to improve the shelf life of seasonal fruits
- Understand the processing of fruits, vegetables, spices and plantation products
- Understand the technology behind canning fruits and vegetable products

COURSE CONTENTS

Unit 1:
Experiment:
Orientation to different processing equipment's, their functions and uses
1. Preparation of Jam, jelly and preserve
2. Preparation of pickle by various methods

Unit 2:
Experiment:
Preparation of chutney
1. Extraction of tomato juice by hot and cold break methods
2. Preparation of tomato sauce/ketchup

Unit 3:
Experiment:
Preparation of tomato puree/paste
1. Extraction of juice by various methods
2. Bottling and processing of fruit juice

Unit 4:
Experiment:
Preparation of syrup and brine solutions
1. Dehydration of peas, potatos
2. Dehydration of grapes and apples

Unit 5:
Experiment:
1. Freezing of peas
2. Preparation of tomato powder

3. Visits of different fruit and vegetable processing industries

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 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 fruits and vegetables processing is a must.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Demonstration of practical by using experimental set-up.
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Fruits and Vegetable Preservation by Girdhari Lal and Sidappa; ICAR (New Delhi).
2. Preservation of Fruits and Vegetable by Srivastava; IBD Co., Lucknow.
3. Preservation of Fruits and Vegetable by Vijaya Khader; Kalyani Publication.
4. Post Harvest Technology of Fruits and Vegetables Handling, Processing, Fermentation and Waste Management by L.R. Verma and V.K. Joshi.
5. Processing Fruits: Science & Technology vol. 1-2 by Somogyi.
6. ProcessingVegetables: Science &Technology vol. 1-2 by Somogyi.

PRACTICUM	4.3 MEAT, FISH & POULTRY TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVES

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.

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LEARNING OUTCOMES

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

- Understand the concept of methods involved in meat and marine products processing
- Understand the concept of methods involved in poultry and egg processing
- Understand the major biochemical reactions that affects the quality of meat and meat products

COURSE CONTENTS

Unit-1: (02 Periods)

Introduction to fish and poultry industry

Unit-2 (08 Periods)

Preparatory operations of meat and meat products ,Composition of muscle, Different types of slaughtering methods, Different types of meatents, Antimortam and postmortem inspection of animal/slaughtered animal, Abattoir– Definition and construction; basic preparatory procedures (culmination, emulsification, pre -blending) Cured and smoked meats, sausage products– classification, processing steps, and canned meat, meat pickles

Experiment:

1. Demonstration of slaughtering and different cutsinmeatata slaughter house
2. Preparation of different types of meat products and their quality evaluation

Unit-3: (08 Periods)

Handling and Dressing of Poultry Inspection of poultry birds, dressing and preparation of ready to cook poultry, factors affecting the quality. Egg and Egg Products Structure, chemical composition and nutritive value, spoilage of eggs and preservation of whole egg and egg products, preparation of egg powder

Experiment:

1. Retail cuts of dressed chicken
2. Calculation of haugh unit of egg
3. Measurement of aircell of egg
4. Calculation of shape and size index of egg
5. Preservation of whole egg
6. Determination of moisture and solid content of different egg constituents
7. Determination of specific gravity of eggs

Unit-4: (06 Periods)

Fish and Fish Products Types of fish, composition and nutritive value, judging the freshness of fish, fish grading and cooking of fish, smoking, pickling, salting and dehydration, preservation of fish and processed fish products .

Experiment:

1. Demonstration of filtering and staking of fish

2. Preparation of fish, meat and egg pickle

Unit-5: (04 Periods)

Frozen Storage of fresh and processed meat, poultry and fish, By-products of meat, fish, poultry and egg industry

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 meat, poultry and fish industry.

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MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Demonstration of practical by using experimental set-up.
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Meat Science by Lawrie, Heinemann Educational Books Ltd., London
2. Egg Science and Technology by Mountney, AVI Publish co.,Westport
3. Egg Science and Technology by P C Pande, Vikas Publishing House (P) Ltd, New Delhi
4. Fish Processing and Preservation by C L Cutting (Agro Botanical Publisher)
5. Poultry, Meat and Egg Products by Parkursht and Mountney (CBS Publishers)
6. Fish and Fish Products by A. L. Winton, Hill Book Company U.K.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	02	10
2.	08	25
3.	08	35
4.	06	20
5.	04	10
Total	**28**	**100**

THEORY	4.4.1 UNIT OPERATIONS & PROCESSES IN FOOD ENGINEERING	L	T	P
		3	-	-

COURSE OBJECTIVES

This subject is included in the curriculum to impart basic knowledge various unit operations and processes involved in food processing industries such as mechanical operations, fluid flow operations, heat and mass transfer operations and thermodynamics.

LEARNING OUTCOMES

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

- Understand the concept of mechanical and fluid flow operations.
- Understand the concept of heat and mass transfer operations.
- Understand the concept of thermodynamics involved in process industry.

COURSE CONTENTS

UNIT-1: Mechanical Operations in Food Processing (06 Periods)

Size Reduction and Related Laws, Methods of Size Reduction, crushing, grinding, Equipment used for Size Reduction, Applications in a Food Processing Industry.

UNIT-2: Rheology of Foods (10 Periods)

Properties and Classification of Fluids, Newtonian and Non-Newtonian Fluids, Newton's Law of Viscosity, Bernoulli's Equation, Flow-Measuring Devices and Flow Rate Calculations.

UNIT-3: Thermodynamics and Heat Transfer (10 Periods)

Principles: Thermal Properties of Foods, Mass Transfer, Modes of Heat Transfer, in solids and liquids, radiate heat transfer, Steady and Unsteady State Heat Transfer. Microwave Heating-Fourier's Law, Stefan Boltzmann Law.

UNIT-4: Unit Operations In Food Engineering (10 Periods)

Distillation, Evaporation, types of evaporators, Drying, drying-curve, drying instruments

UNIT-5: Refrigeration And Freezing (06 Periods)

Parts and Functions of a Refrigerator, Refrigeration Cycle, Refrigerants, Concept of Refrigerator Load (one ton, etc.) , Parts and Functions of a Refrigerator, Refrigeration Cycle

INSTRUCTIONAL STRATEGY

- Teacher should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS:

1. Rao DG. 2009. Fundamentals of Food Engineering. PHI
2. Sharma K, Mulvaney SJ, and Rizvi SSH. 2012. Food Process Engineering: Theory and Laboratory Experiments. Wiley-India.
3. Singh RP and Heldman DR. 2013.Introduction to Food Engineering. Fifth Edition .AP.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	15
2.	10	20
3.	10	25
4.	10	25
5.	06	15
Total	**42**	**100**

THEORY	4.4.2 MODERN SEPRATION TECHNOLOGIES	L	T	P
		3	-	-

COURSE OBJECTIVES:
To identify about the kind of separation processes in general and novel separations are integral part of any process chemical industries.

LEARNING OUTCOMES:
On completion of the course the students will be able to
• Differentiate the conventional techniques and modern techniques
• Understand the principles of modern separation techniques
• Application of these techniques in Industries
• Identify the importance of economics involved in its applications

COURSE CONTENT

UNIT-1: (08 Periods)
Thermal Diffusion: Basic Rate Law, Theory of Thermal Diffusion Phenomena for gas and liquid mixtures, Equipment's design and Applications. Zone Melting

UNIT-2: (08 Periods)
Chroma to graphic techniques, Equipment and Commercial processes, Molecular Sieves.

UNIT-3: (08 Periods)
Cryogenic, Supercritical fluid extraction and Azeotropic separation.

UNIT-4: (10 Periods)
Principle of membrane separations process; Classification: Reverse osmosis, Ultra-filtration, Micro-filtration, Nano-filtration and Dialysis; Membrane modules and application; Electro-dialysis; Per-vaporation and gas separation using membranes; Electrophorosis; Liquid membranes.

UNIT-5: (08 Periods)
Foam and bubble separation: Principle; Classification; Separation techniques; Column operations. Surface Adsorption, Nature of foams.

INSTRUCTIONAL STRATEGY
- Teacher should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT
- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS:

1. Schoen H. M., New Chemical Engineering Separation Techniques, 2nd Edition, Inter Science Publications, New York.
2. Seader, J.D, and Henley E.J.,Separation 'Process Principles,' John Wiley & Sons, Inc..
3. Perry R.H. and. Green D.W.,Perry's Chemical Engineers Hand book, 6th Edition. McGraw Hill, NewYork, .
4. King C.J. 'Separation Processes', 4th Edition, Tata McGraw Hill, New Delhi,.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	08	20
2.	08	20
3.	08	20
4.	10	20
5.	08	20
Total	**42**	**100**

THEORY	4.5.1 PLANT UTILITIES	L	T	P
		3	-	-

COURSE OBJECTIVE:

The objective of this subject is to teach the students about requirement of different utilities for the process plant and effective utilization. Main utilities required for process plants are water, steam, air and refrigerants. Steam and non-steam heating media is used for conversion of raw material to products in reactors and to elevate the temperature in the chemical processes. Similarly, refrigeration is important to maintain the temperature in the process plant. Compressed air and process air is used in processes and instrument air is used in pneumatic devices and controls.

LEARNING OUTCOMES

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

- Acquire the knowledge for selection of different utilities.
- Understand basic calculations involved in steam generation, psychometric operation and refrigeration.
- Describe the different equipment used to run the process plant with different utilities.
- State the Principles involved during water treatment
- Know different fuels used in boilers

COURSE CONTENTS

Unit-1: Importance and Classification of utilities: (06 Periods)

1. Hard and soft water, requisites of industrial water and its uses.
2. Methods of water treatment such as chemical softening and demineralization, resins used for water
3. Softening and reverse osmosis. Effects of impure boiler feed water.

Unit-2: Steam and steam generation: (10 Periods)

1. Properties of steam, problems based on steam, types of steam generator such as solid fuel fired boiler, waste gas fired boiler and fluidized bed boiler.
2. Scaling and trouble shooting. Steam traps and accessories.

Unit-3: Refrigeration: (10 Periods)

Refrigeration cycles, methods of refrigeration used in industry and different types of refrigerants such as monochloro-difluro methane, chlorofluro carbons and brins. Refrigerating effects and liquefaction processes.

Unit-4: Compressed air: (10 Periods)

1. Classification of compressor, reciprocating compressor, single stage and two stage compressor, velocity diagram for centrifugal compressor, silp factor, impeller blade Shape. Properties of air – water vapors and use of humidity chart.
2. Equipments used for humidification, Dehumidification and cooling towers.

Unit-5: Fuel and waste disposal: (06 Periods)

1. Types of fuel used in chemical process industries for power generation such as natural gas, liquid petroleum fuels, coal and coke. Internal combustion engine, petrol and diesel engine.
2. Waste disposal.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Thermal Engineering by P.L. Ballaney; Khanna Publisher New Delhi
2. Industrial water treatment by S.T. Powel; McGraw Hill New York
3. Boiler Operations by Chattopadhyay; Tata McGraw Hill, New Delhi
4. Perry's chemical Engineer's Handbook by Perry R.H. Green D.W; McGraw Hill, New York
5. Elements of Heat Engines Vol. II,III by R.C. Patel C.J.Karmchandani; Acharya Book Depot Vadodara
6. Refrigeration & Air conditioning by P.N. Ananthanarayan; Tata McGraw Hill
7. Industrial chemistry by Jain & Jain; Tata McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	15
2.	10	20
3.	10	20
4.	10	30
5.	06	15
Total	**42**	**100**

THEORY	4.5.2 WASTE MANAGEMENT IN FOOD INDUSTRY	L	T	P
		3	-	-

COURSE OBJECTIVES

This subject is aimed at developing an understanding among the students on Management of agro-processing waste by product utilization as food/feed and environmental protection.

LEARNING OUTCOMES

- After studying this course, the students will be able to:
- Understand and gain knowledge about food wastage, waste management and environment (Protection) act, standards of food processing wastes
- Gain knowledge about by-products obtained from different food processing industries and apply the knowledge for their utilization
- Understand the characteristics of food industry wastes and involved unit operation in effluent treatment
- Understand the concept of biological oxidation and aeration devices systems & their modifications. Understand the advance Technology for waste water treatment

COURSE CONTENTS

Unit-1: (04 Periods)

Introduction- Types of waste and magnitude of waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment

Unit-2: Waste Characterization (10 Periods)

Temperature, pH, Oxygen demands (BOD,COD,TOD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Unit-3: (10 Periods)

Environmental protection act and specifications for effluent of different food industries. By-products and Waste utilization.

Unit-4: (14 Periods)

Effluent Treatment -

1. Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation.
2. Secondary treatments: Biological oxidation – trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons carbon
3. Tertiary treatments: Advanced waste water treatment process-sand, coal and activated filters, heavy metals removal.

Unit-5: (04 Periods)

Assessment, treatment and disposal of solid waste; concept of vermin composting and biogas generation.

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 waste.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Food Processing Work Management by Green and Krammer; CBS Publication
2. Principles of Food Sanitation by Mariett NG;CBS Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	10
2.	10	20
3.	10	20
4.	14	40
5.	04	10
Total	**42**	**100**

PRACTICUM	4.6 BAKERY & CONFECTIONERY TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVES

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.

LEARNING OUTCOMES

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

- Understand the composition, structure and storage of bakery products
- Understand the technology of bakery processing and its products
- Understand the traditional and modern milling operations and technology of bakery and extruded products
- Understand the processing of bakery and their value added products

COURSE CONTENTS

Unit-1: (04 Periods)

Introduction – Status of Bakery industry in India

Unit-2 (05 Periods)

Raw Materials for Bakery Products (15Periods) Flour, sugar, shortening, yeast, salt and leavening agents as raw material for bakery products, their role and PFA specifications of these raw materials

Experiment:

1. Quality analysis of raw materials used in bakery and confectionery industry according to PFA standards)

Unit-3: (08 Periods)

Manufacturing of Bakery Products (35Periods) Different types of bread and preparation of bread using different methods, quality evaluation of bread, staling of bread Different types of biscuits and preparation of biscuits using different methods, quality evaluation of biscuits different types of cakes and pastries, preparation of cakes and pastries using different methods, quality evaluation of cakes, different types of toppings preparation of other bakery products: rusks, crackers, buns, muffins, pizza and kulcha Types of additives used in bakery products

Experiment:

1. Preparation and evaluation: a) Of Bread
2. Preparation and evaluation: Of Cakes
3. Preparation and evaluation: Of Biscuits
4. Preparation and evaluation: Of Buns
5. Preparation and evaluation: Of Pizza
6. Preparation and evaluation: Of Kulcha
7. Preparation and evaluation: Of Rusk

Unit-4: Confectionery Products (07 Periods)

Introduction, classification of confectionery products, confectionery ingredients like starch, fats, colours, flavours additives. A 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

Experiment:

1. Preparation and evaluation: OF Candy like ginger
2. Preparation and evaluation: OF CORN SYRUP
3. Preparation and evaluation: OF MAPLE SYRUP
4. Preparation and evaluation: OF CHOCOLATE
5. Study and analysis of the production charts used for different products by bakery

Unit-5: (04 Periods)

Layout, setting up of units and hygienic conditions required in bakery plant, operation and maintenance of bakery equipment.

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 to demonstrate various operations involved in bakery and confectionary processing industry is a must.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Demonstration of practical by using experimental set-up.
- Presentation and viva-voce

RECOMMENDED BOOKS

1 Bakery Engineering and Technology, Vol. I and II by Matz; CBS
2 Bakery Products Published by SIRI
3 Cereal Technology by Kent; CBS
4 Wheat Chemistry and Technology by Y Pomeranz
5 Basic Baking by SC Dubey
6 Practical Baking by William Sultan Vol. I and II

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	10
2.	05	15
3.	08	35
4.	07	30
5.	04	10
Total	**28**	**100**

THEORY	4.7 RENEWABLE ENERGY TECHNOLOGIES (OE-2)	L	T	P
		2	-	-

COURSE LEARNING OBJECTIVES:

The objective of this course is to provide a comprehensive understanding of the current and future global energy scenario, with a focus on non-conventional energy sources. It aims to introduce the fundamentals of solar and wind energy systems, explore various forms of bioenergy and their applications, and help students identify and evaluate different alternative energy sources.

LEARNING OUTCOMES:

Upon completion of the course the students will be able to

1. Understand the present and future energy scenario of the world.
2. Understand various methods of solar energy harvesting.
3. Identify various wind energy systems.
4. Evaluate appropriate methods for Bio energy generations from various Bio wastes.
5. Identify suitable energy sources for a location.

COURSE CONTENT

Unit-1: (6 Periods)

Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit-2: (6 Periods)

Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-3: (5 Periods)

Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance. Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-4: (5 Periods)

Bioenergy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-5: (6 Periods)

Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

REFERENCE BOOKS:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	20
2.	06	20
3.	05	20
4.	05	20
5.	06	20
Total	**28**	**100**

THEORY	4.7 ENERGY EFFICIENCY AND AUDIT (OE-2)	L	T	P
		2	-	-

COURSE LEARNING OBJECTIVES:

This course aims to develop the competency to undertake energy efficiency measures and conduct energy audits through practical and industry-relevant learning experiences.

LEARNING OUTCOMES:

Upon completion of the course the students will be able to

- Undertake energy efficient activities
- Use energy efficient pumps, compressors and blowers
- Use energy efficient Air Compressors and DG sets
- Use energy efficient Lighting Systems
- Apply energy efficient electrical machines.
- Use Co-generation and relevant tariff for reducing losses in facilities.

COURSE CONTENT

Unit – 1 **(4 Periods)**

Introduction to Energy Efficiency
Energy Scenario: Energy demand and supply, National scenario.
Energy Efficiency and Energy Conservation; concepts
Indian Electricity Act 2001; relevant clauses of energy conservation
BEE and its Roles
Star Labelling: Need and its benefits.

Unit – 2 **(5 Periods)**

Pumping Systems, Fans and Blowers
Factors affecting pump performance
Efficient Pumping system operation
Energy conservation opportunities in Pumping systems
Fan types, flow control strategies
Fan performance Assessment
Energy Conservation opportunities in Pumping systems
Tips for energy saving in fans and blowers

Unit – 3 **(5 Periods)**

Air Compressors and Diesel Power Generator sets
Classification of compressors
Pneumatic System components
Effect of various parameters on efficiency of Compressor
Capacity control of Compressors
Checklist for Energy Efficiency in Compressed air systems
Operating guidelines for diesel generator, operational factors
Effects of improper ventilation of genset
Energy saving measures for DG sets

Unit –4 **(4 Periods)**

Energy Conservation in Lighting System
Replacing Lamp sources
Using energy efficient luminaries
Using light controlled gears

Installation of separate transformers / servo stabilizer for lighting
Periodic survey and adequate maintenance programs
Innovative measures of energy savings in lighting

Unit– 5 **(6 Periods)**

Energy Efficient Electrical Machines
Need for energy conservation induction motor and transformer
Energy conservation techniques in induction motor by:
Energy conservation techniques in Transformer
Energy Conservation Equipment: Soft starters, Automatic star delta converter, Variable Frequency Drives, Automatic p. f. controller (APFC)
Energy efficient motor; significant features, advantages, applications and Limitations
Energy efficient transformers, amorphous transformers; epoxy Resin cast transformers / Dry type of transformer
Aggregated Technical and commercial losses (ATC), Technical losses; causes and measures to reduce, Commercial losses: pilferage, causes and remedies
Application of tariff system to reduce energy bill
Co-generation and Tariff; concept, significance for energy conservation

Unit– 6 **(4 Periods)**

Energy Audit of Electrical Systems
Energy audit (definition as per Energy Conservation Act)
Energy audit instruments and their use
Questionnaire for energy audit projects
Energy flow diagram (Sankey diagram)
Simple payback period, Energy Audit procedure (walk through audit and detailed audit).
Energy Audit report format.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

REFERENCE BOOKS:

1. Guidebooks No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
2. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi, Edition 2018, (ISBN: 978-93-86173-683).
3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978-0195606539
4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
6. Mehta,V. K., Principles of Power System, S. Chand andCo.New Delhi, 2016, ISBN 9788121905947
7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K KatariaandSons, New Delhi ISBN-13: 9789350141014.

8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.
9. Chakrabarti, Aman, Energy Engineering and Management, e-books Kindle Edition

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	15
2.	05	17
3.	05	17
4.	04	15
5.	06	21
6.	04	15
Total	**28**	**100**

AUDIT COURSE	4.8 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVES:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

LEARNING OUTCOMES

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upvedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

Importance and relevance

1. Introduction to the Vedas
2. Upavedas
3. Vedangas
4. Upangas

Unit 2: Modern Science and Indian Knowledge System (06 Periods)

1. Relevance of Science and Spirituality,
2. Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (04 Periods)

1. Basic principles of Yoga
2. Benefits of holistic healthcare practices
3. Integration with modern healthcare

Unit 4: Case Studies / Assignment (02 Periods)

Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times.

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. Teacher should involve students in different practices like meditation, yoga camp etc.

MEANS OF ASSESSMENT

- Viva -Voce Exam

RECOMMENDED BOOKS

1. Cultural Heritage of India-Course Material, V. Sivaramakrishna, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan
3. Science of Consciousness Psychotherapy and Yoga Practices, R N Jha, Vidyanidhi Prakasham, Delhi, 2016.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	16	50
2.	06	20
3.	04	15
4.	02	15
Total	**28**	**100**

8. GUIDELINES FOR THE ASSESSMENT OF STUDENT-CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows

1. 15 Marks for general behavior and discipline (by HODs in consultation with all the teachers of the department)

2. 10 Marks for attendance as per the following: (by HODs in consultation with all the teachers of the department)
   2.1. 75 - 80% 06 Marks
   2.2. 80 - 85% 08 Marks
   2.3. Above 85% 10 Marks

3. 25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
   3.1. 25 - State/National Level participation
   3.2. 20 - Participation in two of the above activities
   3.3. 15 - Inter-Polytechnic level participation

9. RESOURCE REQUIREMENT

A. PHYSICAL RESOURCES

a) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of classrooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

b) Equipment Requirement:

The following Laboratories are required for a diploma programme in Chemical Engineering (3rd and 4th Semester):

FOOD TECHNOLOGY LAB

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt. in Rs. aprox
1	Test tube stand (Plastic/Teflon)	30	20	600
2	Funnel Stand (Plastic/Teflon)	30	20	600
3	Burette Stand Stainless Steel/Wooden/Iron	30	50	1500
4	Pipette Stand Stainless Steel/Wooden/Plastic	30	20	600
5	Fractional Weights set with rider 10 mg to 500 mg with rider	5 sets	25	125
6	Reagents bottles 250 ml 500ml 1000ml	 120 25 5	 20 25 30	 2400 625 150
7	Wide mouth bottle 250 ml Glass	50	15	750
8	Winchester bottle 2.5 liter Plastic/Teflon	15	30	450
9 i ii	Test tubes 1/4" x 6" Corning or Borosil Glass	 200 200	 9 2	 1800 400
10 i ii	Boiling tube 1" x 6" Corning or Borosil Glass	 100 100	 16 5	 1600 500
12	Pestle and mortar Dia 10 cm15 cm (Ceramics)	2	30	60
12	Beakers (Glass/Borosil/Corning Plastic) 250ml 500ml	 50 50	 20 20	 1000 1000
13	Wash bottles (Plastic/Teflon)	30	15	450
14	Conical flask 250 ml. glass (Borosil/Corning/Plastic) Transparent	100	30	3000
15	Flat bottom flask 500 ml. Glass	15	40	600
16	Flat bottom flask 250 ml. Glass	15	25	375
17	Burette 500 ml. (Plastic/Teflon)	30	60	1800

18	Pipette 25 ml. (Plastic/Teflon)	30	20	600
20	Measuring flask 250 ml. with stopper	30	50	1500
20	Measuring Cylinder of various sizes (100 ml, 250 ml, 500 ml, 1000 ml) 3 no. of each	12	30	360
22	Bunsen's burner of brass	30	50	1500
22	Gas plant petrol/LPG 10 to 20 burners automatic	1	5000	5000
24	Spirit lamp (Brass)	30	30	900
25	Tripod stand (Steel/Iron) Large/Medium	30	30	900
26	Wire gauge 15 x 15 cm. with asbestos	30	15	450
27	Test tube holder wooden	50	10	500
28	Porcelain plates Ceramic	30	20	600
29	Funnel 15 cm. Glass Borosil	60	16	960
30	Spatula hard & nickel/steel	2 each	50	100
31	Brush for cleaning	100	10	1000
32	Jars 20 Lit. for keeping distilled water	5	100	500
33	Lab table 2m. x 1.2 m. x1m. height with central sink and cupboards (Teak wood) with drawers and two built in Amirah on each side with reagent racks, better tile top	4	8000	32000
34	Side racks and selves for bench reagents made of teak wood for 24 bottles each set	4	2000	8000
35	Digital balance electronic Electronics up to 2 decimal places	1	10000	10000
36	Hot plates 7-1/2", 3" Dia controlled 2000 watts	1	1000	1000
37	hot air oven thermostatically controlled with shelves and rotary switches 350 x350x25 high	1	8000	8000
38	PH Meter (Digital)	1	1000	1000
39	Glass Electrode	2	850	1700
40	Reference Electrode	2	850	1700
41	Weight Box 1gm, 2gmx2, 5gm, 10 gm, 20gmx2, 50gm, 100gm with for cep miscellaneous	LS		15000
42	Incubator	1		30000
43	Vertical Autoclave	1		30000
44	Analytical Balance	1		50000
45	UV-vis spectrophotometer	1		300000
46	Compound Microscope	1		10000
47	Water distillation plant	1		20000
48	Water bath	1		20000
49	Muffle furnace	1		200000
50	k-jeldal assembly for N2 estimation	1		20000
51	Deep Freezer	1		40000
52	Food Processor	1		7000
53	Sox let Extraction Apparatus Glass Assembly	1		6000
54	Heating Mental (2 lit & 5 lit)	1		5000
55	Juicer/Mixer/Grinder	1		5000
56	Centrifuge	1		20000
57	Microwave Oven	1		20000
58	Fluidized Bed reactor	1		60000
59	Refrigerator	1		10000
60	Laminar Air Flow	1		20000
61	Clinching Machine	1		7000
62	Butyrometer Glass Assembly	1		2000
63	Refractometer	1		12000

64	Vacuum Oven	1		300000
65	Tray Dryer	1		200000
66	Freeze Dryer	1		500000
67	Baking oven	1		300000
68	Homogenizer	1		50000
69	Cream Separator	1		50000
70	Freeze Drier	1		534000
71	Mini Spray Drier	1		200000
72	Balances	1		126000
73	UV Vs. Spectrophotometer	1		309000
74	Gel Electrophoresis	1		102000
75	Trinocular Microscope	1		214000
76	Microprocessor Controlled gas Chromatograph	1		395000
77	Automatic Solvent Extraction System	1		194000
78	Automatic Solvent Extraction System	1		249000
79	Infra-Red Moisture Analyzer (IR-30)	1		120000
80	Research Microscope	1		127000
81	Automatic Microscope Bomb Calorimeter	1		458000
82	Texture Analyzer	1		864000
83	Potato Chip Making Plant	1		85000
84	Pasta Making Machine	1		308000
85	Economy Khoya Machine	1		78000
86	Automatic Protein Analyzer	1		1250000
87	Water Activity Meter	1		468000
88	Electronic Analytical balance	1		50000
89	Water Treatment Plant	1		128000
90	Colour Measurement System	1		11905

B. Furniture Requirement

Norms and standards laid down by AICTE -APH (latest) be followed for working out furniture requirement for diploma courses

C. Human Resources:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, workload norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

10. EVALUATION STRATEGY INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation. The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning the teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students. In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work
- Project Work
- Industrial Training

A. Theory

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 sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 5

Table : Suggested Weightage to be given to different ability levels

Abilities	**Weight to be assigned**
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students' performance in practical work (Laboratory experiments, Workshop practical's/field exercises) aims at assessing students' ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work-related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce.

C. Internship / In-House Project/ Industrial Training

The purpose of evaluation of project work is to assess students' ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce. Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, 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 situations. The formative and summative evaluation may comprise of weightages to performance in testing, general behavior, quality of report and presentation during viva-voce.

11. RECOMMENDATIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. classroom, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated student's behavior as in the curriculum document. It is important for the teachers to understand curriculum documents holistically and further be aware of intricacies of the teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher read them carefully, comprehends and start using them.

(A) Broad Suggestions:

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 documents holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The principles have a great role to play in their dissemination and percolation up to grass-root level. Polytechnics, in turn, are supposed to prepare an institutional academic plan.

3. The HOD of every Programme Department along with HODs and in-charge of other departments are required to prepare academic plan at department level referring to the institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at classroom level and their success in achieving course level objectives lies in using the course plan and their judicious execution, which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lectures, expert lectures, lab/workshop practical, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all the above activities properly and ensure execution of the plan effectively.

The following is the list of suggestions for subject teachers to carry out T-L process effectively:

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

2. Teachers are required to prepare lesson plans for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. 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.

5. Concept and content-based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are available in the institute to impart them effectively.

6. There is a dire need for planning practical experiences from the right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experience effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feedback to every student

The student-centered activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Wherever possible, it is essential to use activity-based learning rather than relying on delivery based conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations to impart field experiences to their students.

11. Students are made aware of issues related to ecology and the environment, safety, concern for wastage of energy and other resources etc.

12. Students may be given relevant and well-thought-out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the department concerned of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

12. LIST OF EXPERTS

Sr.No	Name	Designation	Organization
1.	Dr. Pawan Kumar	Lecturer Chemical Engineering	Govt. Poly. Firozabad.
2.	Smt. Narmata Pal	Lecturer Chemical Engineering	Govt. Poly. Kotwan, Mathura.
3.	Dr. Rahul	Lecturer Chemical Engineering	Govt. Poly. Bindki, Fatehpur.
4.	Dr. Sudhir Kumar	Assist. Professor Food Technology	C.S.J.M. University, Kanpur

13. EVALUATION SCHEME GUIDELINES: As Per AICTE ATTACHED (ANNEXURE- 1)

1. For Theory Courses:

The weightage of Internal assessment is 40% and for End Semester Exam is 60%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

2. For Practical Courses:

The weightage of Internal assessment is 60% and for End Semester Exam is 40%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

3. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc

ANNEXURE- 1

Evaluation Method for Practicum Based Course Paper (End Exam: PRACTICAL)

Internal Assessment (60 Marks)					External Assessment (40 Marks)
Mode	Sessional Exam (02 Best of 03)	Practical Test	Practical Documentation	Attendance and Assignment	Practical Exam
Portion	2 Units	100% Practical	All Practicals	All Units	All Practicals
Duration	1 Hr	3 Hrs	Regularly Monitored by Faculty	Regularly	4Hrs
Exam Marks	20	20	10	10	40
Tentative Schedule	6th Week	12th Week	13th Week	14th – 15th Week	Semester End Exam

NOTE:

1. Complete all exercises/experiments as outlined above and keep them for the practical test. The practical test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be evaluated internally for a total of 20 marks.

2. Maintain a practical file for each exercise. Submit the document for the practical file with a valid certificate (Progress Card) and Lab/classroom attendance and evaluate it for 10 marks.

3. Submit a micro project report along with the fabrication model/analysis report. The performance of each student in the group will be evaluated by the laboratory supervisor and an internal examiner evaluate it for 10 marks.

Evaluation Method for Practical Based Course Paper (End Exam: PRACTICAL)

Internal Assessment (60 Marks)					**External Assessment (40 Marks)**
Mode	Practical Test	Practical Test	Attendance and Practical Documentation	Micro Project	Practical Exam
Portion	50% Practicals	50% Practicals	All Practicals	All Practicals	All Practicals
Duration	3Hr	3 Hrs	Regularly	Regularly	4 Hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} Week	$14^{th} – 15^{th}$ Week	Semester End Exam

NOTE:

1. Complete all exercises/experiments as outlined above and keep them for the practical test. The practical test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be evaluated internally for a total of 20 marks.

2. Maintain a practical file for each exercise. Submit the document for the practical file with a valid certificate (Progress Card) and Lab/classroom attendance and evaluate it for 20 marks.

3. Submit a micro project report along with the fabrication model/analysis report. The performance of each student in the group will be evaluated by the laboratory supervisor and an internal examiner evaluate it for 20 marks.

Evaluation Method for THEORY Based Course Paper

Internal Assessment (40 Marks)					**External Assessment (60 Marks)**
Mode	Sessional Exam-1	Sessional Exam-2	Sessional Exam-3	Attendance and Assignment	Written Exam
Portion	2 Units	2 Units	All Units	Regularly	All Units
Duration	1 Hr	1 Hr	1 Hr	1 Hr	3 Hrs
Exam Marks	10	10	10	10	60
Tentative Schedule	4^{th} Week	8^{th} Week	$12\text{-}14^{th}$ Week	Regularly	Semester End Exam

Evaluation Method for Practicum Based Course Paper (End Exam: THEORY)

Internal Assessment (40 Marks)					**External Assessment (60 Marks)**
Mode	Sessional Exam (02 Best of 03)	Practical Test	Practical Documentation	Attendance and Assignment	Written Exam
Portion	2 Units	100% Practical	All Practicals	All Units	All Units
Duration	1 Hr	3 Hrs	Regularly Monitored by Faculty	Regularly	3 Hrs
Exam Marks	10	10	10	10	60
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} Week	$14^{th} – 15^{th}$ Week	Semester End Exam