NSQF ALIGNED CURRICULUM

THREE YEARS (SIX SEMESTERS)

DIPLOMA PROGRAMME IN

FOOD TECHNOLOGY

(Effective From Session 2023-24)

Prepared by:
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Corrected And Approved By Board Of Technical Education U.P., Lucknow In CDC Meeting Held On 19.08.2023

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PREFACE

An important issue generally debated amongst the planners and educators world over is howtechnical education can contribute to sustainable development of the societies struggling hard tocomeinthesamebracketasthatof thedevelopednations. Therapidindustrializationandglobalizationhas createdanenvironment for free flow of informationandtechnology throughfast and efficient means. This has led to shrinking of the world, bringing people from differentculture and environment together and giving rise to the concept of world turning into a globalvillage.InIndia,ashifthastakenplacefromtheforgettableyears of closedeconomytoknowledge based and open economy in the last few decades. In order to cope with the challengesof handlingnewtechnologies,materialsandmethods,wehavetodevelop humanresourceshavingappropriate professional knowledge, skillsandattitude. Technical educationsystem isoneofthesignificantcomponentsofthehumanresourcedevelopmentandhasgrow nphenomenally during all these years.Now it is time to consolidate and infuse quality aspectthrough developing humanresources, inthedelivery system.Polytechnicsplay animportantroleinmeetingtherequirementsoftrainedtechnicalmanpowerforindu striesandfieldorganizations.

In order to meet the requirements of future technical manpower, we will have to revamp ourexisting technical education system and one of the most important requirements is to developoutcome-based curricula of diploma programmes.The curricula for diploma programmes havebeenrevisedbyadoptingtime-testedandnationallyacclaimedscientificmethod,layingemphasisontheidentificat ionoflearning outcomesofdiplomaprogramme.

The real success of the diploma programme depends upon its effective implementation. Howeverbest the curriculum document is designed, if that is not implemented properly, the output will notbe as expected. In addition to acquisition of appropriate physical resources, the availability ofmotivated,competentandqualifiedfacultyisessentialforeffectiveimplementati onofthecurricula.

It is expected of the polytechnics to carry out jobmarket research ona continuous basis toidentify the new skill requirements, reduce or remove outdated and redundant courses, developinnovative methods of course offering and thereby infuse the much needed dynamism in thesystem.

Director
I.R.D.T. Kanpur

ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following persons:

i) Principal Secretary, Technical Education, Govt. of UP for his exemplary vision and approach.

ii) Special Secretary, Technical Education Department, Govt. of UP for his support and motivation.

iii) Sh. K Ram, Director, Technical Education, UP and Director, I.R.D.T., Kanpur for continuously motivating, guiding and taking keen interest in the review of this curriculum.

iv) Secretary, Board of Technical Education, UP for his support in this project of review curriculum.

v) All the participants from industry/field organizations, engineering colleges, polytechnics and other technical institutions for their professional inputs during curriculum workshops.

vi) Faculty/Subject Experts from different departments of U.P. Government polytechnics for content updating.

vii) Concerning Staff of IRDT Kanpur for their support and assistance in the conduct of Curriculum workshops .

Coordinator
Institute of Research Development & Training,
Kanpur, U.P.

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN FOOD TECHNOLOGY

1)	Name of the Programme	:	Diploma Programme in Food Technology
2)	Duration of the Programme	:	Three years (Six Semesters)
3)	Entry Qualification	:	Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4)	Intake	:	60 (or as prescribed by the Board)
5)	Pattern of the Programme	:	Semester Pattern
6)	NSQF Level	:	Level - 5
7)	Ratio between theory and ***Practice***	:	45 : 55 (Approx.)

8) Industrial Training:

Four weeks of industrial training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.

9) Ecology and Environment :

As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.

10) Energy Conservation:

A subject on Energy Conservation has been incorporated in the curriculum.

11) Entrepreneurship Development:

A full subject on Industrial Management and Entrepreneurship Development has been incorporated in the curriculum.

12) Student Centred Activities:

A provision of 3-6 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co–curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.

13) Project work

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

2. 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
  - Distilleries
  - 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 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.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN FOOD TECHNOLOGY

Sr.	Learning Outcomes
After undergoing this programme, 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	Impartingtechnicalknowledgetodevelophumanresourcesforfood Processingsectors.
4	Impartingknowledge&technicalskillsforbetterprocessingandvalue additionofFood& Agro-productsthroughR&D.
5	Inculcatinginnovativethinkingwiththeaimtosupportentrepreneurshipandtodeve lopstate-of-arttechnologiesfortestingandconsultancytofulfill Theneedsof food industryandsociety
6	Cultivatingstrongethicalvaluesforsustainablemodernandsafefoodto Society.
7	Calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process
	Understandproblemsolvingcapabilitiesinpractical usingarangeof current foodanalysistechniques.
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 life long learning
10	Conduct experiments, analyse, interpret data and synthesis valid conclusions
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 equipments 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
21	Develop communication and interpersonal skills for effective functioning in the world of work.
22	Communicate effectively in English and local language in oral and written form with others
23	Manage resources effectively at work place
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 sheet and making presentation
27	Solve real life problems by application of acquired knowledge and skills
28	Use energy conservation methods to manage energy efficiency
29	Use appropriate practices for conservation and prevention of environment Pollution and safety in process industries.
30	Understand various unit operations, unit processes and process instrumentation in food process industry
31	Learning about new systems that are used to create bio-energy which can greatly contribute to reducing greenhouse gases as they have the possibility of reducing the need to use fossil fuels.
32	Finding a new non-polluting energy source which is also renewable, by which the earth is being kept clean of harmful emissions.

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Prepare and interpret drawings of engineering components and plants	-Engineering Drawing-I
2.	Understandthestatusof Indian Food Industry	-Introduction to food technology
3.	Discussthefactorsaffectingtheshelflife of fruits and vegetables	Technology of fruits and vegetables
4.	Apply basic principles of mathematics, science and engineering to solve chemical engineering problems	- Applied Mathematics - Applied Physics - Applied Chemistry - Basics of Mechanical and Civil Engineering
5.	Select various materials used in Food processes, their properties and specifications	-Introduction to food technology
	Select various materials used in Food processes, their properties and specifications	Food processing
6.	Understandscenarioofmilkindustry,compositionalvariability ofmilk andstandards ofmilk &milk products	Technology of milk and milk products
7.	Food chemistry will provide theoretical and practical knowledge to students to develop their skills in the Food Processing and Technology Sector.	- Food chemistry
8.	Food microbiology will provide theoretical and practical knowledge to students to develop their skills in the food micro biology sector.	Food microbiology
9.	Recognize the need for and have the ability to engage in lifelong learning	- Student Centered Activities

10.	Conduct experiments, analyses, interpret data and synthesize valid conclusions	- Applied Chemistry
11.	Operate conventional machine for machining of components as per specifications as an aid to function effectively in the process industry.	- General Workshop Practice
12.	Understandthe regulationsandstandardsoffoodanalysisand conceptofsampling	Principles of food Engineering
13.	Spectroscopyand chromatography	Principles of food Engineering
14	Understandthecomposition,structureandstorageof bakery products Understand the technologyof bakery processingand itsproducts	Bakery & Confectionery Technology
15	Understand concepts of Food quality and role of total quality managementsystem in food industry	Food quality control and laws
16.	Food safety and preservation is the integral part of any food chain. It has to be ensured from raw material reception to the finished product dispatch	- Food preservation and process principals
17	Understand the general design of process equipments and testing	Technology of Animal Foods
18	Food safety and preservation is the integral part of any food chain. It has to be ensured from raw material reception to the finished product dispatch.	Food preservation and process principals
19	Understand different renewable sources of Energy and their applications.	- Renewable Energy Sources
20.	Understand different plants utilities	- Technology of plant foods
21.	Understand plants generation and maintenance	- Technology of plant foods
22.	Interpret factory acts, laws and taxes	- Industrial Management and Entrepreneurship Development

23.	Develop communication and interpersonal skills for effective functioning in the world of work.	- Communication Skills - Industrial Management and Entrepreneurship Development
24.	Communicate effectively in English and local language in oral and written form with others	- Communication Skills

25.	Manage resources effectively at work place	- Project Work
26.	Plan and execute given task/project as a team member or leader	- Project Work
27.	Prepare detailed project proposal and report.	- Project Work
26.	Use of computer and IT tools for creating documents, making spread sheet and making presentation	- Basics of Information Technology
28.	Solve real life problems by application of acquired knowledge and skills	- Project Work
29.	Use energy conservation methods to manage energy efficiency	- Energy Conservation
30.	Use appropriate practices for conservation and prevention of environment pollution and Safety in process industries.	- Environmental Studies -Pollution Control and Industrial Safety
31.	They will gain a deeper understanding of the production, processing, preservation, packaging, labeling, safety and quality management and distribution of food and beverages.	Food packaging
32.	This subject is designed to provide thorough knowledge to help you analyze food waste management system risks, prepare meet food waste regulations in food industries.	Food processing waste management

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies Communication

Skills Environmental Studies

Energy Conservation

Industrial Management and Entrepreneurship Development

b) Applied Sciences

Applied Mathematics

Applied Physics

Applied Chemistry

c) Basic Courses in Engineering/Technology

Engineering Drawing

General Workshop Practice

Basics of Mechanical and Civil Engineering

Basics of Information Technology

d) Applied Courses in Engineering/Technology

Pollution Control and Industrial Safety

Food Microbiology

Food Technology

Food chemistry

Food preservation and process principals

Food packaging

Food processing waste management

Renewable Energy Sources

Milk & Milk Products Technology

Fruit & Vegetables Technology

Technology of Meat, Fish & Poultry Products

Food Fermentation Technology

Bakery & Confectionery Technology

Cereals & Pulses Technology

- **Industrial Training**
- **Project Work**

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	Communication Skills	6	6	-	-	-	-
2.	Applied Mathematics	5	5	5	-	-	-
3.	Applied Physics	7	7	-	-	-	-
4.	Applied Chemistry	7	-	-	-	-	-
5.	Engineering Drawing	8	8	-	-	-	-
6.	Basic of Information Technology	6	-	-	-	-	-
7.	General Workshop Practice	8	8	-	-	-	-
8.	Basics of Mechanical and Civil Engineering	-	7	-	-	-	-
9.	Environmental Studies	-	-	5	-	-	-
10.	Renewable Energy Source	-	-	-	4	-	-
11.	Introduction to food technology	-	-	5	-	-	-
12.	Food microbiology	-	-	10	-	-	-
13.	Food Chemistry & Nutrition	-	-	10	-	-	-
14.	Milk & Milk Product Technology	-	-	-	8	-	-
15.	Fruit & Vegetable Technology	-	-	-	8	-	-
16.	Meat, Fish & Poultry Technology	-	-	-	6	-	-
17.	Food Fermentation Technology	-	-	8	-	-	-
18.	Bakery & Confectionery Technology	-	-	-	8	-	-
19.	Cereals & Pulses Technology	-	-	-	8	-	-
20.	Principals of Food Processing & Preservation	-	-	-	-	10	-
21.	Pollution Control & industrial Safety	-	-	-	-	9	-
22.	Unit Operations in Food Processing	-	-	-	-	8	-
23.	Food packaging Technology	-	-	-	-	8	-
24.	Principals of Food Engineering	-	-	-	-	6	-
25.	Universal human values	-	-	-		3	-
26.	Energy Conservation	-	-	-	-	-	5
27.	Industrial Management and Entrepreneurship Development	-	-	-	-	-	5
28.	Food storage and Transportation	-	-	-	-	-	8

29.	Waste Management in Food Processing	-	-	-	-	-	5
30.	Food Quality control and Laws	-	-	-	-	-	8
31.	Project Work	-	-	-	-	-	12
32.	Student Centred Activities	1	7	5	6	4	2
	Total	**48**	**48**	**48**	**48**	**48**	**48**

7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN FOOD TECHNOLOGY

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*Communication Skill -I	4	-	2	4	20	10	30	50	2½	20	3	70	100
1.2	*Applied Mathematics-I	5	-	-	4	20	-	20	50	2½	-	-	50	70
1.3	*Applied Physics -I	5	-	2	5	20	10	30	50	2½	20	3	70	100
1.4	*Applied Chemistry	5	-	2	5	20	10	30	50	2½	20	3	70	100
1.5	*Engineering Drawing-I	-	-	8	3	-	40	40	60	3	-	-	60	100
1.6	Basic of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
1.7	General Workshop Practice –I	-	-	8	3	-	40	40	-	-	60	4	60	100
# Students Centered Activities		-	-	1	1	-	30	30	-	-	-	-	-	30
Total		**19**		**29**	**27**	**80**	**180**	**260**	**260**		**180**		**440**	**700**

* Common with other diploma programmes.

\# Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics –II	5	-	-	4	20	-	20	50	2½	-	-	50	70
2.2	*Applied Physics –II	5	-	2	5	20	10	30	50	2½	20	3	70	100
2.3	*Engineering Drawing-II		-	8	5	20	10	30	50	2½	20	3	70	100
2.4	Basic of Mechanical and Civil Engineering	5	-	2	6	20	30	50	50	2½	50	3	100	150
2.5	*Communication Skill -II	4	-	2	4	20	10	30	50	2½	20	3	70	100
2.6	General Workshop Practice –II	-	-	8	3	-	40	40	-	-	60	4	60	100
#Student Centered Activities (SCA)		-	-	7	1	-	30	30	-	-	-	-	-	30
Total		**19**		**29**	**28**	**100**	**130**	**230**	**250**		**170**		**420**	**650**

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self-study etc.

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Environmental Studies	3	-	2	3	20	10	30	50	2½	20	3	70	100
3.2	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2½	-	-	50	70
3.3	Food Fermentation Technology	6	-	2	**5**	20	10	30	50	2½	20	3	70	100
3.4	Introduction to Food Technology	5	-	-	5	20	-	20	50	2½	-		50	70
3.5	Food Microbiology	6	-	4	6	20	10	30	50	2½	20	3	70	100
3.6	Food Chemistry & Nutrition	6	-	4	6	20	10	30	50	2½	20	3	70	100
#Student Centered Activities (SCA)		-	-	5	2	-	30	30	-	-	-	-	-	30
Total		**31**		**17**	**31**	**120**	**70**	**190**	**300**		**80**		**380**	**570**

Student Centered Activities will comprise of co-curricular activities like extension lectures, self-study, games, hobby clubs e.g. Photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	Milk & Milk Products Technology	6	-	2	5	20	30	50	50	2½	50	3	100	150
4.2	Fruit & Vegetables Technology	6	-	2	**5**	20	30	50	50	2½	50	3	100	150
4.3	Meat, Fish & Poultry Technology	4	-	2	**4**	20	10	30	50	2½	20	3	70	100
4.4	Renewable Energy Source	4	-	-	3	20	-	20	50	2½	-	-	50	70
4.5	Bakery & Confectionery Technology	6	-	2	**5**	20	30	50	50	2½	50	3	100	150
4.6	Cereals & Pulses Technology	6	-	2	**5**	20	30	50	50	2½	50	3	100	150
#Student Centered Activities (SCA)		-	-	6	2	-	30	30	-	-	-	-	-	30
Total		**32**		**16**	**29**	**120**	**160**	**280**	**300**		**220**		**520**	**800**

* Common with other diploma programmes

- 4 weeks Field Exposure (Industrial Training) will be organised after 4th Semester exam.

Student Centered Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g.photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
	Industrial Training	-	-	-	2	-	-	-	-	-	50	-	50	50
5.1	Principals of Food Processing & Preservation	6	-	4	5	20	30	50	50	2½	50	3	100	150
5.2	Pollution control and industrial safety	5	-	4	6	20	30	50	50	2½	50	3	100	150
5.3	Unit Operations in Food Processing	4	-	4	5	20	30	50	50	2½	50	3	100	150
5.4	Food packaging Technology	6	-	2	5	20	30	50	50	2½	50	3	100	150
5.5	Principals of Food Engineering	6	-	-	5	20	-	20	50	2½	-	3	50	70
5.6	Universal Human values	2	-	1	1	-	20	20	-		30	3	30	50
# Student Centered Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30
Total		**29**		**19**	**30**	**100**	**170**	**270**	**250**		**280**		**530**	**800**

* Common with other diploma programme

Student Centered Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME *Periods/Week*			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Energy Conservation	3	-	2	3	20	10	30	50	2½	20	3	70	100
6.2	Industrial Management and Entrepreneurship Development	5	-	-	4	20	-	20	50	2½	-	-	50	70
6.3	Foods Storage &Transportation	6	-	2	5	20	30	50	50	2½	50	3	100	150
6.4	Waste Management in Food Processing	6	-	2	5	20	30	50	50	2½	50	3	100	150
6.5	Food Quality Control & Laws	6	-	2	5	20	30	50	50	2½	50	3	100	150
6.6	Project Work	-	-	12	5	-	50	50	-	-	100	3	100	150
#Student Centered Activities (SCA)		-	-	2	2	-	30	30	-	-	-	-	-	30
Total		**26**		**22**	**29**	**100**	**180**	**280**	**250**		**270**		**520**	**800**

Student Centered Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

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

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 10 Marks for general behavior and discipline

(by HODs in consultation with all the teachers of the department)

ii. 5 Marks for attendance as per following:

(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	2 Marks
b)	80 - 85%	4 Marks
c)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:

(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	State/National Level participation
b)	10	-	Participation in two of above activities
c)	5	-	Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

1.1 COMMUNICATION SKILLS – I

L T P
4 - 2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

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

.

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension

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DETAILED CONTENTS

1 Basics of Communication (13 periods)

1.1 Definition and process of communication

1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal

1.3 Communications barriers and how to overcome them

1.4 Barriers to Communication, Tools of Communication

2	Application of Grammar		(18 periods)
	2.1	Parts of Speech (Noun, verb, adjective, adverb) and modals	
	2.2	Sentences and its types	
	2.3	Tenses	
	2.4	Active and Passive Voce	
	2.5	Punctuation	
	2.6	Direct and Indirect Speech	

3 Reading Skill (10 periods)

Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

4 Writing Skill (15 periods)

4.1 Picture composition
4.2 Writing paragraph
4.3 Notice writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writingreports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Listening and Speaking Exercises

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centred activities in class room and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.

Websites for Reference:

1. http://www.mindtools.com/page 8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	13	24
2	18	32
3	10	16
4	15	28
Total	**56**	**100**

1.2 APPLIED MATHEMATICS - I

L	T	P
5	-	-

RATIONALE

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

LEARNING OUTCOMES

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

- Apply Binomial theorem to solve engineering problems
- Apply determinants properties and Crammer's rule to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems
- Use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- Find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

DETAILED CONTENTS

1. Algebra -I (12 Periods)

   1.1 Series : AP and GP; Sum, nth term, Mean

   1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.

   1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Cramer's rule

2. Algebra- II (12 Periods)

   2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.

   2.2 Complex number.

   Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. Trigonometry (10 Periods)

3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relationship between sides and angle of a triangle.

3.2 Inverse circular functions: Simple case only

4. Differential Calculus - I (18 Periods)

4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logaritimic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.

5. Differential Calculus - II (18 Periods)

5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.

5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

INSTRUCTONAL STRATEGY

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content**.**

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-I by Chauhan and Chauhan, Krishna Publications, Meerut**.**

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	12	20
2.	12	20
3.	10	12
4	18	24
5	18	24
Total	**70**	**100**

1.3 APPLIED PHYSICS – I

L	T	P
5	-	2

RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

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

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc. .
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

DETAILED CONTENTS

1. Units and Dimensions (10 Periods)

1.1 Need of Measurement in engineering and science, unit of a physical quantities
- Fundamental and derived units, systems of units (FPS, CGS and SI units)

1.2 Dimensions and dimensional formulae of physical quantities.

1.3 Principle of homogeneity of dimensions

1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities

1.5 Limitations of dimensional analysis

1.6 Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.

1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non-metallic blocks, wires, pipes etc. (at least two each).

2. Force and Motion (10 periods)

2.1 Scalar and vector quantities – examples, representation of vector, types of vectors

2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.

2.3 Resolution of Vectors and its application to lawn roller.

2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.

2.5 Impulse and its Applications

2.6 Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.

2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)

2.8 Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.

2.9 Application of various forces in lifts, cranes, large steam engines and turbines

3. Work, Power and Energy (10 periods)

3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,

3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of

friction and its Engineering Applications.

3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.

3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

3.6 Power and its units, calculation of power in numerical problems

3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.

4 Rotational Motion (10 periods)

4.1 Concept of translatory and rotatory motions with examples

4.2 Definition of torque with examples

4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples

4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.

4.5 Rotational kinetic energy, Rolling of sphere on the slant plane

4.6 Comparison of linear motion and rotational motion.

4.7 Application of rotational motions in transport vehicles, and machines.

5 Motion of planets and satellites (08 periods)

5.1 Gravitational force, Kepler's law of planetary motion

5.2 Acceleration due gravity and its variation

5.3 Gravitational Potential and Gravitational potential energy

5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity

5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology

5.6 Concept of Black Holes

6. Properties of Matter (12 periods)

6.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve

6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications

6.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension

6.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and

effect of temperature on viscosity, application in hydraulic systems.

6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications.

7. Heat and Thermodynamics (10 periods)

` 7.1 Difference between heat and temperature

7.2 Modes of transfer of heat (Conduction, convection and radiation with examples)

7.3 Different scales of temperature and their relationship

7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them

7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co-efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.

7.6 Isothermal and Adibatic process

7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.

7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS

1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.

2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.

3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer

4 To verify parallelogram law of forces

5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.

6 To find the Moment of Inertia of a flywheel about its axis of rotation

7 To determine the atmospheric pressure at a place using Fortin's Barometer

8 To determine the viscosity of glycerin by Stoke's method

9 To determine the coefficient of linear expansion of a metal rod

10 To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSEMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva voce

RECOMMENDED BOOKS

1 Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi

2 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi

3 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi

4 B.Sc.Practical Physics by C L Arora, S. Chand Publication..

5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

6 Engineering Physics by DK Bhhatacharya& Poonam Tandan; Oxford University Press,

7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications

8 V. Rajendran,physics-I, Tata McGraw-Hill raw Hill publication, New Delhi

9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi

10 Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	10	15
3	10	15
4	10	15
5	8	10
6	12	16
7	10	14
Total	**70**	**100**

1.4 APPLIED CHEMISTRY

L T P
5 - 2

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

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

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and their relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select polymer/rubber/plastic materials for engineering applications.

DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)

    1.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
    1.2 Bohr's model of atom and successes and limitations of atomic theory (Qualitative treatment only).
    1.3 Atomic number, atomic mass number isotopes and isobars.

1.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,

1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).

1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)

1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma (σ) and pi (π) covalent bonds in H_2, HCl, Cl_2, elementary idea of hybridization in $BeCl_2$, BF_3, CH_4, NH_3 and H_2O, VSEPR, Molecular orbital Theory

1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding- explanation with the help of electron gas (sea) model.

2. Fuelsand Lubricants (18 periods)

2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels

2.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.

2.3 Coal - types of coal and proximate analysis of coal

2.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers

2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.

2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.

2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.

2.8 Synthetic lubricants and cutting fluids.

3. Water (14 periods)

3.1 Demonstration of water resources on Earth using pie chart.

3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.

3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water. Priming and foaming and caustic embrittlement in boilers.

3.4 Removal of hardness -Permutit process and Ion-exchange process.

3.5 Physico-Chemical methods for Water Quality Testing

a) Determination of pH using pH meter, total dissolved solids (TDS)

b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).

c) Understanding of Indian Water Quality standards as per WHO

3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.

3.7 Municipality waste water treatment. Definition of B.O.D and C.O.D.

4. Electrochemistry (4 periods)

Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrolytes); Nernst equation.

5. Corrosion and its Control (10 periods)

5.1 Definition of corrosion and factors affecting corrosion rate.

5.2 Theories of

a) Dry (chemical) corrosion- Pilling Bedworth rule

b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism

5.3 Definition of passivity and galvanic series

5.4 Corrosion control:

a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel –Application of Metal Zn (Sheradizing),Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage

b) Inorganic coatings – Anodizing and phosphating,

c) Organic coatings - use of paints varnishes and enamels

d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)

6. Organic compounds, Polymers and Plastics (10 periods)

6.1 Classification of organic compounds and IUPAC Nomenclature

6.2 Definition of polymer, monomer and degree of polymerization

6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)

6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics

6.5 Applications of polymers in industry and daily life

LIST OF PRACTICALS

1. Estimation of total hardness of water using standard EDTA solution

Estimation of total alkalinity of given water sample by titrating it against standard sulphuric acid solution

3. Proximate analysis of solid fuel)
4. Estimation of temporary hardness of water sample by O' Hener's Method.

5. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

MEANS OF ASSEMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva voce

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuricose& J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij&ShikshaVij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1.	14	20
2.	18	24
3.	14	20
4.	4	6
5.	10	15
6.	10	15
Total	**70**	**100**

1.5 ENGINEERING DRAWING -I

L T P
- - 8

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

i) First angle projection is to be followed

ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD

iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

LEARNING OUTCOMES

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

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)

    1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.
    1.2 Different types of lines in Engineering drawing as per BIS specifications
    1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.
    1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4

2. Dimensioning Technique (01 sheet)

    2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
    2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches

3. Scales (02 sheets)

    3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale
    3.2 Drawing of plain and diagonal scales

4. Orthographic Projections (06 sheets)

    4.1 Theory of orthographic projections (Elaborate theoretical instructions)
    4.2 Projection of Points in different quadrant
    4.3 Projection of Straight Line (1^{st} and 3^{rd} angle)
        4.3.1. Line parallel to both the planes
        4.3.2. Line perpendicular to any one of the reference plane
        4.3.3. Line inclined to any one of the reference plane.
    4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1^{st} angle only
    4.5 Three views of orthographic projection of different objects. (At least one sheet in 3^{rd} angle)
    4.6 Identification of surfaces

5 Projection of Solid (02 sheets)

5.1. Definition and salient features of Solid
5.2. Types of Solid (Polyhedron and Solid of revolution)
5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.

6. Sections (02 sheets)

6.1 Importance and salient features
6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
6.4 Orthographic sectional views of different objects.

7. Isometric Views (02 sheets)

7.1 Fundamentals of isometric projections and isometric scale.
7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.

8. Common Symbols and Conventions used in Engineering (02 sheets)

8.1 Civil Engineering sanitary fitting symbols
8.2 Electrical fitting symbols for domestic interior installations

*9. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

* **Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

1.6 BASICS OF INFORMATION TECHNOLOGY

L	T	P
-	-	6

RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

LEARNING OUTCOMES

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

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools(Google suits)

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Introduction to Computers and Peripherals.

   Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD,Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.
2. Operation System and Application Software

   System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, Working with window, Desktop components,

Menu bars, creating shortcut of program. Installation of Application softwares, Antivirus and Drivers.

3. Word Processing, Spreadsheet and Presentation

Usage and creation of word document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc. Google presentation)

.

4. Internet

Basics of Networking – LAN, WAN, Wi-Fi technologies, Concept of IP Addresses, DNS, Search Engines, e-mail, Browsing and cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of various application software and peripheral drivers
3. Installation of operating system (windows/linux/others)
4. Creation and Management (Rename, delete, search of file and folders)
5. Installation of Antivirus and remove viruses
6. Scanning and printing documents
7. Browsing, Downloading, Information using Internet
8. E-Mail ID creation, comparing, sending and receiving e-mail. Attaching a file with e-mail message.
9. Word Processing (MS Office/Open Office)

a) File Management:
   - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file

b) Page set up:
   - Setting margins, tab setting, ruler, indenting

c) Editing a document:
   - Entering text, cut, copy, paste using tool- bars

d) Formatting a document:
   - Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
   - Aligning of text in a document, justification of document, inserting bullets and numbering
   - Formatting paragraph, inserting page breaks and column breaks, line spacing
   - Use of headers, footers: Inserting footnote, end note, use of comments, autotext
   - Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders:
   - Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
   - Print preview, zoom, page set up, printing options
   - Using find, replace options

f) Using Tools like:

- Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and lables
- Using shapes and drawing toolbar,
- Working with more than one window .

10. Spread Sheet Processing (MS Office/Open Office/Libre Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

b) Menu commands:
Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

c) Work books:
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations
Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

d) Creating a chart:
Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
Using a list to organize data, sorting and filtering data in list

e) Retrieve data with query:
Create a pivot table, customizing a pivot table. Statistical analysis of data

f) Exchange data with other application:
Embedding objects, linking to other applications, import, export document.

11. PowerPoint Presentation (MS Office/Open Office/Libre office)

a) Introduction to PowerPoint
- How to start PowerPoint
- Working environment: concept of toolbars, slide layout & templates.
- Opening a new/existing presentation
- Different views for viewing slides in a presentation: normal, slide sorter.

b) Addition, deletion and saving of slides

c) Insertion of multimedia elements
- Adding text boxes
- Adding/importing pictures
- Adding movies and sound
- Adding tables and charts etc.
- Adding organizational chart
- Editing objects
- Working with Clip Art

d) Formatting slides
- Using slide master
- Text formatting
- Changing slide layout
- Changing slide colour scheme

- Changing background
- Applying design template

12. Google Suits
Using Google drive, Google shut, Google docs, Google slides.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

MEANS OF ASSESSMENT

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net…Set…Go… Surviving in an e-world by AnushkaWirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Online Resources

1. www. tutorialspoint..com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org
5. Swayam.gov.in

1.7 GENERAL WORKSHOP PRACTICE – I

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

L	T	P
-	-	8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

DETAILED CONTENTS

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop

4. Welding Shop
5. Plumbing Shop

1. CARPENTRY SHOP

1.1 General Shop Talk

1.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials

1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.

1.1.3 Specification of tools used in carpentry shop.

1.1.4 Different types of Timbers, their properties, uses & defects.

1.1.5 Seasoning of wood.

1.2. Practice

1.2.1 Practices for Basic Carpentry Work

1.2.2 Sawing practice using different types of saws

1.2.3 Assembling jack plane — Planning practice including sharpening of jack plane cutter

1.2.4 Chiselling practice using different types of chisels including sharpening of chisel

1.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.

1.3 Job Practice

Job 1	Marking, sawing, planning and chiselling and their practice
Job II	Half Lap Joint (cross, L or T – any one)
Job III	Mortise and Tenon joint (T-Joint)
Job IV	Dove tail Joint (Lap or Bridle Joint)

1.4. Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

2. PAINTING AND POLISHING SHOP

2.1. Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.

2.2. Job Practice

Job 1: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Job II: To prepare metal surface for painting, apply primer and paint the same.

Job III: To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

i) Abrasive cutting by leather wheel
ii) Polishing with hard cotton wheel and with polishing material
iii) Buffing with cotton wheel or buff wheel.

3. ELECTRICAL SHOP

3.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.

3.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.

3.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.

3.4 Introduction to the construction of lead acid battery and its working.

Job III Installation of battery and connecting two or three batteries in series and parallel.

3.5 Introduction to battery charger and its functioning.

Job IV Charging a battery and testing with hydrometer and cell tester

4. WELDING SHOP

4.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.

4.2 Job Practice

Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).

Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

5. PLUMBING SHOP

5.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.

5.2. Introduction and demonstration of tools, equipment and machines used in plumbing shop.

5.3. Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.

5.4. Job Practice

Job 1 : Preparation of job using elbow, bend and nipple

Job II: Preparation of job using Union, Tap, Plug and Socket.

Job III: Threading practice on pipe with die

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

2.1 APPLIED MATHEMATICS - II

L	T	P
5	-	-

RATIONALE

Basic elements of integral calculus, differential calculus, numerical methods, differential m equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

LEARNING OUTCOMES

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

- Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

DETAILED CONTENTS

1. Integral Calculus - I (20 Periods)

Methods of Indefinite Integration

1.1 Integration by substitution.
1.2 Integration by rational function.
1.3 Integration by partial fraction.
1.4 Integration by parts.
1.5 Integration of special function

2. Integral Calculus - II (20Periods)

2.1 Meaning and properties of definite integrals, Evaluation of definite Integrals.
2.2 Application : Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, centre of mean of plane areas.
2.3 Simpsons 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

3. Co-ordinate Geometry (2 Dimension) (18 Periods)

3.1 Circle

Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

4. Co-ordinate Geometry (3 Dimension) (12 Periods)

4.1 Straight lines and planes in space

Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

INSTRUCTONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	20	28
2.	20	28
3.	18	24
4	12	20
Total	**70**	**100**

2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and itsmeasurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- Explain Biot-Savart Law, Ampere’s law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor
- Apply the knowledge of diodes in rectifiers, adapters IC’s and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fibre and its uses in Medical field and Communication.

DETAILED CONTENTS

1. Wave motion and its applications (12 periods)

1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application

1.2 Wave equation y = r sin wt, phase, phase difference, principle of superposition of waves

1.3 Simple Harmonic Motion (SHM): definition and characteristic, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., simple pendulum, concept of simple harmonic progressive wave,

1.4 Free, Damped and forced oscillations, Resonance with examples, Q-factor

1.5 Definition of pitch, loudness, quality and intensity of sound waves, intensity level, Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Accoustics of building defects and remedy.

1.6 Ultrasonics –production, detection, properties and applications in engineering and medical applications.

2. Wave Optics (6 periods)

2.1 Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, Power of lens, magnification.

2.2 Two-Source Interference, Double-Slit interference, Interference due to thin films, Fresnel's biprism.

2.3 use of interference making highly efficient solar panel.

2.4 diffraction, Single Slit diffraction, Intensity calculation etc

2.5 Polarization of electromagnetic waves, polarizing sheets, polarizing by Reflection (Brewser's law), Malus law, use of polariods.

3. Electrostatics (12 periods)

3.1 Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.

3.2 Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals), charging and discharging of a capacitor.

3.4 Dielectric and its effect on capacitance, dielectric break down.

3.5 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)

4. Current Electricity (12 periods)

4.1 Electric Current, Resistance, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances, Ohm's law. Superconductivity.

4.2 Kirchhoff's laws, Wheatstone bridge and its applications (meter bridge and slide wire bridge)

4.3 Concept of terminal potential difference and Electro motive force (EMF), potentiometer.

4.4 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy

4.5 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.

5. Magneto Statics and Electromagnetism (12 periods)

5.1 Magnetic poles, force on a moving charge, circulating charges, force on a current carrying wire, Hall effect, torque on a current loop.

5.2 Magnetic field due to moving charge(Biot-Savart Law), due to current (Biot-Savart Law), parallel currents, field of a solenoid, Ampere's law.

5.3 Faraday's law, Lenz' law, motional emf, induced electric fields.

5.4 Magnetic dipole and force on a magnetic dipole in a non-uniform field, Magnetization, Gauss' law for magnetism.

5.5 Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,

5.6 Application of electromagnetism in ac/dc motors and generators.

6. Semiconductor physics (8 periods)

6.1 Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics

6.2 Diode as rectifier – half wave and full wave rectifier (centre taped),

6.3 Semiconductor transistor, pnp and npn (concepts only)

6.4 Application of semiconductor diodes (Zener, LED) and that of transistor as amplifier and oscillator.

7. Modern Physics (8 Periods)

7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.

7.2 Fibre optics: Total internal reflection and its applications, Critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture, types and applications of optical fibre in communication.

7.3 Introduction to nanotechnology, nanoparticles and nano materials,

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To find the focal length of convex lens by displacement method.
3. To find the refractive index of the material of given prism using spectrometer.
4. To find the wavelength of sodium light using Fresnel's biprism.
5. To verify laws of resistances in series and parallel combination
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw hysteresis curve of a ferromagnetic material.
10. To draw characteristics of a pn junction diode and determine knee and break down voltages.
11. To find wave length of the laser beam.
12. To find numerical aperture of an optical fiber.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT

-Assignment & Quiz

-Mid-Term and End-Term written test
-Model Making

-Actual Lab & Practical Work
-Viva-Voce

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	18
2	6	8
3	12	18
4	12	16
5	12	16
6	8	12
7	8	12
Total	**70**	**100**

2.3 ENGINEERING DRAWING - II

L	T	P
-	-	8

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

1) First angle projection is to be followed.
2) Minimum 16 sheets to be prepared. At least 2 sheets in AutoCAD.
3) Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students.
4) Continuous evaluation be done by the teachers for exercises/work done on CAD software. For this proper record may be maintained for its inclusion in the internal assessment.

LEARNING OUTCOMES

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

- Draw and learn different types of wooden joints used in furniture.
- Draw the assembly from part details of objects
- Identify and draw different types of screw threads used in various machines and assemblies as per domestic and international standards
- Draw different types of nuts, bolts and washers
- Draw various locking devices and foundation bolts
- Draw different section of various types of keys and cotter joints
- Draw various riveted joints
- Draw various types of couplings used in power transmission.
- Prepare drawing of given joints/couplings using AutoCAD

DETAILED CONTENTS

1. Detail and Assembly Drawing (02 sheets)

   Principle and utility of detail and assembly drawings

   1.1 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortice and Tenon joint, furniture drawing - freehand and with the help of drawing instruments.

2. Screw Threads (03 sheets)

   2.1 Thread Terms and Nomenclature

   2.1.1 Types of threads-External and Internal threads, Right and Left hand threads (Actual and Conventional representation), single and multiple start threads.

2.1.2 Different Forms of screw threads-V threads (B.S.W threads, B.A thread, American National and Metric thread), Square threads (square, Acme, Buttress and Knuckle thread)

3. Nuts and Bolt (02 sheets)

3.1 Different views of hexagonal and square nuts. Square and hexagonal headed bolt
3.2 Assembly of Hexagonal headed bolt and Hexagonal nut with washer.
3.3 Assembly of square headed bolt with hexagonal and with washer.

4. Locking Devices (02 sheets)

4.1 Different types of locking devices-Lock nut, castle nut, split pin nut, locking plate, slotted nut and spring washer.
4.2 Foundations bolts-Rag bolt, Lewis bolt, curved bolt and eye bolt.
4.3 Drawing of various types of studs

5. Keys and Cotters (03 sheets)

5.1 Various types of keys and cotters - their practical application, drawings of various keys and cotters showing keys and cotters in position
5.2 Various types of joints
- Spigot and socket joint
- Gib and cotter joint
- Knuckle joint

6. Rivets and Riveted Joints (04 sheets)

6.1 Types of general purpose-rivets heads
6.2 Caulking and fullering of riveted joints
6.3 Types of riveted joints
(i) Lap joint-Single riveted, double riveted (chain and zig-zag type)
(ii) Single riveted, Single cover plate butt joint
(iii) Single riveted, double cover plate butt joint
(iv) Double riveted, double cover plate butt joint(chain and zig-zag type)

7. Couplings (02 sheets)

7.1 Introduction to coupling, their use and types
7.2 Flange coupling (protected)
7.3 Flexible Coupling

*8. Use of CAD software (02 sheets)

Draw any two joints/coupling using CAD software from the following:
i) Sleeve and cotter joint
ii) Knuckle joint
iii) Spigot and socket joint
iv) Gib and cotter joint
v) Flange coupling

vi) Muff coupling

* **Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House (Pvt. Ltd.), Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. AutoCAD 2010: For Engineers & Designers by Prof. Sham Tickoo& D. Sarvanan; Wiley India Pvt. Ltd., Delhi.

2.4 BASICS OF MECHANICAL AND CIVIL ENGINEERING

L	T	P
5	-	2

RATIONALE

Apart from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementary Mech. Engg. to impart some necessary knowledge and skill about mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical and civil technician is intermingled with either civil or mechanical engineering. As such the relevant basic topics of these disciplines are included in the content of the subject.

Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

LEARNING OUTCOMES

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

- Apply Thermodynamics Laws.
- Use of various energy sources.
- Solve basics problems related to fuel and combustion.
- Have an idea of loading on machine components.
- Explain the application of different types of bearings.
- Explain the uses of different types of gears and springs.
- Explain the working principle of different lubrication systems.

SECTION A - MECHANICAL ENGINEERING

DETAILED CONTENTS

1. Thermal Engineering (14 periods)

1.1 Sources of Energy

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work. Zeroth law of thermodynamics Basic ideas, conventional and nonconventional forms- Thermal, wind, Solar, Biomass and Nuclear and their uses. Hydel, Tidal,

1.2 Fuels & Combustion:

Combustion of fuels- their higher and lower calorific values. Combustion equations for carbon, sulphur, hydrogen and their simple compounds. Calculation of minimum amount of air required for complete combustion.

Combustion analysis n mass basis and on volume basis. Concept of excess air in a boiler furnace combustion. Heat carried away by flue gases. Analysis of flue gases by Orsat apparatus. Simple numerical problems

Idea of specific properties of liquid fuels such as detonation, knock resistance (cetane and octane numbers), viscosity, solidification point, flash point and flame point.

2. Machine Components (20 periods)

Brief idea of loading on machine components.

(i) Pins, Cottor and Knuckle Joints.
(ii) Keys, Key ways and spline on the shaft.
(iii) Shafts, Collars, Cranks, Eccentrics.
(iv) Couplings and Clutches.
(v) Bearings-Plane, Bushed, Split-step, ball, Roller bearing, Journal bearing, Foot step bearing, thrust bearing, collar bearing and Special type bearings and their applications.
(vi) Gears

Different types of gears, gear trains and their use for transmission of motion.

Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound and epicyclic gear trains and their use. Definition of pitch and pitch circle & module.

(vii) Springs

Compression, Tension, Helical springs,Torsion springs, Leaf and Laminated springs. Their use and material.

(08 periods)

3. Lubrication

Different lubrication system for lubricating the components of machines.

Principle of working of wet sump and dry sump system of lubrication. (Explain with simple line diagram). Selection of lubricant based on different application (Requirement with the help of manufacturer catalogue).

SECTION B : CIVIL ENGINEERING

4. Construction Materials (06 periods)

Properties and uses of various construction materials such as stones, bricks, lime, content and timber with their properties, physical/field testing, elements of brick masonry.

5. Foundations (08 periods)

5.1 Bearing capacity of soil and its imporance

5.2 Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines.

6. Concrete (08 periods)

Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete, placing and curing of concrete..

7. RCC (06 periods)

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building.

Note: While imparting instructions, teachers are expected to lay more emphasis on concepts and principles. It will be better if the classes for general engineering are conducted by organized demonstrations for explaining various concepts and principles.

LIST OF PRACTICALS

1. Study and Sketch of Pins and Cottor
2. Study and Sketch of Keys and Key ways
3. Study and sketch of Couplings andClutches
4. Study and Sketch of Bearings
5. Study and Sketch of Springs
6. Study of green energy
7. Testing of bricks
   a) Shape and size
   b) Soundness test
   c) Water absorption
   d) Crushing strength
8. Testing of concrete
   a) Slump test
   b) Compressive Strength of concrete cube
9. The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on basic principles and use charts in class, visits to labs and industry may be arranged to demonstrate certain materials and practices.

MEANS OF ASSESSMENT

- Sessional Tests
- End term Tests
- Practical
- Viva-Voce

RECOMMENDED BOOKS

1. Textbook of Concrete Technology 2nd Edition, by Kulkarni, PD Ghosh TK and Phull, YR; New Age International(P) Ltd, Publishers, New Delhi
2. Materials of Construction by Ghosh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Concrete Technology by J.Jha and Sinha; Khanna Publishers, Delhi
5. Building Construction by Jha and Sinha; Khanna Publishers, Delhi
6. Building Construction by Vairani and Chandola; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, New Delhi
8. Soil Mechanics and Foundation Engineering by SK Garg; Khanna Publishers, New

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	14	20
2.	20	28
3.	08	12
4	06	08
5	08	12
6	08	12
7	06	08
Total	**70**	**100**

2.5 COMMUNICATION SKILLS – II

L	T	P
4	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

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

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organised set up and social context.

DETAILED CONTENTS

1. Functional Grammar (16 periods)

    1.1 Prepositions
    1.2 Framing Questions
    1.3 Conjunctions
    1.4 Tenses

2 Reading (16 periods)

    2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic.

3 Writing Skill (24 periods)

    3.1. Correspondence
        a) Business Letters- Floating Quotations, Placing Orders, Complaint Letters.
        b) Official Letters- Letters to Government and other Offices
    3.2. Memos, Circular, Office Orders
    3.3. Agenda & Minutes of Meeting
    3.4. Report Writing

LIST OF PRACTICALS
COMMUNICATION SKILLS – II

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.
Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Speaking and Listening Skills

1. Debate
2. Telephonic Conversation: general etiquette for making and receiving calls
3. Offering- Responding to offers.
4. Requesting – Responding to requests
5. Congratulating
6. Exploring sympathy and condolences
7. Asking Questions- Polite Responses
8. Apologizing, forgiving
9. Complaining
10. Warning
11. Asking and giving information
12. Getting and giving permission
13. Asking for and giving opinions

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR,Chandigarh.

Websites for Reference:

1. http://www.mindtools.com/ page 8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28
2	16	28
3	24	44
Total	**56**	**100**

2.6 GENERAL WORKSHOP PRACTICE –II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering)

L	T	P
-	-	8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1 Fitting Shop
2 Sheet Metal Shop
3 Mason Shop
4 Machine Shop

1. FITTING SHOP

1.1 Use of personal protective equipment and safety precautions while working.

1.2 Basic deburring processes.

1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.

1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)

1.5 Identification of various steel sections (flat, angle, channel, bar etc.).

1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

1.7 Job Practice

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of ±.25 mm.

Job IIIMaking a cut-out from a square piece of MS flat using hand hacksaw and chipping

Job IV Drilling and tapping practice on MS Flat.

2. SHEET METAL SHOP

2.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

2.2 Introduction and demonstration of hand tools used in sheet metal shop.

2.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

2.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanized corrugated sheet, aluminum sheet etc.

2.5 Study of various types of nuts, bolts, rivets, screws etc.

2.6 Job Practice

Job I: Shearing practice on a sheet using hand shears.

Job II: Practice on making Single riveted lap joint/Double riveted lap Joint. Job III :Practice on making Single cover plate chain type, zig-zag type and single riveted Butt Joint.

3 MASON SHOP

3.1. Introduction and importance of Mason shop

3.2. Introduction of tools, equipment and machines used in Mason shop

3.3. Job Practice

Job I : Preparation of simple bond

Job II : Preparation of Arched bond

Job III: Preparation of RCC structure (column and beam)

4 MACHINE SHOP

4.1 Study and sketch of lathe machine

4.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.

4.3 Plain and step turning and knurling practice.

4.4 Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

3.1 ENVIRONMENTAL STUDIES

L	T	P
3	-	2

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

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

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Introduction (04 Periods)

   1.1 Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non-renewable.

2. Air Pollution (04 Periods)

   2.1 Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (08 Periods)

   3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O_2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (06 Periods)

4.1 Sources of soil pollution
4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
4.3 Effect of Solid waste
4.4 Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (06 Periods)

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (08 Periods)

Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)

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

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house,effluent treatment plant of any industry,rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	**42**	**100**

3.2 APPLIED MATHEMATICS –III

L	T	P
5	-	-

RATIONALE

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

LEARNING OUTCOMES

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

- Understand matrix operations and uses of matrix in different problems.
- Apply elementary row and column operations in finding inverse of a matrix.
- Find Eigen values, Eigen vectors of a matrix and their different properties.
- Understand degree/order of differential equations and their solution techniques.
- Use differential equations in engineering problems of different areas.
- Find Fourier series expansion of a function
- Apply Laplace transform and their applications in solving engineering problems.
- Understand concept of probability distribution and their applications.

DETAILED CONTENTS

1. Matrices (16 Periods)

1.1 Algebra of Matrices
Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.
Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation
Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence
Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

1.4 Eigen Pairs
Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. Differential Calculus (15 Periods)

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians.

2.3 Vector Calculus :

Vector function, Introduction todouble and triple integral,differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

3. Differential Equation (15 Periods)

3.1 Formation, Order, Degree, Types, Solution :

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, nonlinear equation.

3.2 First Order Equations :

Variable separable, equations reducible to separable forms, Homogeneous equations, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation :

Property of solution, Linear differential equation with constant coefficients (PI for $X= e^{ax}$, Sinax, Cosax, X^n, $e^{ax}V$, XV

3.4 Simple Applications

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

4. Integral Calculus (12 Periods)

4.1 Beta and Gamma Functions :

Definition, Use, Relation between the two, their use in evaluating integrals.

4.2 Fourier Series :

Fourier series of f(x),-n<x<n, Odd and even function,Half range series.

4.3 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, inverse laplace transform, Solution of ordinary differential equations

5. Probability and Statistics (12 Periods)

5.1 Probability :
Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution :
Discrete and continuous distribution, Binomial Distribution, Poisson Distribution, Normal Distribution..

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. The basic elements of Laplace transform, differential equations and applications of differential equations can be taught with engineering applications of relevant branch.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-III by Chauhan and Chauhan, Krishna Publications, Meerut**.**
4. Applied Mathematics-II by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	16	24
2.	15	20
3.	15	20
4	12	18
5	12	18
Total	**70**	**100**

3.3 FOODFERMENTATIONTECHNOLOGY

L T P

6 - 2

RATIONALE

This subject is developed with an objective to impart knowledge and skills related toprocess technologies and equipment used for the production of various fermented foodproductstothestudents.

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthecourse thestudents will beable to

- Understandtheimportanceandproductionofcommon Indian traditionalfoods
- Understandtheconceptofmicrobialcultureselectionforparticularfermente d product
- Understandtheprocessingoffermentedmilk,meatandfish productsand analyzetheir qualities
- Understandtheeffectsoffermentationinfoodproductionandits influenceonthemicrobiologicalqualityandstatusofthefoodproduct.

DETAILEDCONTENTS

1. Introduction (04Periods)

   Definition,advantages offermentationand nutritivevalueoffermentedfoodproducts

2. Typeoffermentationprocesses;differentsubstratesforfermentationprocess;purecultures andtheirmaintenanceprocedures (10Periods)

3. Fermenter (10Periods)

   Basicconfiguration,differentparts–agitator/impellers,sparger,baffles,processcontrol,functions

4. Technologyof FermentedProducts (22Periods)

   Productionofdistilledbeverages(whisley,primary,rum),wine,beer,vinegarandbakersyeast

5. FermentedFoods (22Periods)

Productiontechnologyofcurd,yogurt,idli,dosa,dhokla,srikhand,tempehandmiso,sauerkraut,buttermilk,lassi,sausages

6. SingleCellProtein (16Periods)

Sources,micro-organism,process,nutritivevalueandadvantagesandlimitations;Conceptofproductionof vitamins andaminoacids

LISTOFPRACTICALS

1. Demonstrationandstudyoffermenteranditsfunctioning
2. Preparationofwine
3. Preparationofbeer
4. Preparationofvinegar
5. PreparationoftraditionalfermentedproductsPreparationofsauerkraut
6. Preparationofginger ale
7. Todeterminealcoholcontentinalcoholicbeverages
8. Visittobeveragesanddistillery(whiskey, Brandy,Rum)

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitabletutorialexercisesmaybedesignedbytheteachers,whichrequirestudentsvisitto various industries. Students may also be exposed to various national and internationalstandards. Visits to the relevant industry for demonstrating various operations involved inthe food beverage, is a must.Experts from the industry may be invited to deliver lectureson the latest technology.Knowledge about pollution control and devices for the samemay be provided to the students. Wherever relevant, students may be made aware aboutsafetyaspects.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDEDBOOKS

1. Industrial Microbiology by Prescott and Don, *CBS* Publishers and distributors Pvt.Ltd,NewDelhi

2. IndustrialMicrobilogybyCasida,P*ublishers*,Inc.,NewYork...byLesterEarl *Casida*

3. Biotechnology:FoodFermentationbyVKJoshiandAshokPandey,AVI*Publish* co.,.Westport

4. Biotechnology–FoodProcessingApplicationbySSMarwaha,Asiatech *Publishers*Inc.,NewDelhi

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	04	06
2	10	12
3	10	12
4	22	26
5	22	26
6	16	18
Total	**84**	**100**

3.4 Introduction to Food Technology

L	T	P
5	-	-

RATIONALE

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

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

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

LEARNING OUTCOMES

Onthesuccessfulcompletionofthecourse, studentswill beable to

- Understandthestatusof Indian Food Industry
- Understandtheimportanceofnutrition,desirable&undesirablecomponentspresent infood,andRecommendedDietaryAllowances (RDA)
- Understatedthecharacteristicsoflivingcells,differencebetweenplant and animalcells
- Understandthe basics concepts offood biochemistry
- Understandthe basics conceptsof food microbiology
- Determinethebasic compositionoffoodsexperimentally

DETAILED CONTENTS

1. BASIC CONSIDERATION: (20 Periods)

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 through out the year, Scope of food technology : Prerequisite and channenges, Desirable and potentially undesirable food constituents and their importance

2. BASIC BIOCHEMISTRY : (20 Periods)

Energy transformation in living cells, Bioenergetics, Enayme and Metabilic pathways, Regulation and control.

3. BASIC MICROBIOLOGY : (20 Periods)

3.1 Characterization, classification and identification of micro-organisms, Microscopy, Micro-organism : Morphology and structure, Pure culture and cultural characteristics, Reproduciton growth and cultivation, Control of microorganisms, Beneficial uses of microbes in foods, General principles of food hygiene.

3.2 Pure Culture

Streak plating, pour plating, spread plating, serial dilution technique, Isolation and preservation – lyophilization, slant method, liquid nitrogen method

3.3 Microbial Growth

Growth curve and its different phases, Synchronous growth, factors affecting microbial growth, generation time-their significance

3.4Bacteria

Structure size and shape. Types depending upon different requirements. Gram positive and negative bacteria. Mode of reproduction.

3.5 Fungi

Yeast and moulds –structure: their growth requirements, mode of reproduction, its importance.

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitabletutorialexercisesmaybedesignedbytheteachers,whichrequirestudentsvisitto various industries. Students may also be exposed to various national and internationalstandards. Visits to the relevant industry for demonstrating various operations involved inthe food beverage, is a must.Experts from the industry may be invited to deliver lectureson the latest technology.Knowledge about pollution control and devices for the samemay be provided to the students. Wherever relevant, students may be made aware aboutsafetyaspects.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

- Industrial Microbiology by Prescott and Don, *CBS* Publishers and distributors Pvt.Ltd,NewDelhi

- IndustrialMicrobilogybyCasida,P*ublishers*,Inc.,NewYork...byLesterEarl
  - *Casida*

- Biotechnology:FoodFermentationbyVKJoshiandAshokPandey,AVI*Publish*
  - co.,.Westport

- Biotechnology–FoodProcessingApplicationbySSMarwaha,Asiatech
  - *Publishers*Inc.,NewDelhi

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	20	25
2	20	25
3	30	50
Total	**70**	**100**

3.5 FOODMICROBIOLOGY

RATIONALE

LT		**P**
6	**–**	**6**

This subject is aimed to develop an understanding among the students on various microfloraassociatedwithfoodproductsandtheirbeneficialroleaswellasdeleteriouseffectonprocessedfoodproducts.

LEARNING OUTCOMES

Onthesuccessfulcompletionofthecourse, studentswill beable to

- Understandtherelevantgeneraandspeciesofmicroorganisms
- Determiningthemicrobiologicalqualityandsafetyoffoodand environmentalfactorsaffectingmicrobiological stability/spoilage
- Understandthe microbiologyof different typesoffoodcommodities
- Understandthenecessityofmicrobiologicalqualitycontrolprograms infoodproduction.

DETAILEDCONTENTS

1. Introduction–Definition, historicaldevelopmentsinthefoodmicrobiologyand itssignificance (10 Periods)
2. Microbiologyofmilkandmilkproductslikecheese,butter,Ice-cream,milkpowder (06 Periods) (10 Periods)
3. Microbiologyofmeat,fish,poultryandeggproducts (10Periods)
4. Microbiologyoffruitsandvegetableproductslikejam,jelly,sauce,juice (10Periods)
5. Microbiologyofcerealandcerealproductslikebread, (10Periods)
6. Microbialspoilageoffoods– foodbornepathogens,foodpoisoning,foodinfectionandintoxication (18Periods)

7. Concept ofTDT,F,ZandDvalue (06Periods)

8. Anti-microbialagents–physicalandchemicalagents –theirmechanismofaction (10Periods)

LISTOFPRACTICALS

1. Studyofthe microbiological qualityof milkbyMBRtest

2. Estimationoftotalmicrobialbacterialplatecount offoodsamplebydirectmicroscopicandSPC method

3. Estimationoftotalmicrobialcountofyeastandmould

4. Estimation of total microbial count of (a) milk products (b) fruits and vegetableproducts(c)meat,fishandpoultryproducts(d)water(e)surface(f)air(g)workers(h) cannedfoods

5. Studyofthegrowthcurveofmicro-organisms
6. Demonstrationofeffectofdifferentanti-microbialagentsi.e.(a)high andlowtemperature (b) UV radiation and (c) chemical preservatives on the growth ofmicrobes

INSTRUCTIONALSTRATEGY

This being one of the most basic subjects for the students of food technology, the teachersshould lay a lot of emphasis on explaining the facts, concepts, principles and proceduresinvolved in various topics. The students should be given appropriate tutorial exercises.Teachers should made use of chart and other appropriate media to support classroominstruction. Emphasis during the practical session should be on performance by individualstudents and teacher should develop instructional manual for various exercises to facilitatethe students. Visits to some of the local industries and quality control centers may bearranged to demonstrate various aspects of basic microbiology to the students. Expertsmaybeinvitedtodeliver lecturers onlatestdevelopments inthefield.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. EssentialsofMicrobiologybyKSBilgrami;CBS
2. FoodMicrobilogybyWCFrazier;TataMcGrawHill
3. ModernFoodMicrobilogybyJamesM Jay;CBS
4. BacteriologybySale
5. StandardMethodsforWasteWaterAnalysis byAPHA
6. BasicFoodMicrobilogy:Bannett,Chapman andHall
7. FoodMicrobiologybyM.R.Adams
8. HandBookofMicrobiologybyBisen
9. TextBookofFungibySharma

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	10	12
2	10	12
3	10	12
4	10	12
5	10	12
6	18	22
7	06	06
8	10	12
Total	**84**	**100**

3.6 FOODCHEMISTRYANDNUTRITION

LTP

6 - 6

RATIONALE

Diplomaholdersinfoodtechnologyarerequiredtotestthefoodproductsinthelaboratoriesandshould havetheoreticalaswellaspracticalunderstandingoffoodchemistry and nutrition, which relates to different aspects of food chemistry and nutrientssuch as water, carbohydrates, fats, protein, minerals, vitamins, food pigments, enzymesetc.Hencethesubject isincludedfordevelopingthesecompetencies.

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthecourse thestudents will beable to

- Understandthechemistryofwaterandcarbohydrateandtheirinteractionwith other food components
- Understandthebasicstructureoflipidandreactioninvolvedduringprocessing
- Understandthechemistryandpropertiesoffoodproteinsandmodificationoffood proteins duringprocessing
- Determinationandanalysisoffoodconstituents
  - Understandthe basicconcepts of foodnutrition and RDI
  - Understandthedigestionofnutrients inthehuman body
  - Formulatedifferentdiets
  - Calculatecalorificvalue offood
  - Performsensoryanalysisoffood

DETAILEDCONTENTS

1. Importanceoffood.Scopeoffoodchemistry (02Periods)

2. Introductiontocolloidalchemistryanditsroleinfoodproduction (05Periods)

3. Introduction to different food groups (cereals & pulses, meat & fish & poultry,milk & milk products, fats & oils, vegetables & fruits, sugar &jaggery, spices andcondiments&theirclassificationandimportance
(05Periods)

4. Water (09Periods)
Structureofwatermolecule,typesandpropertiesofwater,wateractivityanditsimportance

5. Carbohydrates (09Periods)
Basiccomposition,classification,sources,nutritionalandindustrialimportance

6. Proteins (09Periods)
Basiccomposition,classification,sources,functional,nutritionalandindustrialimportance

7. Fats (09Periods)
Basiccomposition,classification,sources,nutritionalandindustrialimportance

8. VitaminsandMinerals (09Periods)
Functionandsourcesofminerals-calcium,iodine,zinc,iron,floride,fatsolubleandwater-solublevitamins,effect ofprocessingandstorageonvitamins

9. Deficiencydisordersandrequirementofdifferentnutrients(Calcium,Iodine,vitamin-A,iron,proteinandcalorieorenergy. (03Periods)

10. ConceptofBalancedDiet. (03Periods)

11. FoodPigments (09Periods)
Importance andplant sourcesofpigments(Chlorophyll,Anthocyanin, carotenoids,lycopene)

12. Enzymes (09Periods)
Definitions,modeofaction,importancesources, nomenclatureandclassification

13. Foodadditives –definitionandimportanttypes (03Periods)

LISTOFPRACTICALS

1. Determinationofmoistureinagivenfoodsample

2. Determinationofproteininagivenfoodsample

3. Determinationofcarbohydratesinagivenfoodsample

4. Determinationofashinagivenfoodsample

5. Determinationoffatinagivenfoodsample

6. DeterminationofpHofagivensample

7. Determinationofacidityofgivenfoodsample/beverage

8. Determinationoftotalnonreducingand reducingsugars

9. DeterminationofvitaminCingivenfoodsample

10. Determinationofdiastaseenzymeactivity

11. Identificationofpigmentsinagiven foodsample

12. EffectofBakingSodainCO_2 production

13. DetectionofSaccharineinbeverages

14. Visittohospital/slideshowonvariousnutritionaldeficiencydisorders

Note: Wherevernecessaryequipmentarenotavailablestudentsmaybedemonstratedthattopicinrelevant industryorinanyotherinstitute.

INSTRUCTIONALSTRATEGY

This is one of the basic subjects for the diploma holders in food technology. Teachershoulddesignappropriatetutorialexercisesforthestudents.Studentsmay begivensufficient practice on different experiments, individually, under the guidance of teacher.Teachersmayalsopreparechartsandslides.Studentmaybetakentoindustryforshowingdifferenttests.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. EssentialsofFoodandNutritionbySwaminathanVol.IandII,HealthKalyanipublishers,NewDelhi
2. FoodChemistrybyLHMeyer,VanNostrandReinholdCo.NewYork**...**
3. HandbookofAnalysisofFruitsandVegetablesbyS.Ranganna,TataMeGraw-Hill.PublishingCompany,NewDelhi
4. BiochemistrybyMohinderSingh,SejwalPublisher.NewDelhi
5. IntroductiontoBiochemistrybyBraverman,ElsevierScientificPublishing
6. FoodChemistrybyLinhinger,CBSPublishers,Delhi ...
7. FoodChemistrybyFANNEMA,
8. HandBookofFood&NutritionbySwaminathan,NarosaPublishingHouse,NewDelhi
9. AText BookofBiochemistryA.V.S.S.RamaRao,UB SPublishers,NewDelhi
10. AText BookofBiochemistryA.K.Berry, Narosa PublishingHouse
11. Nutrition&DieteticsbyJoshi,TataMcGraw-HillEducation,New Delhi
12. ClinicalDieteticsandNutritionbyAntia&Abraham,OxfordUniversityPress,USA

13. ChemicalChangesinFoodDuringProcessingbyRichardson,JohnW.Finley...AviPublishin gCoInc.
14. FundamentalsofFood&NutritionbySumatiR.Mudambi,PublishedbyNewAge International (P)Ltd.,
15. Nutrition&DieteticsbyRose
16. FoodsciencebySri Laxmi,NewAge InternationalPublishers,NewDelhi
17. Foodchemistry(Narosapublication)byH.K.ChopraandP.S.Panesar(2010),Published ByMorgan& Claypool

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	02	02
2	05	06
3	05	06
4	09	10
5	09	10
6	09	10
7	09	10
8	09	10
9	03	06
10	03	04
11	09	10
12	09	12
13	03	04
Total	**84**	**100**

4.1 MILKANDMILKPRODUCTS TECHNOLOGY

LT	P
6 –	2

RATIONALE

This subject is aimed at developing an understanding of various process technologies andhandlingofequipmentusedintheprocessingandvalueadditionofmilkandmilkproductsinthestudents.

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthecourse thestudents will beable to

- Understandscenarioofmilkindustry,compositionalvariability ofmilk andstandards ofmilk &milk products
- Explainthemarketmilkprocessingtechnology&defectin marketmilkduringprocessing

DETAILEDCONTENTS

1. Introduction–Statusandscope ofdairyindustryin India (04Periods)

2. FluidMilk (14Periods)

   Definitionofmilk,composition,physicalandchemicalpropertiesofmilkconstituents and nutritive value of milk, factors affecting composition of milk,typesofmilk,

   Physico-chemical properties of milk: Colour, flavour, taste, specific gravity,&density, boiling and freezing point, refractive index, acidity and pH, viscosity,surfacetension,thermalconductivity.Basis forpricingofmilk

3 Qualitycontroltests (08Periods)

   Platformtestslike-
   smell,appearance,temp,sediment,acidity,lactometerreadingChemical/Laboratorytest: Acidity,PH,alcohol,fat,SNF,etc.

   Microbiological:SPC,MBRT,Resazurintestsetc.

4. FluidMilkProcessing (10Periods)

   Receiving,Filtrationandclarification,straining,standardizationHomogenizationanditseffects,Pasteurization:andvarioussystemsofPasteurization;LTLT,HTST,UHTmethods,Pasteurizers(Heatingsystem,cooling system, flow controller, regenerator, flow division

valve) sterilization,packagingoffluidmilk

5. CoagulatedMilkProducts (08Periods)

Channa,paneer,classificationandmanufacturingprocessofcheese

6. Cream/Butter/Ghee–Manufactureandstorageofbutterand ghee (08Periods)

7. CondensedMilk (08Periods)

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

8. DryMilkProducts (08Periods)

Methodsofdryingmilk(DrumandSpraydrying),factorsaffectingthequalityofdrymilk.Introductiontoinstantnon-fatdrymilkpackagingofdrymilkproducts

9. FrozenProducts (05Periods)

Manufacturingofandicecream;factors affectingthequalityoffrozenproducts

10. Cleaningandsanitationofdairyplantandequipment (06Periods)

11. Utilizationofby-productsofmilkprocessingindustry:skimmilk,buttermilk,whey,casein (05Periods)

LISTOFPRACTICALS

1. Toconductplatformtest ofmilk

2. DeterminationofSNF(SolidsNotFat),specificgravity,totalsolidsofmilk.

3. Testingefficacyofpasteurizedmilk

4. Determinationofmoisture&fatcontentofmilkpowder

5. Studyoffamiliarizationwithvariouspartsandworkingof creamseparator

6. PreparationofKhoa

7. Detectionofadulterantsinmilklikewater,urea,neutralizers,preservatives,sucrosestarch

8. Preparationofchannaandpaneer

9. Preparationoficecream

10. Visitstodifferentdairyplants

11. Toperformsamplingof milk

12. Determinationoftitrableacidityofmilk

13. Determinationoffatbygarbermethod

Note: Whereverthe requiredequipment'sarenotavailablestudentsmaybedemonstrated that topictheindustryorother

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitabletutorialexercisesmaybedesignedbytheteachers,whichrequirestudentsvisittovari ousindustries.StudentsmayalsobeexposedtovariousNational,BISandinternationalstandards.Vis itstotherelevantindustryfordemonstratingvariousoperations involved in the dairy technology, is a must. Experts from the industry may beinvited to deliver lectures on the latest technology.Knowledge about pollution controland devices for the same may be provided to the students. Wherever relevant, studentsmaybemadeawareabout safetyaspects.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. MilkandMilkProductsbyEcklesandEckles,Tata*McGraw-HillEducation*Pvt. *Limited*;
2. Outlines ofDairyTechnologybySukmar De, OxfordUniversityPress,India
3. DairyPlantSystemandLayoutbyTufailAshmed,McGraw-HillEducation(India)PvtLtd
4. Principles ofDairyTechnologybyWoarner, OxfordUniversityPress,India
5. DairyEngineeringbyForvall
6. Milk&MilkProductsbyCBSE,OxfordandIBH*Publishing* Co.,NewDelhi
7. Chemistry& TestingofDairyProducts byAthertonNewlander,JohnAlvin *NewlanderPublisher*:Westport

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	04	03
2	14	18
3	08	10
4	10	12
5	08	10
6	08	10
7	08	10
8	08	10
9	05	05
10	06	06
11	05	06
Total	**84**	**100**

4.2 FRUITSANDVEGETABLESTECHNOLOGY

LT		P
6	–	2

RATIONALE

This subject is aimed to develop an understanding in processing techniques and skills inhandling equipment/machines used for preservation and value addition of perishables likefruitsandvegetables.

LEARNING OUTCOMES

Onthesuccessfulcompletionofthecourse, studentswill beableto

- Discussthefactorsaffectingtheshelflifeof fruitsandvegetables
- Understandthephysiologicalchangesinfruitsafterharvesting
- Understandtheroleandimportanceofpreservationtechniquesto improvetheshelflifeofseasonalfruits
- Understandtheprocessingoffruits,vegetables,spicesandplantation products
- Understandthetechnologybehindcanningoffruitsandvegetable products

DETAILEDCONTENTS

1. Introduction (06Periods)

   Statusandscopeoffruitsandvegetablesindustryin India,classification,compositionandnutritivevalueoffruitsandvegetables

2. PreparatoryOperationsandRelatedEquipments(10Periods)

   Cleaning,sorting,grading,peelingandblanchingmethods

3. a) Ingredientsandprocessesforthemanufactureof: (16Periods)
      i) jam,jellies,marmalade,preserves,(ii)picklesandchutneys

   b) Defectsandfactorsaffectingthequalityofabove

4. TomatoProducts (06Periods)

   Ingredients and their role, process for the manufacture of tomato ketchup, sauce,pureeandpaste.

5. Juices (06Periods)

Rawmaterials,extraction,classification,processingandasepticpackaging

6. ThermalProcessingofFruitsandVegetables (16Periods)

History, definition, various techniques of thermal processing and their effects onthequalityoffruitsandvegetableproducts,typesofcontainersandtheirselection,spoilage ofcannedfoods

7. a) Dehydration of fruits; equipment and process for dehydration of plums,apricot,apple,fig,grapespeachetc (06Periods)

   b) DehydrationofVegetables:equipmentandprocessfordehydrationofpeas,cauliflower,potato,methi,mushroom,tomatoetc

   c) Osmo-dehydration–basicconceptandapplications

8. Freezing (06Periods)

Freezingprocessofselectedfruitsandvegetables:peas,beans,cauliflower,apricot,mushroom–changesduringfreezingandspoilageoffrozenfoods

9. FoodLaws andFPOstandardsfor fruitsandvegetableproducts (06Periods)

10. By-productsutilization (06Periods)

LISTOFPRACTICALS

1. Orientationtodifferentprocessingequipments,theirfunctionsanduses
2. PreparationofJam,jellyandpreserve
3. Preparationofpicklebyvariousmethods
4. Preparationofchutney
5. Extractionoftomatojuicebyhot andcoldbreakmethods
6. Preparationoftomatosauce/ketchup
7. Preparationoftomatopuree/paste
8. Extractionofjuicebyvariousmethods
9. Bottlingandprocessingoffruitjuice
10. Preparationofsyrupand brinesolutions
11. Dehydrationofpeas,potatos
12. Dehydrationofgrapes andapples
13. Freezingofpeas
14. Preparationoftomatopowder
15. Visitstodifferentfruitandvegetableprocessingindustries

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitable tutorial exercises may be designed by the teachers, which requirestudents visitto various industries. Students may also be exposed to various National and internationalstandards. Visits to the relevant industry for demonstrating various operations involved infruits and vegetables processing, is a must. Experts from the industry may be invited todeliver lectures on the latest technology. Knowledge about pollution control and devicesfor the same may be provided to the students. Wherever relevant, students may be madeawareabout safetyaspects.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. FruitsandVegetablePreservationbyGirdhariLalandSidappa;ICAR(NewDelhi)
2. PreservationofFruitsandVegetablebySrivastava; IBDCo., Lucknow
3. PreservationofFruitsandVegetablebyVijayaKhader;KalyaniPublication
4. PostHarvestTechnologyofFruitsandVegetables– Handling,Processing,FermentationandWasteManagementyLRVermaandVKJoshi
5. ProcessingFruits:Science&Technologyvol1-2bySomogyi
6. ProcessingVegetables:Science &Technologyvol 1-2bySomogyi
7. TheTechnologyof FoodPreservationbyDesrosier
8. FoodSciencebyPotter
9. FoodSciencebyMudambi
10. BasicFoodPreparation(Manual)
11. Fruit&VegetableProcessingbyBhatt,Verma
12. CommercialVegetableProcessingbyWoodroof
13. PreservationofFruits&VegetablesbyIRRI
14. FoodCanningTechnologybyLarcousse&Brown
15. FoodComposition&PreservationbyBhawnaSabarwal
16. FoodPreservationbyS.K.Kulshrestha
17. ProcessingFoodsbyOliverra

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	06	06
2	10	10
3	16	16
4	06	08
5	06	08
6	16	18
7	06	10
8	06	08
9	06	08
10	06	08
Total	**84**	**100**

4.3 MEAT, FISH & POULTRY PRODUCTS TECHNOLOGY

RATIONALE **LT P**
4– 2

This subject is included in the curriculum to impart basic knowledge and skills of varioustechnologies and equipment used for production of raw as well as processed meat, fishandpoultryproducts,inthestudents.

LEARNING OUTCOMES

- Understandtheconceptofmethodsinvolvedinmeatandmarine productsprocessing
- Understandtheconceptofmethodsinvolvedinpoultryandegg processing
- Understandthemajorbiochemicalreactionsthataffectsthequalityofmeatandmeatproducts

DETAILEDCONTENTS

1. IntroductiontoIndianmeat,fishandpoultryindustry (03Periods)

2. Preparatoryoperationsofmeatandmeatproducts (20Periods)

   Composition of muscle, Different types of slaughtering methods, Different typesofmeatents,Antimortamandpost-morteminspectionofanimal/slaughteredanimal,Abattoir–Definitionandconstruction;basicpreparatoryprocedures(culmination,emulsification,pre-blending)Curedandsmokedmeats,sausageproducts–classification,processingsteps,andcannedmeat,meatpickles

3. HandlingandDressingofPoultry (07Periods)

   Inspection of poultry birds, dressing and preparation of ready to cook poultry,factorsaffectingthequality

4. EggandEggProducts (07Periods)

   Structure,chemicalcompositionandnutritivevalue,spoilageofeggsandpreservationofwholeeggandeggproducts,preparationofeggpowder

5. FishandFishProducts (07Periods)

   Types of fish, composition and nutritive value, judging the freshness of fish, fishgradingandcookingoffish,smoking,pickling,saltinganddehydration,preservationoffi

shandprocessedfishproducts

6. FrozenStorageoffreshandprocessedmeat,poultryandfish (05Periods)

7. By-productsofmeat,fish,poultryandeggindustry (07Periods)

LISTOFPRACTICALS

1. Demonstrationofslaughteringanddifferent cutsinmeatataslaughterhouse
2. Preparationofdifferenttypesofmeatproductsandtheirqualityevaluation
3. Cuttingofmeat
4. Preparationofsausages
5. Calculationofshapeand sizeindex ofegg
6. Preparationof readytocookpoultry
7. Retailcutsofdressedchicken
8. Calculationofhoggunitofegg
9. Measurementofaircellofegg
10. Determinationofeffectoftemperatureoncoagulationofeggprotein
11. Determinationofmoistureandsolidcontentofdifferenteggconstituents
12. Determinationofspecificgravityofeggs
13. Preparationofeggpowder
14. Preparationoffish,meatandeggpickle
15. Candlingand gradingofeggs
16. Ironsulphideformationincookedeggs
17. Preservationofwholeegg
18. Visittoslaughterhouses andabattoir
19. Demonstrationoffiltering&stakingoffish

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitabletutorialexercisesmaybedesignedbytheteachers,whichrequirestudentsvisitto various industries. Students may also be exposed to various National and internationalstandards.Visitstotherelevantindustryfordemonstratingvariousoperationsinvolved ,in the fermentation of food, is a must. Experts from the industry may be invited to deliverlectures on the latest technology. Knowledge from pollution control and devices for thesame may be provided to the students. Wherever relevant, students may be made awareaboutsafetyaspects.

MEANS OF ASSESSMENT

– Assignments and quiz/class tests, mid-semester and end-semester written tests

- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. MeatSciencebyLawrie,HeinemannEducational*Books* Ltd.,London
2. EggScienceandTechnologybyMountney,AVI*Publish*co.,.Westport
3. EggScienceandTechnologybyPCPande,Vikas*Publishing* House(P)Ltd,NewDelhi
4. FishProcessingandPreservationbyCLCutting(AgroBotanicalPublisher)
5. Poultry,MeatandEggProductsbyParkurshtandMountney(CBS Publishers)
6. FishandFishProducts byALWinton, Hill*Book*CompanyU.K.
7. TheCanningofFishandMeatbyRJFootillandASLewis(BlackiePublishers)
8. ProcessedMeatbyPearsonandGlite(CBSPublishers)
9. FermentedMeatbyCampbellPlattandPECook(BlackiePublishers)
10. FishProcessingTechnologybyGMHall (Blackie Publishers)
11. IntroductiontoFishTechnologybyJMRegensteinandCERegusten(CBSPublishers)

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	03	04
2	20	38
3	07	12
4	07	12
5	07	12
6	05	10
7	07	12
Total	**56**	**100**

4.4 RENEWABLE ENERGY SOURCES

L	T	P
4	-	-

RATIONALE

Energy is an important input in all sectors of country's economy. Standard of living of a country can be directly judged by per capita consumption of energy. In light of energy crises and environmental concerns, renewable energy is the only solution to save our planet. Hence this subject.

LEARNING OUTCOMES

After completion of this course, the students will be able to:

- Understand the importance and applications of various renewable sources of energy
- Understand the types of biogas plants and electricity generation from biomass
- Identify usage of different types of wind turbines
- Understand the working of various types of collectors and applications of solar energy
- Understand different geothermal power plants
- Understand the usage of tidal and wave energy
- Understand the importance of hydrogen energy

DETAILED CONTENTS

1. Renewable and Non-Renewable Sources of Energy (06 Periods)

    1.1. Introduction
    1.2. Need of renewable sources of energy
    1.3. Renewable sources of energy such as biomass, wind, solar, geothermal, and tidal and wave, hydrogen energy.

2. Biomass Energy (08 Periods)

    2.1. Introduction to biomass energy
    2.2. Resources of biomass energy
    2.3. Types of biogas plants-fixed dome and floating type
    2.4. Electricity generation from biomass
    2.5. Other useful products from biomass

3. Wind Energy (06 Periods)

    3.1. Introduction to wind energy
    3.2. Site selection of wind mill
    3.3. Types of Wind Turbines-Horizontal axis wind turbine (HWAT) and vertical axis wind turbine (VAWT), their construction, working, advantages and disadvantages

4. Solar Energy (20 Periods)

4.1. Introduction to solar energy, solar spectral and greenhouse effect
4.2. Classification of solar thermal collectors- flat type, focusing type and central tower receivers, their construction and working
4.3. Application of solar energy like solar cooker, solar water heater, solar crop dryers and solar pond
4.4. Solar photo voltaic- construction and working principle
4.5. Solar energy storage methods

5. Geothermal Energy (06 Periods)

5.1. Introduction and its significance
5.2. Geothermal Power Plants-dry stream, flash steam and binary cycle

6. Tidal and Wave Energy (06 Periods)

6.1. Generation of Tidal and Wave Energy
6.2. Tidal Power Plant
6.3. Wave Power Plant

7. Hydrogen Energy (04 Periods)

7.1. Methods for hydrogen production
7.2. Storage of Hydrogen
7.3. Transportation of Hydrogen-through pipelines and containers

INSTRUCTION STRATEGY

This subject is of great importance, therefore the teachers are expected to lay considerable stress on renewable sources, their importance, production, utilization and storage system. As far as possible, the teaching of the subject must be supplemented by showing the videos on working principle of various renewable energy equipment and also visits to nearby places where such equipment is installed.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Non-Conventional Energy Sources by G.D. Rai; Khanna Publishers, New Delhi.
2. Renewable and Conventional Energy by S. Rao; Khanna Publisher, New Delhi
3. Non-Conventional Sources of Energy by Umesh Chandra Sharma; Studium Press, Texas, USA
4. Solar Energy by S.P. Sukhatme; Tata McGrawHill Publishing Co. Ltd., New Delhi

SUGGESTEDDISTRIBUTIONOFMARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	10
2	08	14
3	06	10
4	20	38
5	06	10
6	06	10
7	04	08
Total	**56**	**100**

4.6 BAKERY AND CONFECTIONERY TECHNOLOGY

L T P
6– 2

RATIONALE

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

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthecourse thestudents will beable to

- Understandthecomposition,structureandstorageof bakery products
- Understand the technologyof bakery processingand itsproducts
- Understandthetraditionalandmodernmillingoperationsandtechnologyof bakeryand extruded products
- Understandtheprocessingofbakeryandandtheirvalueadded products
- Understandtheprocessingofbakeryandutilizationoftheir byproducts

DETAILED CONTENTS

1 Introduction – Status of Bakery industry in India (04Periods)

2 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

3 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

4. Confectionery Products (15Periods)

Introduction, classification of confectionery products, confectionery ingredients like starch, fats, colours, flavours additives. Brief account of sweeteners like Gur, refined sugar, beet

sugar, white sugar and liquid sweeteners like Molasses, corn syrup, high fructose syrup, maple syrup. Reaction of sugar like caramelization, hydrolysis sand crystallization, sugar boiled, chocolate and Indian confectionary

5. Layout, setting up of units and hygienic conditions required in bakery plant, operation and maintenance of bakery equipment (15Periods)

LIST OF PRACTICALS

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

2 Preparation and evaluation of bakery and confectionery products: a) Bread b) Cakes c) Biscuits d) Buns e) Pizza f) Candy like ginger g) Kulcha

3 Study and analysis of the production charts used for different products by bakery industries

4 Visits to bakery and confectionery 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 the Bakery and Confectionery processing is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- 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

7 Practical Handbook of Bakery by US Wheat Associates

SUGGESTEDDISTRIBUTIONOFMARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	6
2	15	16
3	35	46
4	15	16
5	15	16
Total	**84**	**100**

4.6 CEREALSANDPULSES TECHNOLOGY

RATIONALE **LTP**
6– 2

Thissubjectisaimedatimpartingknowledgeandskillsrelatedtotheprocessingtechniques, value addition, and handling of processing equipment of cereal, pulses and oilseeds to the students, as the understanding of these aspects is essential for diploma holdersinfoodtechnologytoperform efficientlyandeffectivelyintheindustry.

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthecourse thestudents will beable to

- Understandthecomposition,structureandstorageoffood grains
- Understand the technologyofpaddyprocessingand itsproducts
- Understandthetraditionalandmodernmillingoperationsofwheatandtech nologyof bakeryand extruded products
- Understandtheprocessingofcoarsecerealsandlegume-pulsesandtheirvalueadded products
- Understandtheprocessingofoil&oilseedsandutilizationoftheirbyproduc ts

DETAILEDCONTENTS

1. Introduction (11Periods)

Status,productionandmajorgrowingareasofcereals,pulsesandoilseeds inIndiaandworld
Structureandchemicalcompositionofcereals,pulsesandoilseeds,aniti-nutritionalfactors whereverapplicable

2. Cerealsandmillets (51Periods)

2.1 Wheat:typesofwheat,conditioningandtempering,typesofwheatmillingtechnolog y,pastaandextrudedproducts

2.2 Rice: Varieties of rice, classification of rice based on various physicalparameters,parboiling, millingofrice,andfactorsaffectingqualityofriceproducts

2.3 Maize:Classificationofmaize,dryandwetmillingofcorn,preparationofcornflakes

2.4 Barleyandsorghum:Graincharacteristics,technologyofmaltproduction,milling,malt ingandpoppingofsorghum

2.5 Differentmilletsandtheirchemicalcomposition,processingandutilization

3. Pulses (11Periods)

Pretreatmentofpulses formilling,millingofmajorpulses

4. By-productutilizationofdifferentmillingindustries (11Periods)

LISTOFPRACTICALS

1. Determinationofphysicalcharacteristicsof(a)rice(b)wheat(c)pulses(d)maize (e)barleyandsorghum(f)oil seeds

2. Millingofwheattostudyitseffectonvariousphysico-chemicalproperties

3. Estimationofflourquality:Gluten,Ash,WaterAbsorptionPower(WAP)SedimentationTest ,MaltoseValue,PelshenkeValue

4. Parboilingandmillingofrice

5. Pre-treatmentandmillingofpulses

6. Demonstrationofoilextractionandrefiningofoil,andvisittorelevantindustry

7. PreparationofPastaproducts–Noodles,Macroni, Vermicelli(Sevian)

8. Preparationofready-to-eat(RTE)foodproductsbyextrusioncookingtechnology

9. Visitsto flourmill, RiceMill/RiceSheller,Dhal Mill,Oilexpelling Unit, RefiningUnits,MillingandBrewingUnits

INSTRUCTIONALSTRATEGY

This being one of the most important subjects, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitable tutorial exercises may be designed by the teachers, which require students visit tovariousindustries.StudentsmayalsobeexposedtovariousNational,BISandinternationalstandards.Visitstotherelevantindustryfordemonstratingvariousoperations involved in the cereal, pulses, and oilseed processing is a must. Experts fromthe industry may be invited to deliver lectures on the latest technology. Knowledge frompollution control and devices for the same may be provided to the students. Whereverrelevant,students maybe madeawareabout safetyaspects.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. CerealTechnologybyKent,CBS
2. WheatChemistryandTechnologybyYPomeranz,AACC
3. PostHarvestTechnologyofCerealspulsesandoilseedsbyChakrabortyAC,IBH
4. RiceChemistryandTechnologybyJulian,AACC
5. ChemistryofTechnologyofCerealsasFoodandFeedbyMatz

Note: Whereverequipmentsarenotavailablestudentsmaybedemonstratedthattopicrelevantindustryorin anyotherinstitutions.

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	11	14
2	51	54
3	11	16
4	11	16
Total	**48**	**100**

5.1 PRINCIPLESOFFOODPROCESSINGANDPRESERVATION

L	T	P
6	–	4

RATIONALE

Knowledge and skills related to food processing and preservation are essential for thediplomaholderinfoodtechnology.Inthissubject,studentsareexposedtovarioustechniques of food preservation such aslow temperature,high temperature, moistureremoval,chemicalsandradiationpreservation.Relevantskillswillalsobeimpartedthrough this subject

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthe coursethestudentwill beable to

- Learnabouttheprocessingandpreservationofperishableandsemiperishablefood products
- Understandfundamentalprinciplesoffood preservation
- Understandtheprinciplesoflowtemperaturepreservation
- Understandtheprincipleofthermalprocessingandapplying high temperatureprocessingin food industry
- Understandtheconceptofwateractivityandpreservationby reductionofwaterremoval
- Understandtheprinciplesofnon-thermalpreservationmethods

DETAILEDCONTENTS

1. Scopeandtrendsinfoodindustry (12Periods)

   Status of Indian food industry with emphasis on State of Haryana. Definition offood – food technology, food science, food preservation and food engineering – basicconsiderations.Importanceoffoodprocessingandpreservation.Classification of foods on the basis of shelf life, pH, origin; Different types of foodspoilage viz. microbiological, bio-chemical, chemical, physical and their effects onfoodquality. Principles offoodpreservation.

2. Preservationbysugarandsalt (08Periods)

   Principles of Salt and sugar preservation, Intermediate Moisture Food (IMF) likejam,jellyandmarmalade.Techniquesofpickling.

3. PreservationbyLowTemperature (12Periods)

Low temperature required for different foods – refrigeration – refrigeration load,refrigeration systems; slow and fast freezing, freezing process; types of freezeradvantagesanddisadvantagesoffreezing;storage andthawingoffrozenfood.

4. PreservationbyHighTemperature (12Periods)

Pasteurization, Sterilization, Canning: their Definition, Method, advantages anddisadvantages.

5. MoistureRemoval (18Periods)

Evaporation, concentration, drying and dehydration, types of dryers, advantagesanddisadvantages,selectionofdryers.

6. FoodAdditivesincludingChemicalPreservatives-Classification,functions anduses

infoods (12

Periods)

7. Preservation of foods by Radiation – Irradiation of foods, Radiation doses forspices, onions, potatoes and meat. Concept of microwave heating effect on foodquality (10Periods)

LISTOFPRACTICALS

1. Studyofchangesinfruits/vegetablesduringstorage
2. Peelingoffruitsandvegetables
3. Preparationofbrineand syrup
4. Blanchingofseasonalfruitsandvegetables
5. Dehydrationoffruits&vegetables
6. Preparationoffruitbars
7. Freezingofseasonalvegetables,meatand fishproducts
8. PreparationofJam,Jelly&squash
9. Picklepreparation
10. Storageoffrozenproducts
11. Preparationofsauerkraut

12. Visittofruitsandvegetableindustrytosee aboveoperations

INSTRUCTIONALSTRATEGY

This being one of the most basic subjects for the students of food technology, the teachersshould lay a lot of emphasis on explaining the facts, concepts, principles and proceduresinvolved in various topics. The students should be given appropriate tutorial exercises.Teachers should make use of chart and other appropriate media to support classroominstruction. Emphasis during the practical session should be on performance by individualstudents and teacher should develop instructional manual for various exercises to facilitatethe students. Visits to some of the local industries and quality control centers may bearrangedtodemonstratevariousaspectsoffoodtechnologyandpreservationandprinciple involved therein to the students. Experts may be invited to deliver lecturers onlatestdevelopments inthefield.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDEDBOOKS

1. FoodSciencebyNNPotter,CBS publishers,NewDelhi
2. TechnologyofFoodPreservationbyDesrosier,TheAviPublishingCompany,Inc.,Westport
3. PrinciplesofFoodScienceVol.– IbyFennema,Karrel,McGraw-HillBookCompany,NewYork
4. PreservationofFruitsandVegetablesbyGirdhariLal,SidhapaandTandon,CBSPublishers,Delhi
5. HandbookofAnalysisofFruitsandVegetablesbySRanganna,TataMeGraw-Hill.PublishingCompany,NewDelhi
6. FruitsandVegetableProcessingbyCruss,OxfordandIBHPublishingCo.,NewDelhi
7. FoodSciencebyMudambi,NewAgeInternationalPvtLtdPublishers,NewDelhi
8. BasicFoodPreparation(Manual)
9. Fruit&VegetableProcessingbyBhatt,Verma,TataMcGrawHillPublishingCompany Limited,.NewDelhi
10. CommercialVegetableProcessingbyWoodroof, vannostrandReinhold,NewYork
11. PreservationofFruits&VegetablesbyIRRI, Oxford&IBHPublishing,NewDelhi
12. FoodCanningTechnologybyLarcousse&Brown
13. FoodComposition&PreservationbyBhawnaSabarwal,Commonwealth *Publishers* 1999,NewDelhi.
14. FoodPreservationbyS.K.Kulshrestha,vikas*publishing*housePvt.Ltd.,NewDelhi
15. ProcessingFoodsbyOliverra,CRCPress,New York
16. Principles&PracticesfortheSafeProcessingofFoodsbyHeinz,HJ*Heinz* Company,UK

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	12	16
2	08	12
3	12	12
4	12	12
5	18	22
6	12	14
7	10	12
Total	**84**	**100**

5.2 POLLUTIONCONTROLANDINDUSTRIALSAFETY

L T P 5- 4

RATIONALE

A Chemical Engineering technician must have the knowledge of different types of pollution causeddue to industrialization so that he may help in balancing the eco-system and control the pollution bymeans of control devices. The technician must know various types of accidents which occur inchemicalplantsandhowtosafeguardthemtoavoidinjurytomenandmaterial.Hencethissubject.

LEARNINGOUTCOMES

Aftercompletionofthiscourse, thestudentswillbeableto:

- Understanddifferenttypesofpollutioncausedduetoindustrialization.
- Balancepollutantstosavetheecosystem
- Controlpollutionbymeansofcontroldevices
- HaveknowledgeofdifferentActsandrulesabouttheenvironmentalprotection.
- Managesolidwastestoreducethepollution.
- HaveKnowledge ofvarioustypesofaccidentswhichoccurinchemicalplants

DETAILEDCONTENTS

1. Introduction (06 Periods)

   Environment and Pollution, Classification of pollution e.g. Land, Water, Air, Noise. Environment Impact assessment Studies, Character and origin of industrial wastes.

2. Air Pollution (06 Periods)

   2.1. Definition of air pollution, Types of Air pollutants and their sources like SPM, SOX, NOX, NH3, F, C1, CFC, CO2 etc.

   2.2. Air Pollution control equipment in industries.

      2.2.1. Settling chamber
      2.2.2. Cyclone
      2.2.3. Scrubber (dry & wet)
      2.2.4. Multicyclone
      2.2.5. Electrostatic precipitator
      2.2.6. Bag Filter

   2.3. Ambient air quality measurement & their standards

   2.4. Vehicular Pollution and its control
   2.5. Noise Pollution and its control mechanism

3. Water Pollution (06 Periods)

Water pollution, standards for drinking water, domestic waste water and industrial waste water. Methods of measurement of various parameter like BOD, SS, pH, COD, TDS etc. Methods of treatment of industrial waste water like

3.1. Chemical treatment
3.2. Physio-Chemical treatment
3.3. Bio-chemical treatment
3.4. Any other advance treatment

4. Environment Protection (10 Periods)

4.1. Environmental protection from hazardous chemicals waste:

4.2. Terminology relating to chemical hazards and air pollution, classification of chemical hazards and hazardous chemicals, codes of safety for operational hazards in laboratories, industries etc. (Reference should be made of I.S. Codes)

5. Radio Active Pollution (06 Periods)

Sources and effect on human, animal, plant and material. Measurement, means to control, preventive measures.

6. Solid Waste Management (08 Periods)

6.1. Municipal solid waste, biomedical waste, Plastic waste and its management, solid waste disposal methods such as open dumping, sanitary landfilling composting, incineration.
6.2. Importance of development of green area

7. Pollution Acts (08 Periods)

A water pollution prevention control Act 1974, Air Pollution Act 1981, Environment protection Act 1986, Hazardous chemical manufacturing, storage and impact rules 1989 and hazardous waste and management and handling rules 1989, Regulation and control Rules 2000.

8. Safety in Chemical Industry (20 Periods)

Receiving and storing chemicals- transporting and moving chemicals- Safety in chemical reactions, pipe-lines with color coding in chemical factories. Precautions in the case of processes in operations involving explosive or inflammable dusts, gases, vapors etc. Maintenance of chemical plants-corrosion health hazards in common chemical processes, Fire hazards and their prevention. Codes of practice and specification for safety equipment (Reference should be made from I.S. Codes), case study of major chemical process industries disasters/accidents.

LISTOFPRACTICALS

1. Determination of pH value.
2. Determination of turbidity
3. Determination of total solids, suspended solids and total dissolved solids.
4. Determination of dissolved oxygen (DO)
5. Determination of BOD.
6. Determination of COD
7. Determination of Sulphate in water
8. Determination of chloride in water
9. Prepare chart for treatments of different solid waste.
10. Removal of suspended impurities from air using fabric filter.
11. Removal of suspended solids by coagulation

INSTRUCTIONALSTRATEGY

- Case study of any disaster should be undertaken. Study should be data based Field visit to the industries should be planned.
- Student should encouraged to undertake project work related to environmental problems.

MEANSOFASSESSMENT

- Class Test
- Home Assignment
- Attendance
- Sessional Test

RECOMMENDEDBOOKS

1. Safety in Process Plant Design by Wells
2. Safety and Accident Prevention in Chemical Operation by H. H, Tanacatte and W. S. Wood
3. Engineering Chemistry by P.C. Jain

SUGGESTEDDISTRIBUTIONOFMARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	6	8
2.	6	8
3.	6	8
4.	10	14
5.	6	8
6.	8	12
7.	8	12
8.	20	30
Total	**70**	**100**

5.3 UNITOPERATIONSINFOOD PROCESSING

	LT		P
RATIONALE	**4**	**–**	**4**

This subject is aimed to develop an understanding among the students about variousmethods of handling, transportation and storage of food grains and perishables. It will alsoimpartknowledgeandskillsashowtominimizepost–harvestlossoffood commodities

LEARNING OUTCOMES

On thesuccessful completionofthecoursethestudentwillbeable to

- Describeanddiscusstheprocessingoffoodsintermsofcommonunit operationslikesizereduction,mixing,andseparation
- Apply his computational skills in calculating the energy required in size reduction, mixing operations.
- Understand the construction, working and applicability of various size reduction, mixing and separation equipments.
- analyze the optimum value of reflux ratio to achieve best quality product at minimum total cost in case of the continuous distillation system
- able to understand the principle and application of leaching and extraction process

DETAILEDCONTENTS

1. PreliminaryUnitoperation (06Periods)

   Cleaning,sorting&Grading-aims,methodsand applications

2. SizeReductionandSieveAnalysis (18Periods)

   Theory of comminution; Calculation of energy required during size reduction.Crushing efficiency; Size reduction equipment; Size reduction of fibrous, dry andliquid foods; effects of size reduction on sensory characteristics and nutritive valueoffood

   Sieving: Separation based on size (mesh size); types of screens; effectiveness ofscreens

3. Mixing (12Periods)

   Mixing,Agitating,kneading,blending,homogenizationandrelatedequipment

4. SeparationProcesses (20Periods)

PrinciplesofFiltration,Sedimentation,CrystallizationandDistillationandequipmentused

LISTOFPRACTICALS

1. Analysisofsampledfoodsforphysicalcharacteristics
2. Determinationofcritical speedofball-mill
3. Sizereductionandparticlesizedistributionusinghammer-mill
4. Steamdistillationofherbs
5. Concentrationbycrystallization
6. Clarificationofapplejuiceusingfilterpress
7. Visittoapublicdistributionsystem(PDS)showingstoragefacilities,warehouse,coldstorage ,refrigerationsystem andslaughterhouseetc
8. Visittovariousfoodindustriesfordemonstrationofvariousunitoperations

INSTRUCTIONALSTRATEGY

Teachers should prepare tutorial exercises for the students, involving visits to variousfood-processing units. These tutorials can be considered a mini projects.Students may beaskedtobringspecificationsandcataloguesfromindustries.Studentsmayalsobeexposed to relevant National, BIS and international standards. An intensive exercise onactual workbench performance in the industries is recommended. Experts may be invitedto deliver lectureson various themes.Useofaudio-visualaids willalso be usefulforbetterconceptualizationofvarious operations.

RECOMMENDEDBOOKS

1. Handling, Transportation and Storage of Fruits and Vegetables by A Lloyd, RyallPenizer(AVIPublications)

2. Proceedings of Regional Workshop on Warehouse Management of Stored FoodGrainsbyGirishandAshokKumar(UNDP)

3. ModernPotatoandVegetableStoragebyVolkindandRoslov(Amerind)

4. ControlledAtmosphericStorageofFruitsbyMettelSkilv

5. FoodGrainsinTropical andSubTropicalAreasbyHall

6. FoodStoragePartofasystembySinhaandMuir(AVI)

7. PostHarvestTechnologyofFruitsandVegetables–Handling,Processing,FermentationandWasteManagementbyLRVermaandVKJoshi;IndusPublishingcom.,NewDelhi

8. DryingandStorageofGrainsandOilseedsbyBrooker&Hall,CBS

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	06	08
2	18	34
3	12	20
4	20	38
Total	**56**	**100**

5.4 FOODPACKAGINGTECHNOLOGY

L T P
6 - 2

RATIONAL

The main objective of this subject is to impart knowledge and skills related to designingpackagingsysteminfoodproductsanddevelopingskillsinhandlingofpackagingequipment inthestudents

LEARNING OUTCOMES

Onthesuccessful completionofthecourse,students willbeableto:

- Understandbasicconceptofpackaging,printingandpackaginglaws&regulationsin food industries
- Understanddifferenttypesofpackagingmaterialandtheirpropertiesandapplythe knowledgein packagingvarious food commodities
- Understandtheselectionofpackagesforspecificfood&agriculturalcommoditiesand advancement in food packaging
- Analyzetheperformance andqualityofpackagingmaterials
- Understandthedesigningofstoragestructuresfor foodcommodities

DETAILEDCONTENTS

1. Introduction (05Periods)

   Definition,importanceandscopeofpackagingoffoods

2. PackagingMaterials (16Periods)

   Originofpackagingmaterials,types,properties,advantages&disadvantagesofpackagingmaterials

3. Typesofpackaging (16Periods)

   Vacuumpackaging,gaspackaging,MAP,CAP,activepackaging,asepticpackaging,ediblepackaging,shrinkpackaging

4. Brief Introductionto (12Periods)

   WVTR,GTR,burstingstrength,tensilestrength,tearingstrength,droptest,puncturetest,impact testetc.

5. PackagingRequirements (20Periods)

Packagingrequirements andtheirselectionforrawandprocessedfoods

5.1 Meat,fish,poultry, eggs
5.2 Milkanddairyproducts
5.3 Fruitsandvegetables
5.4 Cerealgrainsandbakedfoodproducts
5.5 Beverages
5.6 Snacks

6. PackagingMachinery (10Periods)

Bottling,canformer,formfillandsealmachines,bags–theirmanufacturingandclosing,vacuum packsunit,shrinkpackunit,tetrapackunit

7. Packagelabeling– functionsandregulations (05Periods)

LISTOFPRACTICALS

1. Identificationofdifferenttypesofpackagingand packagingmaterials
2. Determinationoftensilestrengthofgivenmaterial
3. Toperformdifferentdestructivetestsforglasscontainers
4. To perform non-destructive tests for glass containers suchasphysicalexamination
5. Determinationofwaxweight
6. Determinationoftearingstrengthofpaper
7. Measurementofthicknessofpackagingmaterials
8. Toperform grease-resistancetestinplasticpouches
9. Determinationofburstingstrengthofpackagingmaterial
10. Determinationofwater-vapourtransmissionrateforpaper
11. Demonstrationofcan-seamingoperation
12. Testingofchemical resistanceofpackagingmaterials
13. Determinationofdroptestoffoodpackage

14. Visittorelevantindustries

15. Introducingthestudentswiththelatesttrendsinpackagingconsultingthewebsitesandmagazines.

INSTRUCTIONALSTRATEGY

This being one of the most important subject, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitable tutorial exercises may be designed by the teachers, which requirestudents visitto various industries. Students may also be exposed to various National and internationalstandards. Visits to the relevant industry for demonstrating various operations involved inthe food packing technology, is a must. Experts from the industry may be invited todeliver lectures on the latest technology.Knowledge from pollution control and devicesfor the same may be provided to the students. Wherever relevant, students may be madeawareabout safetyaspects.

RECOMMENDEDBOOKS

1. HandbookofPackagingbyPaineandPaine;Morgan-Grampian*Publishing*Co.,NewYork(1976).

2. ManualofAnalyzingforFruitsandVegetablesProductsbySRanganna;CBS *Publishers*&Disttributor,NewDelhi.

Note: WhereverthenecessaryequipmentisnotavailablethestudentsmaydemonstratedThattopicinrelevant industryorinanyotherinstitute

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	05	04
2	16	18
3	16	20
4	12	16
5	20	20
6	10	14
7	15	08
Total	**84**	**100**

5.5 PRINCIPLESOFFOODENGINEERING

L	T	P
6	–	-

RATIONALE

Thissubjectisaimedtodevelopinthestudentstheknowledgeandskillsrelatedtovariousoperations ofprocess equipmentusedinfoodprocessingindustry

LEARNING OUTCOMES

Onthesuccessfulcompletion ofthe coursethestudentwill beable to

- Understandthe regulationsandstandardsoffoodanalysisand conceptofsampling
- Understandandapplythemethods forcompositionalanalysis of food
- Explainthemethodsforchemicalpropertiesandcharacterization of food
- Spectroscopyand chromatography

- Understandcoloranalysisandthe rheologicalmethodsinfood analysis
- Selectionand applythe appropriatemethod and instrument to performparticularanalysis

DETAILEDCONTENTS

1. Introduction (12Periods)

Unitsofmeasurementandtheirconversion
Physicalpropertieslikecolour,size,shape,density,specificgravity,thousand grain weight/bulk density, porosity, Rheological properties offoodmaterials andtheirimportance
Thermal conductivity, specific heat, thermal diffusivity and other physicalpropertiesoffoods

2. MaterialsandenergyBalance (12Periods)

Basicprinciples,totalmass&componentmassbalance,systemboundaries,material balance calculations, principle of energy balance, Heat, Enthalpy,calculationsofspecificheat.

3. FluidMechanics (20Periods)

Manometers,Reynoldsnumber,fluidflowcharacteristics,pumps– principles,types,andworkingofmost commonpumpsusedinfoodindustry

4. Heat and Mass Transfer during food processing – Modes of heat transfer i.e.conduction, convection and radiation. Different heat exchangers.Principle ofmasstransfer,diffusion. (20 Periods)

5. ThermalProcessingof Foods (12Periods)

Selection,operationandperiodicalmaintenanceofequipmentsusedinfoodindustry viz. pasteurizer, autoclave, heat exchangers, evaporators, driers, boilersetc.

6. Psychometry (08Periods)

Principleofpsychometryanditsapplication

INSTRUCTIONALSTRATEGY

This being one of the most basic subjects for the students of food technology, the teachersshould lay a lot of emphasis on explaining the facts, concepts, principles and proceduresinvolved in various topics. The students should be given appropriate tutorial exercises.Teachers should made use of chart and other appropriate media to support classroominstruction.Emphasisduringthepracticalsessionshouldbeonperformancebyindividual students and teacher should develop instructional manual for various exercisestofacilitatethe students.Visitstosome ofthe localindustriesmaybe arrangedtodemonstrate various equipment used in food processing Industries and cold stores to thestudents.Expertsmaybe invitedtodeliverlecturersonlatestdevelopmentsinthefield.

RECOMMENDEDBOOKS

1. PostHarvestTechnologyofCereal,PulseandOilSeedsbyChakraborty,AC,CBS *Publishers*,Delhi.

2. UnitOperationsinAgricultureProcessingbySinghandSahay,Vikas*Publishing* House(P)Ltd,NewDelhi

3. FundamentalsofFoodEngineeringbyBrennen, AVI*Publishing*Co.,Westport

4. FundamentalsofFoodProcessingEngineeringbyRomeoTToledo,AVI *Publishing*Co.,Westport,

5. AgriculturalProcessEngineeringbyHendersonandPerry,JohnWileyandSons,Inc.,NewYork

6. TransferProcessesandUnitOperationbyCJGeanKoplis,McGraw-Hill*Book* Co.,NewYork.

7. Physical PropertiesofPlantsandAnimal MaterialsbyNKMohsenin,Gordon andBreachScience*Publishers*,NewYork,USA

8. PrinciplesofFoodEngineeringbyTECharm,McGraw-Hill*Book*Co.,NewYork.

9. IntroductiontoFoodEngineeringbySinghRPandDRHeldmann,McGrawHill *Book*Co.,NewYork.

10. UnitObservationinChemicalEngineeringbyMcCabe,Smithandothers,McMillan*publishing*compony,Newyork

11. UnitOperationinFoodProcessingbyEarlle,oodhead*Publishing*Limited,Cambridge,England

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	12	16
2	12	16
3	20	22
4	20	22
5	12	16
6	08	08
Total	**84**	**100**

5.6 Universal Human Values

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2 - 0 -1

Course Objectives

This introductory course input is intended

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or value prescriptions.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

The syllabus for the lectures is given below:

- After every two lectures of one hour each, there is one hour practice session.
- The assessment for this subject is as follows:
- Sessions Marks (Internal): 20
- Practical Marks (External): 30
- Total Marks: 50

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and

Experiential Validation- as the mechanism for self-exploration

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material the Body'
2. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;

a. Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship

3. Understanding the meaning of *Vishwas*; Difference between intention and competence
4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva*as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj),* Universal Order (*SarvabhaumVyawastha)*- from family to world family!

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems

6. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations

7. To inculcate Human Values among Students: The Role of self ,Parents and Teachers

-Practice Exercises and Case Studies will be taken up in Practice Sessions.

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Practical assessment

Reference Material

The primary resource material for teaching this course consists of

a. The text book (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

b. The teacher's manual (Latest Edition)

R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
3. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming,*Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan VidyaekParichay,*Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if peoplemattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, *http://www.aktu.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology–the Untold Story*
6. Case study Hevade Bazar Movie

7. RC Shekhar , Ethical Contradiction ,Trident New Delhi
8. *Gandhi A., Right Here Right Now, Cyclewala Production*

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
Total	**42**	**100**

6.1 ENERGYCONSERVATION

LT	P
3 -	2

RATIONALE

The requirement of energy has increased manifolds in last two decadesdue to rapid urbanizationand growth in industrial/service sector. It has become challenging task to meet ever increasingenergydemands with limited conventionalfuels and naturalresources.Dueto fast depletion offossil fuels and a tremendous gap between supply and demand of energy, it is essential to adoptenergy conservation techniques in almost every field like industries, commercial and residentialsectors etc. Energy conservation has attained priority as it is regarded as additional energy resource.Energy saved is energy produced. This course covers the concepts of energy management and itsconservation. It gives the insight to energy conservation opportunities in general industry and detailsoutenergyauditmethodologyandenergyauditinstruments.

LEARNINGOUTCOMES

- After undergoing this subject, the students will be able to:
- Define principles and objectives of energy management and energy audit.
- Understand Energy Conservation Act 2001 and its features.
- Understand various forms & elements of energy.
- Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipment.
- Identify areas of energy conservation and adopt conservation methods in various systems.
- Evaluate the techno economic feasibility of the energy conservation technique adopted.

DETAILED CONTENTS

1. Basics of Energy

    1.1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
    1.2. Global fuel reserve
    1.3. Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
    1.4. Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

    2.1. Introduction to energy management, energy conservation, energy efficiency and its need
    2.2. Salient features of Energy Conservation Act 2001 & The Energy Conservation

(Amendment) Act, 2010 and its importance. Prominent organizations at Centre and State level responsible for its implementation.

2.3. Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating

3. Electrical Supply System and Motors

3.1. Types of electrical supply system
3.2. Single line diagram
3.3. Losses in electrical power distribution system
3.4. Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
3.5. Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
3.6. Electric Motors: Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors.

4. Energy Efficiency in Electrical Utilities

4.1. Pumps: Introduction to pump and its applications, efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps.
4.2. Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
4.3. Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5. Lighting and DG Systems

5.1. Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting.
5.2. DG Systems: Introduction, Energy efficiency opportunities in DG systems, loading estimation.

6. Energy Efficiency in Thermal Utilities

6.1. Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Ton of Oil Equivalent (MTOE)
6.2. Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do’s and Don’ts for efficient use of boilers and furnaces
6.3. Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
6.4. Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

    7.1. ECBC and its salient features
    7.2. Tips for energy savings in buildings: New buildings, Existing buildings

8. Waste Heat Recovery and Co-Generation

    8.1. Concept, classification and benefits of waste heat recovery
    8.2. Concept and types of co-generation system

9. General Energy Saving Tips Energy saving tips in

    9.1. Lighting
    9.2. Room Air Conditioner
    9.3. Refrigerator
    9.4. Water Heater
    9.5. Computer
    9.6. Fan, Heater, Blower and Washing Machin
    9.7. Color Television
    9.8. Water Pump
    9.9. Cooking
    9.10. Transport

10. Energy Audit

    10.1. Types and methodology
    10.2. Energy audit instruments
    10.3. Energy auditing reporting format

LIST OF PRACTICALS

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

INSTRUCTIONAL STRATEGY

1. Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications.

2. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

WEBSITES FOR REFERENCE

1. Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.
2. Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.
3. Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.
4. Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.
5. Energy Efficiency Services Limited (EESL). www.eeslindia.org.
6. Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

6.2 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
5	-	-

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

After undergoing this course, the students will be able to

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organization
- Have insight into different types of organizations and their structures
- Inculcate leadership qualities to motivate self and others
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organization
- Use marketing skills for the benefit of the organization
- Maintain books of accounts and take financial decisions
- Undertake store management
- Use modern concepts like TQM, JIT and CRM

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. Introduction (04 Periods)

    1.1. Concept /Meaning and its need
    1.2. Qualities and functions of entrepreneur and barriers in entrepreneurship
    1.3. Sole proprietorship and partnership forms and other forms of business organizations
    1.4. Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organization: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. Market Survey and Opportunity Identification/Ideation (04 Periods)

2.1. Scanning of the business environment

2.2. Salient features of National and Haryana State industrial policies and resultant business opportunities
2.3. Types and conduct of market survey
2.4. Assessment of demand and supply in potential areas of growth
2.5. Identifying business opportunity
2.6. Considerations in product selection
2.7. Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)

3.1. Preliminary project report
3.2. Detailed project report including technical, economic and market feasibility
3.3. Common errors in project report preparations
3.4. Exercises on preparation of project report
3.5. Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

4.1. Definitions and importance of management
4.2. Functions of management: Importance and process of planning, organizing, staffing, directing and controlling
4.3. Principles of management (Henri Fayol, F.W. Taylor)
4.4. Concept and structure of an organization
4.5. Types of industrial organizations and their advantages
4.6. Line organization, staff organization
4.7. Line and staff organization
4.8. Functional organization

5. Leadership and Motivation (08 Periods)

5.1. Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders
5.2. Motivation: Definition and characteristics, Importance of self-motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)

6.1. Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods
6.2. Material and Store Management: Introduction functions, and objectives, ABC Analysis and

EOQ

6.3. Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion

6.4. Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)

7.1. Introduction and importance of Healthy Work Culture in organization

7.2. Components of Culture

7.3. Importance of attitude, values and behavior

7.4. Behavioral Science – Individual and group behavior.

7.5. Professional ethics - Concept and need of professional ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

8.1. Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company

8.2. Objectives of Financial Management: Profit Maximization v/s Wealth Maximization

9. Miscellaneous Topics (10 Periods)

9.1. Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)

9.2. Intellectual Property Right (IPR): Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organizations on visit. Approach extracted reading and handouts may be provided.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/Prototype making.

RECOMMENDED BOOKS

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

2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

WEBSITES FOR REFERENCE

1. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	**70**	**100**

6.3 FOODS STORAGE AND TRANSPORTATION

L	T	P
6	–	2

RATIONALE

This subject is aimed to develop an understanding among the students about variousmethods of handling, transportation and storage of food grains and perishables. It will alsoimpartknowledgeandskillsashowtominimizepost–harvestlossoffood commodities

LEARNING OUTCOMES

- Understandthe chemical, biologicalandnutritionalpropertiesoffoods.
- Understandthebasic post-harvestphysiologyandconsequences during handlingof freshproduce.
- Understandthe facilities and techniquesoftreatment &storageoffoods.
- Knowabout workingprinciples ofvarious innovativetechniques infood processing
- Knowabouttheadvantage&disadvantageofinnovativetechniquestoimprovequalityandyield ofproduction.

DETAILEDCONTENTS

1. Introduction (06Periods)

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

2. Post- HarvestChangesinFoods–Physiological,chemical,microbiologicalandbiochemical (10Periods)

3. Handling,TransportationandStorage (12Periods)

   Various unit operations of post-harvest handling, transportation, introduction todifferentconveyingsystemslikebeltconveyors,chainconveyors,screwconveyors, hydraulic conveyors, pneumatic conveyors, vibrating and oscillatingconveyors,bucketelevators–theirselection,operationandmaintenance.

4. Grains (12Periods)

Preparationofgrainsforstorage,Storagerequirements,infestationcontrol,mycotoxin, handling practices, causes of spoilage and their prevention, factorsaffectingqualityofgrainduringstorageandtypesofstoragestructuresandfacilities

5. FruitsandVegetables (10Periods)

Handling,transportationandstorage,spoilageandprevention

6. AnimalFoods (12Periods)

Pre-slaughter handling and transportation system – their effects on quality of meatproducts, transportation and storage requirements, ante-mortem examination ofanimals

7. Milk (06Periods)

Collection,pre-cooling,handlingandtransportationsystems–theireffectsonqualityof milk

8. Eggs (06Periods)

Candlingandgrading,packaging,handling,pre-treatment,transportationandstorage

9. ColdStorage (10Periods)

Introductiontocoldstoragefacilities&requirementsforstorageofdifferentfruitsandvegetables.

LISTOFPRACTICALS

1. SamplingTechniquesofstoredfoodsfromdifferentstoragestructuresandconditions

2. Analysisofsampledgrainforforeignmatterlikestrawparities,rodentexcretaandrodents&insects infectedgrains

3. Demonstrationofchangesduring storageoffreshfruitsandvegetablesin(a)traditionalstorage(b)modifiedstoragesystem(controlledatmosphere

4. DeterminationofchangesinpHandacidvaluesinstorageofmilk

5. Visittoapublicdistributionsystem(PDS)showingstoragefacilities,warehouse,coldstorage,refrigerationsystem andslaughterhouseetc

6. Visittodemonstrationofmaterialhandlingsystemsinvariousfoodindustries

7. Visitstocoldstorage

INSTRUCTIONALSTRATEGY

Teachers should prepare tutorial exercises for the students, involving visits to variousfood-processing units. These tutorials can be considered a mini projects.Students may beaskedtobringspecificationsandcataloguesfromindustries.Studentsmayalsobeexposed to relevant National, BIS and international standards. An intensive exercise onactual workbench performance in the industries is recommended. Experts may be invitedto deliver lectureson various themes.Useofaudio-visualaids willalso be usefulforbetterconceptualizationofvarious operations.

RECOMMENDEDBOOKS

1. Handling, Transportation and Storage of Fruits and Vegetables by A Lloyd, RyallPenizer(AVIPublications)

2. Proceedings of Regional Workshop on Warehouse Management of Stored FoodGrainsbyGirishandAshokKumar(UNDP)

3. ModernPotatoandVegetableStoragebyVolkindandRoslov(Amerind)

4. ControlledAtmosphericStorageofFruitsbyMettelSkilv

5. FoodGrainsinTropical andSubTropicalAreasbyHall

6. FoodStoragePart ofasystembySinhaandMuir(AVI)

7. Post-HarvestTechnologyofFruitsandVegetables–Handling,Processing,FermentationandWasteManagementbyLRVermaandVKJoshi;IndusPublishingcom.,NewDelhi

8. DryingandStorageofGrainsandOilseedsbyBrooker&Hall,CBS

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	06	6
2	10	12
3	12	16
4	12	16
5	10	12
6	12	16
7	06	6
8	06	6
9	10	10
Total	**84**	**100**

6.4 WASTEMANAGEMENTINFOODINDUSTRY

	LT	P
RATIONALE	**6 – 2**	

This subject is aimed at developing an understanding among the students on Managementofagro-processingwaste,by-productutilizationasfood/feedandenvironmentalprotection.

LEARNING OUTCOMES

Onthesuccessful completionofthe course,thestudents willbeable to

- Understandandgainknowledgeaboutfoodwastage,wastemanagementandenvironment(Protection)actstandardsoffood processingwastes
- Gainknowledgeaboutby-productsobtainedfromdifferentfood processingindustries andapplytheknowledgefortheirutilization
- Understandthecharacteristicsoffoodindustrywastesand involvedunitoperationineffluenttreatment
- Understandtheconceptofbiologicaloxidationandaerationdevicessystems &theirmodifications.
- Understandthe advance Technologyfor wastewatertreatment

DETAILEDCONTENTS

1. Introduction (06Periods)

   Types of waste and magnitude of waste generation in different food processingindustries; concept scope and maintenance of waste management and effluenttreatment

2. WasteCharacterization (20Periods)

   Temperature,pH,Oxygendemands(BOD,COD,TOD),fat,oilandgreasecontent,metalcontent,formsofphosphorousandsulphurinwastewaters,microbiologyofwaste,otheringredientslikeinsecticide,pesticidesandfungicidesresidues

3. Environmentalprotectionactandspecificationsforeffluentofdifferentfoodindustries (10Periods)

4. By-productsandWasteutilization (16Periods)

5. EffluentTreatment (20Periods)

5.1 Pre-treatmentofwaste:sedimentation,coagulation,flocculationandfloatation

5.2 Secondary treatments: Biological oxidation – trickling filters, oxidationditches,activatedsludgeprocess,rotatingbiologicalcontractors,lagoons

5.3 Tertiary treatments: Advanced waste water treatment process-sand, coaland activated carbon filters, phosphorous, sulphur, nitrogen and heavymetalsremoval

6. Assessment,treatmentanddisposalofsolidwaste;conceptofvermin-compostingandbiogasgeneration
(12Periods)

LISTOFPRACTICALS

1. Wastecharacterization:(a)temperature(b)pH(c)solidscontent(d)turbidity(e)BOD(f)COD
2. Visittoeffluenttreatmentplantattachedwithfood industryand city
3. Toestimateresidualchlorine
4. EvaluationeffectoflimetreatmentonwastewaterinrespectsofBOD,COD,solidscontent,phosphatecontent
5. Visitstovariousindustriesusingwasteandfoodby-products
6. VisittoBiogasplantandvermin-culturecentre

INSTRUCTIONALSTRATEGY

Pollution control and waste utilization are important in food technology. Teacher shoulddesign suitable tutorial exercises for the students. Experts may be invited to deliverlectures on various themes. Students may be taken to some effluent treatment plant andindustries engaged in requirements-cycling and utilization of wastes.Students may begivensufficientexposuretovariousnationalandinternationalstandardsforqualityparametersrequiredforsafedisposalofwaste.

RECOMMENDEDBOOKS

1. FoodProcessingWork ManagementbyGreen andKrammer;CBSPublication

2. PrinciplesofFoodSanitationbyMariettNG;CBS Publication

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	06	08
2	20	24
3	10	12
4	16	16
5	20	26
6	12	14

Total	**84**	**100**

6.5 FOODQUALITYCONTROL AND LAWS

L	T	P
6	-	2

RATIONAL

In the production of processed foods, one of the important aspects is to assure quality.Thissubjectisintroducedinthecurriculumtoimpartknowledgeandskillsinthestudents related to various food quality parameters/systems, techniques of food analysis,foodlaws andstandards

LEARNING OUTCOMES

Onthesuccessfulcompletionofthecourse, studentswill beable to:

- Understand concepts of Food quality and role of total quality managementsystem in food industry
- Assessmentsof qualityof food productsusingvarious techniques
- Understandthe safetyaspectsof variousfoods
- Understandthenational&internationalfoodlawsandregulationsfor qualityof foods
- Understandthestandards ofinternationalregulatorybodies
- Understandthe conceptand applicationofknowledge about foodsafety managementsystemin foodindustry

DETAILEDCONTENTS

1. Introduction (18Periods)

1.1 Principlebehinddifferentmethodsofproximateanalysisof

a. Moisture
b. Ash
c. CrudeFat
d. CrudeProtein
e. CrudeFibre
f. TotalCarbohydrates

1.2 Concept,objectivesandneedof

a. quality,
b. qualitycontroland
c. qualityassurance
d. TQM(TotalQualityManagement)and
e. TQC(TotalQualityControl),
f. planandmethodsofqualitycontrol

2. Sampling (08Periods)

2.1 Definitionofsampling,
2.2 purpose,
2.3 samplingtechniquesrequirementsand
2.4 samplingproceduresfor
   a. liquid,
   b. powderedand
   c. granularmaterials

3. Physicochemicalandmechanicalproperties (14Periods)
   a. Colour,
   b. gloss,
   c. flavour,
   d. consistency,
   e. viscosity,
   f. textureandtheirrelationshipwithfoodquality

4. Sensoryqualitycontrol (18Periods)

   a. Definition,
   b. objectives,
   c. panelselectionandtheirtraining,
   d. subjectiveandobjectivemethods,
   e. interpretationofsensoryresultsinstatisticalqualitycontrol,
   f. consumerpreferencesandacceptance

5. FoodLawsandRegulationsinIndia

   (10Periods)Agenciesandstandards:
   - BIS(BureauofIndianStandards),
   - AGMARK(AgriculturalMarketingBoard),
   - PFA(PreventionofFoodAdulterationAct),
   - FSSA(FoodSafetyandStandardsAct),
   - FPO(FruitProductsOrder),
   - MoFPI(MinistryofFoodProcessing Industries)
   - ISO(InternationalOrganizationforStandardization)-Objectivesandprinciples
   - CAC(CodexAlimantariousCommission)

6. GeneralHygieneandSanitationinfoodindustry

   (10Periods)Conceptsof:
   a. GMP(GoodManufacturingPractices),
   b. GHP(GoodHygienicPractices),
   c. GLP(GoodLaboratoryPractices)
   d. HACCP(Hazardanalysisandcriticalcontrolpoint)

7. Layoutofqualityevaluationandcontrollaboratories (06Periods)

LISTOFPRACTICALS

1. Proximateanalysisofmarketedfoodproducts
   1.1. Moisture
   1.2. Ash
   1.3. CrudeFat
   1.4. CrudeProtein
   1.5. CrudeFibre
   1.6. TotalCarbohydrates

2. Detectionofbasictastes andtheirthresholdvalues
3. Consumeracceptabilitytrial
4. Statisticalanalysisofsensorydata
5. Visitstothequalitycontrollaboratoriesofthefoodindustry,educationalinstitutionsandtesti ngcentres

INSTRUCTIONALSTRATEGY

This being one of the most important subjects, teacher should lay emphasis on developingbasic understanding of various concepts and principles and procedures involved herein.Suitable tutorial exercises may be designed by theteachers, which require students visitto various industries. Students may also be exposed to various National and internationalstandards. Visits to the relevant industry for demonstrating various operations involved inthe food evaluation and quality control is a must. Experts from the industry may beinvited to deliver lectures on the latest technology. Knowledge from pollution control
anddevicesforthesamemaybeprovidedtothestudents.Whereverrelevant,studentsmaybemade awareabout safetyaspects.

LISTOFRECOMMENDEDBOOKS

1. FoodAnalysisbySuzzaneNielsen
2. ISIHandbookof FoodAnalysis-(18Volumesin5parts)- BIS
3. AOAC-18th Edition-(CDROMEdition)
4. HandBookofAnalysisofFruitsandVegetablesbyS Ranganna(THM)
5. FoodAnalysisTheoryandPracticesbyPomeranzandMeloan(AVI)
6. QualityControlforthe FoodIndustry(Vol.Iand II)byKramer andTwigg(AVI)
7. LaboratoryMethods ofSensoryEvaluationbyLarmond
8. SensoryAnalysis byPiggot
9. HandBookofFoodAnalysisbyS.N.Mahindru
10. TheChemical AnalysisofFoodand FoodProductsbyJacobs
11. AFirstCourseinFoodAnalysisbyA.K.Sathe

SUGGESTEDDISTRIBUTIONOFMARKS

TopicNo.	TimeAllotted(Periods)	MarksAllotted(%)
1	18	24
2	14	08
3	14	16
4	18	20
5	10	14
6	10	14

7	6	04
Total	**84**	**100**

6.6 PROJECT WORK

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RATIONALE

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the project work, the students will be able to

- Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.
- Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.
- Assemble/fabricate and test an electronics gadget.

GENERAL GUIDELINES

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.
This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with either minimal or no -supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches

with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.
The project assignments may consist of

1. Development of prototypes

2. Study of different types of
   2.1. Heat exchangers
   2.2. Distillation columns
   2.3. Evaporators
   2.4. Reactors
   2.5. Drying unit etc.

3. Study of different types of vessels, heads and joints (can be done through factory visit)

4. Study of pumps and valves used in process industries

5. Fabrication of components / equipment's

6. Fault diagnosis and rectification experiences

7. Bringing improvements in the existing system/equipment

8. Audits of industry- energy audit, water audit, material audit etc.

9. Case Studies

NOTE:

1. The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in Table below:

Sr.No.	**Performance Criteria**	**Max.** Marks**	**Rating Scale**				
			Excellent	**Very Good**	**Good**	**Fair**	**Poor**
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4

4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self-expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9.	Viva voce	10%	10	8	6	4	2
10.	**Total Marks**	**100**	**80**	**60**	**40**	**20**	**10**

Theoverallgradingofthepracticaltrainingshallbemadeasper aboveTable.

Inordertoqualifyforthediploma,studentsmustget“OverallGoodgrade”failingwhichthestudents may be given one more chance to improve and re-evaluate before being disqualified anddeclared “not eligible to receive diploma”.It is also important to note that the students must getmore than six “goods” or above “good” grade in different performance criteria items in order to get“Overall Good”grade.

IMPORTANTNOTES

1. This criteria must be followed by the internal and external examiner and they should seethedaily,weeklyandmonthlyreportswhileawardingmarksaspertheabovecriteria.

2. The criteria for evaluation of the students have been worked out for 200 maximum marks. Theinternal and external examiners will evaluate students separately and give marks as per thestudyandevaluationschemeofexamination.

3. Theexternalexaminer,preferably,apersonfromindustry/organization,whohasbeenassociated with the project-oriented professional training of the students, should evaluate thestudents'performanceaspertheabovecriteria.

4. It is also proposed that two students or two projects which are rated best be given meritcertificate at the time of annual day of the institute. It would be better if specific nearbyindustriesareapproachedforinstitutingsuchawards.

Theteachersarefreetoevolveothercriteriaofassessment,dependinguponthetypeofprojectwork. Itisproposedthat theinstitutemayorganizeanannual exhibitionoftheprojectworkdonebythestudentsandinviteleadingIndustrial organizationsinsuchanexhibition.

10. RESOURCE REQUIREMENT: As per AICTE NORMS.

EQUIPMENTREQUIREDFORFOOD TECHNOLOGY

COMMUNICATION LABORATORY			
Sl.No	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Stools	40	10,000
2.	Display Board/Screen	02	6,000
3.	Sound recording and playing system	01	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	01	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	01 Each	20,000
8.	English spoken course	01	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	01	30,000
10.	Miscellaneous	LS	1,500
APPLIED PHYSICS LABORATORY			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000

4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesend's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil Weston-type ammeter with ebonite stand	10	3,500
12.	DC Milli ammeter	02	1,000
13.	DC Micro ammeters	02	700
14.	DC voltmeters	10	700
15.	DC Millivolt meters	10	2,000
16.	Sensitivity Galvanometer	02	800
17.	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	02	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	02	1,000
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	08	8,000
21.	Resistance boxes (dial type) assorted	08	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerin, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	02	20,000
25.	Stoke's Apparatus	02	10,000
26.	Gumther's Apparatus	02	16,000

27.	Resonance Tube Apparatus with accessories and Tuning fork set	02	14,000
28.	Sodium Lamp setup with Bi-prism	02	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	02	8,000
31.	PN Junction diode Apparatus	02	10,000
32.	Laser (as per requirement)	01	1,00,000
33.	Numerical aperture setup	01	25,000
34.	Miscellaneous	LS	3,000

APPLIEDCHEMISTRYLABORATORY			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Digital Balance	01	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000
8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Able's Flash Point apparatus	02	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	01	18,000
14.	Desiccator	06	8,000
15.	Pair of tongue (small and big)	24 (Small) 2 (Big)	2,000
16.	Chemicals • EDTA-1 kg • Eriochrome Black-T(Solochrome black T)- 200g • Buffer solution (NH3 - 2.5 Ltr, NH4Cl – 1 kg) • Zinc sulphate- 500g • H2SO4- 2.5 Ltr • Phenolphthalein indicator (as per requirement) • Methyl orange indicator (as per requirement) • Charcoal (as per requirement) • Kerosene- 1 Ltr	LS	20,000
17.	Miscellaneous	LS	2,000

ENGINEERING DRAWING			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Drawing Boards (700 x 500mm)	60	25,000
2.	Draughtsman Tables	60	1,80,000
3.	Draughtsman Stools	60	40,000
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Model of different wooden joints	01	1,000
6.	Model of different screw threads	01	1,000
7.	Model of various locking devices	01	1,000
8.	Model of various joints	01	1,000
9.	Cut section Model of various couplings	01	3,000
10.	Miscellaneous	LS	5,000

BASICSOFITLABORATORY/COMPUTERAPPLICATIONSLABORATORY			
Sl.No.	**Nameof Equipment**	**No.**	**Amount (₹)**
1.	ComputerSystemwithlatestconfiguration	30	8,00,000
2.	Printer(MFP)	01	25,000
3.	Printer(Laser)	01	35,000
4.	Plotter	01	75,000
5.	Digitizer	01	50,000
6.	AntivirusSoftware	LS	10,000
7.	InternetFacilityonComputers	LS	2,00,000
8.	LCDProjector	01	35,000

9.	UPS	60	1,20,000
10.	Software(latestwindows,latestMSOffice)	01	1,00,000
11.	Scanner	01	10,000
12.	SoftwareMATLAB	01	2,00,000
13.	Miscellaneous	LS	5,000

CARPENTRY SHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Work benches fitted with carpenter vices	05	20,000
2.	Circular saw grinder	01	6,000
3.	Wood cutting band saw-vertical	01	10,000
4.	Bench grinder	01	5,000
5.	Drilling machine	01	8,000
6.	Wood turning lathe	01	40,000
7.	Wood Planner	01	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	01	10,000
10.	Miscellaneous	LS	1,500

PAINTINGANDPOLISHINGSHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Spraygunwithhosepipe	01	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	AirCompressor with2HPmotor	1 Set	10,000
5.	Miscellaneous	LS	2,000

ELECTRICALSHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Toolkit(Plier,Screwdriver,Knife,Steelrule,hammer,scriber,pincersteeltapeetc.)	20	20,000
2.	Fuses,Switches,Plugs,Sockets,Ceilingrose,Wires,cleats, Clamps,Testlamp,Tester.(asperrequirement)		8,000
3.	ElectricIron	01	1,500
4.	Electrickettle	01	1,500
5.	Ceilingfan/tablefan	01	2,500
6.	Desertcooler	01	5,000
7.	Leadacidbattery	02	8,000
8.	BatteryCharger	01	6,000
9.	Miscellaneous		3,000

WELDING SHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Electricalweldingtransformersetwithaccessories	03	30,000
2.	GasCuttingUnit	01	3,000
3.	Work bencheswithvices	03	5,000
4.	Weldinggeneratorset	01	10,000
5.	Oxyacetyleneweldingsetwithaccessories	01	7,000
6.	Acetylenegeneratingset	01	6,000
7.	Electricweldertoolkit	10	10,000
8.	Projectionweldingmachine	01	15,000
9.	Brazingequipmentwithaccessories	01	10,000
10.	Solderingirons	03	1,000
11.	Pedestalgrinder	01	10,000
12.	Metalsprayinggun	01	10,000
13.	Spotwelder	01	25,000
14.	TIGweldingset	01	1,00,000
15.	MIGweldingset	01	1,00,000
16.	WeldingPartitionScreen	05	2,500
17.	Miscellaneous	LS	3,000

SHEET METAL SHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Hammers	08	3,000
2.	Mallets (Hard & Soft)	05	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	01	20,000
5.	Bar folding Machine	01	20,000
6.	Burring machine	01	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminum)	01 Each	1,000
8.	Hand Shears/Snippers	04	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	500
10.	Miscellaneous	LS	1,000

FITTING AND PLUMBING SHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Work benches with vices (4 vices on each bench)	05	30,000
2.	Marking tables with scribers	04	24,000
3.	Surface plates	05	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits - taps, dies, drills	25	40,000
6.	Tool kits - chisels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	02	12,000
8.	Pipe vice	04	1,000
9.	Chain wrenches	05	1,250
10.	Ring spanner set	05	600
11.	Pipe die set 2”	02 Set	1,000
12.	Pipe bending device	01	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500

MACHINESHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Centrelathes	10	6,00,000
2.	Grinder	01	10,000
3.	Universalmillingmachine	01	1,25,000
4.	Shaper	02	1,20,000
5.	Plainer	02	1,20,000
6.	Workbench	03	10,000
7.	Precisioninstruments	01	10,000
8.	Handtoolsandaccessories	02	8,000
9.	CNCtrainerlathe	01	4,00,000
10.	Miscellaneous	LS	5,000

MASON SHOP			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Mason Trowel	10	1,000

2.	Concrete Finishing Trowel	10	1,000
3.	Gauging Trowel	10	1,000
4.	Margin Trowel	10	1,000
5.	Pointing Trowel	10	1,000
6.	Round Trowel	10	1,000
7.	Mason/Brick Hammer	10	3,000
8.	Comb hammer	10	3,000
9.	Blocking chisel	10	1,000
10.	Plumb bob	10	500
11.	Spirit level	10	1,000
12.	Straight Edge	10	1,000
13.	Jointer	10	1,000
14.	Masonry Pan	10	1,500
15.	Steel Measuring Tape	10	500
16.	Miscellaneous (Bricks, Blocks, Stones, Sand, Cement)	10	3,000
ENVIRONMENTENGINEERINGLABORATORY			

Sl.No.	Name of Equipment	No.	Amount (₹)
1.	Phmeter	01	699
2.	Turbiditymeter	01	188
3.	Ovenwithtemperaturecontroller andforcedair circulation type	01	24,000
4.	B.o.d.Incubator	01	25,550
5.	Wateranalysiskit	01	3,099
6.	Highvolumesampler	01	75,000
7.	Electricalbalanceforweighingup to1/10ofmilligram(capacity)	01	12,000
ENERGY CONSERVATION LABORATORY			

Sl.No.	Name of Equipment	No.	Amount (₹)
1.	Clamp meter	02	4000
2.	Multimeter	02	2000
3.	Power Analyzer	01	4799
4.	Different types of lamps (LS) i. 60 W lamp, 230 V, 100 V ii. 200 W lamp, 230 V, 100 V iii. 500 W lamp, 230 V, 100 V iv. 100 W lamp, 110 V, 150 V	10	25/each
5.	Lux meter	02	4,000/each
6.	Standard window A.C.	01	28,000
7.	Anemometer	02	2000/each
8.	Thermometer	03	950/each
9.	Flow meter	02	49,500/ each
10.	Pumping set with at least two pumps of different capacity	1 Set	
11.	Pressure gauge fitted on discharge lines	1 Set	690/each
12.	Variable Frequency Drive	02	8999/each
13.	A small compressor with a small network of pipeline, gauge, safety valve and loading / unloading pressure switch	01	10,0000
14.	Stop watch	02	1000/each
15.	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	01	40000/unit

POLLUTION CONTROL AND INDUSTRIAL SAFETY			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	BOD incubator ($5^0C\ -\ 50^0C$) with digital temperature indicator	01	25,550
2.	COD Heater	01	62675
3.	Refrigerator, 280 Ltr.	01	27,740
4.	Laboratory oven $2' \times 2' \times 2$	01	24,000
5.	Turbidity meter (0 - 4000 NTU)	01	188
6.	TDS portable meter	01	699
7.	Electronic balance (0.001 grams)	01	14,500
8.	Beakers	01	124/each
9.	Conical flask, round bottom flasks	01	180/each
10.	Condenser, reflux condenser	01	110/each
11.	BOD bottles, rubber pipe, burette, pipette etc.	LS	1050/total

ENERGY CONSERVATION			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	Multimeter	01	17,000
2.	Power Analyzer	01	20,000
3.	Lux meter	01	5,000
4.	Black Box (for checking lamp efficacy including stand and lux meter)	01	25,000
5.	Centrifugal pump, 1 kW	01	15,000
6.	Variable Frequency drive	02	50,000
7.	Water Flow meter	01	10,000
8.	Pressure Gauge	01	2,000
9.	Experimental Set up for Valve Throttling vs VFD	01	50,000
10.	Compressor, 20 cfm, single-stage	01	50,000
11.	Air leakage meter	01	18,000
12.	Blower (2 HP)	01	8,000

ELECTRICAL TECHNOLOGY & ELECTRONICS LAB			
Sl.No.	**Name of Equipment**	**No.**	**Amount (₹)**
1.	D.C. Shunt Motor 3 Kw. 1500 RPM with 3 Point Starter.	02	20,000
2.	D.C. Compound Motor 3 Kw. 1500 RPM	02	20,000
3.	Single Phase Transformer 1 KVA 50 Hz. Primary Voltage 230 with tapping at 50%, 86.6 % Facility	02	12,000
4.	3 Phase Induction Motor 415 V., 50 Hz, 440 RPM, 3 KVA Star/Delta/Autotransformer Starter.	02	10,000
5.	Loading Drum Spring Balance & Belt Arrangement.	02 Set	
6.	Tachometer (Analog/Digital)	01	2,000

7.	3 Phase Inductive Loading of Variable Nature	01	8,000
8.	Single Phase Inductive Loading Variable 0-10 Amp., 50 Hz.	01	8,000
9.	Moving Coil Ammeter 0-10 Amp.	08	1,000
10.	Moving Coil Voltmeter 0-300 V.	08	8,000
11.	Moving Iron Ammeter 0-10 Amp.	08	8,000
12.	Moving Iron Voltmeter 0-300 V.	08	8,000
13.	Wattmeter Single Phase Dynamo Type 75/300/600 V. 2.5/5 Amp.	04	10,000
14.	Three Phase Variable Inductive Loading.	01	8,000
15.	Single Phase Variable Inductive Loading with Rheostat.	01	8,000
16.	Megger 0-20 Mega Ohm, 500 RPM		
17.	Fluorescent Tube With Choke.	01	100
18.	SCR Bread Board	01	1,000
19.	Power Supply 230 V.	01	1,000
20.	Moving Coil Ammeter 0-500 M.A.	01	1,000
21.	Moving Coil Voltmeter 0-250 V.	01	1,000
22.	Energy Meter Single Phase 230 V., 5 Amp	01	2,000
23.	Misc.	LS	1,500

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 my 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 litre 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 mortarDia 10 cms 15 cms (Ceramics)	2	30	60
12	Beakers (Glass/Brosil/Corning Plastic) 250ml 500ml	 50 50	 20 20	 1000 1000
13	Wash bottles (Plastic/Tafflon)	30	15	450
14	Conical flask 250 ml. glass (Brosil/Corning/Plasic) 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 250ml. 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 cup boards (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" diacontrolled 2000 watts	1	1000	1000
37	hot air oven thermostatically controlled with selves and rotary switches 350 x350x25 high	1	8000	8000

38	PH Meter (Digital)	1	1000	1000
39	Glass Electrode	2	850	1700
40	Reference Electro	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	kjeldal assembly for N2 estimation	1		20000
51	Deep Freezer	1		40000
52	Food Processor	1		7000
53	Sox letExtraction 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 Vls. 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-RedMoistureAnalyzer (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

Note:

1. Thespecificationsandpriceofequipmentmentionedaboveusedasbroadguidelinesforpurchaseofequipment.
2. Anyotheritemsnotmentionedinthelitofequipmentcanbepurchasedasprovisionhasbeenmadeforpurchaseundertheitemmiscellaneousforeachlab/shop.
3. Anyadditionalequipment,alreadyavailableintheinstitute,maybeusedfordemonstrationtothestudents.

NOTE:

Inadditiontotheabove,laboratoriesinrespectofphysics,chemistry,ComputerCentreetcwillbe required for effective implementation of the course. Provision forphotocopiers, PC facilitiesalongwithLCD ProjectionSystemetc.hasalsotobemade.

(A) FurnitureRequirement

Norms and standards laid down by AICTE be followed for working out furniture requirement forthis course.

HumanResourcesDevelopment:

Weekly work schedule, annual work schedule, student teacher ratio for various group andclasssize,staffingpattern,workloadnorms,qualifications,experienceandjobdescriptionofteachingstaffworkshopstaffandotheradministrativeandsupportingstaffbeworked outaspernormsandstandardslaiddownbytheAICTE.

EVALUATIONSTRATEGY

INTRODUCTION

Evaluationplaysanimportant roleintheteaching-learningprocess.Themajorobjectiveofany teaching-learningendeavoristoensurethequalityoftheproductwhichcanbeassessedthroughlearner'sevaluation.

The purpose of student evaluation is to determine the extent to which the general and thespecificobjectivesofcurriculumhavebeenachieved.Studentevaluationisalsoimportant from the point of view of ascertaining the quality of instructional processes andto get feedback for curriculum improvement. Ithelps theteachers in determining thelevelofappropriatenessofteachingexperiencesprovidedtolearnerstomeettheirindividualandprofessionalneeds.Evaluationalsohelpsindiagnosinglearningdifficultiesofthestudents.Evaluationisoftwotypes:FormativeandSummative(InternalandExternalEvaluation)

FormativeEvaluation

Itisanon-goingevaluationprocess.Itspurposeistoprovidecontinuousandcomprehensivefeedbacktostudentsandteachersconcerningteaching-learningprocess.Itprovidescorrectivestepstobetakentoaccountforcurricularaswell asco-curricularaspects.

SummativeEvaluation

It iscarriedout atthe endof a unit of instructionlike topic, subject, semester or year.Themainpurposeof summativeevaluationistomeasureachievementforassigningcoursegrades,certificationof studentsandascertaining accountability of instructionalprocess.Thestudentevaluationhastobedoneinacomprehensiveandsystematicmannersinceanymistakeorlacuna islikelytoaffect thefuture ofstudents.

InthepresenteducationalscenarioinIndia,wheresummativeevaluationplaysanimportantroleineducationalprocess,thereisaneedtoimprovethestandardofsummativeevaluationwithaviewtobringvalidityandreliabilityintheend-termexaminationsystemforachievingobjectivityandefficiencyinevaluation.

STUDENTS'EVALUATIONAREAS

Thestudentevaluationiscarriedoutforthefollowingareas:

- Theory
- PracticalWork(Laboratory,Workshop,FieldExercises)
- ProjectWork
- ProfessionalIndustrialTraining

A. Theory

Evaluationintheoryaimsatassessingstudents'understandingofconcepts,principles and procedures relatedtoa course/subject, and their ability toapplylearnt principles and solve

problems. The formative evaluation for theory subjectsmaybecausedthroughsessional/class-tests,home-assignments,tutorial-work, seminars,andgroupdiscussionsetc.Forend-termevaluationoftheory,thequestionpapermaycompriseofthreesections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of theorder of 20 percent of the total marks and no choice should be given in this section.The objective type items should be used to evaluatestudents'performanceinknowledge,comprehensionandatthemostapplicationdomainsonly.

Section-II

It should contain short answer/completion items.The weightage to this sectionshouldbe of the order of 40percent of thetotal marks.Again, no choiceshouldbegiveninsection-II

Section-III

It may contain two to three essay type questions.Total weightage to this sectionshould be of the order of 40 percent of the total marks.Some built-in, internalchoiceofabout 50percentofthequestionsset,canbegiveninthissection

TableII:SuggestedWeightagetobegiventodifferentabilitylevels

Abilities	Weightagetobeassigned
Knowledge	10-30percent
Comprehension	40-60percent
Application	20-30percent
Higherthanapplicationi.e.Analysis, SynthesisandEvaluation	Upto10percent

B. PracticalWork

Evaluation of students performance inpractical work(Laboratory experiments,Workshop practicals/field exercises) aims at assessing students ability to apply orpractice learnt concepts, principles and procedures, manipulative skills, ability toobserve and record, ability to interpret and draw conclusions and work relatedattitudes.Formativeandsummativeevaluationmaycompriseofweightagesto performanceontask,qualityofproduct,generalbehaviouranditshouldbefollowedbyviva-voce.

C. ProjectWork

The purpose of evaluation of project work is to assess students ability to apply, inan integrated manner, learnt knowledge and skills in solving real life problems,manipulativeskills,abilitytoobserve,record,creativityandcommunicationskills. The formative and summative evaluation may comprise of weightage tonature of project, quality of product, quality of report and quality of presentationfollowedbyviva-voce.

D. ProfessionalIndustrialTraining

Evaluation of professional industrial training report and viva-voce/ presentationaimsatassessingstudents'understandingofmaterials,industrialprocesses,practices in the industry/field and their ability to engage in activities related toproblem-solving in industrial setting as well as understanding of application oflearnt knowledge and skills in real life situation.The formative and summativeevaluationmaycompriseofweightagestoperformanceintesting,generalbehavior, qualityofreportandpresentationduring viva-voce.

RECOMMENDATIONSFOREFFECTIVECURRICULUMIMPLEMENTATION

ThiscurriculumdocumentisaPlanofActionandhasbeenpreparedbasedonexhaustiveexercise of curriculumplanninganddesign.Therepresentativesamplecomprising selectedsenior personnel (lecturers and HODs) from various institutions and experts from industry/fieldhavebeeninvolvedincurriculumdesignprocess.

The document so prepared is now ready for its implementation.It is the faculty of polytechnicswhohavetoplay avitalroleinplanninginstructionalexperiencesforthecoursesinfourdifferent environments viz. class-room, laboratory, library and field and execute them in rightperspective.Itisemphasizedthatapropermixofdifferentteachingmethodsinalltheseplaces of instruction only can bring the changes in stipulated students behavior as in the curriculumdocument.It is important for the teachers to understand curriculum document holistically andfurtherbeawareofintricaciesofteaching-learningprocess(T-L)forachievingcurriculumobjectives.Given below are certain suggestions which may help the teachers in planning anddesigning learning experiences effectively.Theseareindicativein natureandteachers usingtheir creativity can further develop/refine them.The designers of the programme suggest everyteachertoreadthemcarefully, comprehendand startusingthem.

(A) BroadSuggestions:

1. Curriculumimplementationtakesplaceatprogramme,courseandclass-roomlevelrespectivelyandsynchronizationamongthemisrequiredforitssuccess.Thefirststeptowardsachievingsynchronizationistoreadcurriculumdocumentholistically

andunderstanditsrationaleandphilosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well inadvance.ThePrincipals havea great roleto play in its disseminationand, percolationupto grass-root level. Polytechnics, in turn are supposed to prepare institutional academicplan.

3. HODofeveryProgrammeDepartmentalongwithHODsandinchargesofotherdepartmentsarer equiredtoprepareacademicplanatdepartmentlevelreferringtoinstitutionalacademicplan.

4. Alllecturers/Seniorlecturersarerequiredtopreparecourselevelandclasslevel lessonplans referringdepartmentalacademicplan.

(B) CourseLevelSuggestions

Teachers are educational managers at class room level and their success inachievingcourse level objectives lies inusing course planandtheir judicious executionwhichisveryimportantforthesuccessofprogrammebyachievingitsobjectives.

Polytechnic teachers are requiredto planvarious instructional experiences viz. theorylecture,expertlectures,lab/workshoppracticals,guidedlibraryexercises,fieldvisits,stud y tours, camps etc.In addition, they have to carry out progressive assessment oftheory, assignments, library, practicals andfield experiences. Teachers are also requiredto doall theseactivities withina stipulated period of time. Itis essential for them to usethegiven timejudiciously by planning all above activities properly and ensure executionoftheplaneffectively.

FollowingisthegistofsuggestionsforsubjectteacherstocarryoutT-Lprocesseffectively:

1. Teachersarerequiredtoprepareacourseplan,takingintoaccountdepartmentalacademicplan,nu mberofweeksavailableandcoursestobetaught.

2. Teachersarerequiredtopreparelessonplanforevery theory class.Thisplanmaycompriseof contentsto be covered,learning materialfor execution of a lesson plan.They may follow steps for preparing lesson plan e.g. drawing attention, state instructionalobjectives, helpinrecallingpre-requisiteknowledge, deliver plannedsubject content,checkdesiredlearningoutcomesandreinforcelearningetc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps aretoplaninadvance,identifyfieldexperts,makecorrespondencetoinvitethem,takenecessaryb udgetaryapprovaletc.

4. Teachersare requiredtoplanfor guidedlibrary exercisesby identificationof coursespecificexperiencerequirement,settingtime,assessment,etc.Theassignmentsandsemi narscanbethoughtofasterminal outcomeoflibrary experiences.

5. Concept and content based field visits may be planned and executed for such content

ofcourse which is abstract in nature and no other requisite resources are readily available ininstitutetoimpartthemeffectively.

6. Thereisadireneedforplanningpracticalexperiencesinrightperspective.Theseslotsina courseare the avenues to use problem based learning/activity learning/ experientiallearningapproacheffectively.Thedevelopmentoflabinstructionsheetsforthecour seisagoodbeginningtoprovidelabexperienceseffectively.

7. Planning of progressive assessment encompasses periodical assessment in asemester,preparationofproperqualityquestionpaper,assessmentofanswer sheets Immediatelyandgivingconstructivefeedbacktoeverystudent

8. Thestudentcentredactivitiesmaybeused to develop generic skills like taskmanagement,problemsolving,managingself,collaboratingwithothersetc.

9. Whereeverpossible,itisessentialtouseactivitybasedlearningratherthan relyingondeliverybasedconventionalteachingallthetime.

10. Teachersmaytakeinitiativeinestablishingliaisonwithindustriesandfieldorganizationsforimp artingfieldexperiencestotheir students.

11. Students be made aware about issues related to ecology and environment, safety, concernforwastageofenergyandotherresourcesetc.

12. Studentsmay begivenrelevant andwell thought out project assignments,whicharepurposeful and developpractical skills. Thiswill helpstudentsin developing creativityandconfidencefor theirgainfulemployment.

13. A Project bank may be developed by the concerned department of the polytechnics inconsultationwithrelatedIndustry,researchinstitutesandotherrelevantfieldorganizationsint hestate.

Listofexperts

Listofexpertswhosedeliberationhelpedthenewdevelopmnet curriculum for Three Year Diploma Course in FoodTechnologyat I.R.D.T. U.P., Kanpur on 15.01.15,18.02.15and19.02.15arehonourablynamedbelow-

o Dr.GauriShanker H.B.T.I.,Kanpur	Ex. H.O.D.	B.E.F.T.,
o ShriB.N.Singh	Ex.Director	I.R.D.T.,U.P.,

• Dr.SeemaSonker	• Head(FoodSc.)	• C.S.A.Uni. Kanpur
• Dr.UmeshChandra	• Lect.(ChemicalEngg.)	• U.I.E.T., C.S.J.M. Uni.Kanpur
• ShriAvanishKumar	• Asstt.Prof(FoodPro.)	• S.H.I.A.T.S. Allahabad
• Dr.ShatrughanSingh	• Lect.(FoodTech.)	• S.L. BahugunaUni., Dehradoon
• SriA. K.Agarwal	• H.O.D.,Chem.Engg..	• G.P.,Sutawali
•	•	• Moradabad
• ShriR. K. Rakesh	• Lecturer(DairyEngg.)	• G.P.Etawah
• SriDurgesh Chandra	• Lect(ChemicalEngg.)	• G.P.,Firozabad
• SriG.N.Singh	• AssisstantProfessor	• I.R.D.T.,Kanpur

List ofexpertswhose deliberationhelpedthedevelopment ofcurriculuminSemester System for Three Year Diploma Course in FoodTechnology at I.R.D.T. U.P., Kanpuron15.2.17 are honourably namedbelow–

1.	ShriU CSharma	Professor (Chem.Engg)	UIET,CSJMUni.Kanpur
2.	ShriDurgeshChandra	HOD(Chemical)	G.P.,Firozabad
3.	ShriM. Q.Zaman	Lecturer(English)	G.P.,Kanpur
4.	ShriPrabhuNathJaiswal	Lecturer(Chemical)	G.P.,Kanpur
5.	NamrataPal	Lecturer(Chemical)	G.P., Kanpur
6.	G.N. Singh	Asstt.Prof.	I.R.D.T.,Kanpur

List of experts

List ofexpertswhose deliberationhelpedthedevelopment of curriculuminSemester System for Three Year Diploma Course in FoodTechnology

- Dr. Priya Pandey, (Food Science and Nutrition Expert) Madhuraj Hospital Kanpur.
- Dr. U.C. Sharma, Professor, Chemical Engineering, C.S.J.M. University, Kanpur.
- Designated Food / Hotel Industry Expert, J. R. S. Technology Kanpur.
- Dr. Seema Sonkar, HOD (Food Science & Nutrition), C.S.A. University, Kanpur.
- Dr. Vinita Singh, Associate Prof. (Food Science & Nutrition) C.S.A. University, Kanpur.
- Dr. ShilpaDesh Pandey, Associate Professor, C.S.J.M. University, Kanpur.
- Dr. Ruchi Mittal, Principal, Ruchi Institute of Creative Art, Allahabad.
- Smt. SuveditaKatiyar, Lecturer, Home Science, Juhari Devi Girls Inter College Canal Road Kanpur.
- Mrs. Namrata Pal, Lecturer, Government Polytechnic, Mathura.
- Mrs. Shashi BalaGautam, Lecturer, Government Polytechnic, Kanpur.
- Mr. Amit Singh, Training Advisor, MP Tourism Board, Bhopal.