NSQF Aligned Curriculum for

Three Year (Six Semester) Diploma Programme in

DAIRY ENGINEERING

For the State of Uttar Pradesh

Prepared by:

Curriculum Development Centre

Institute of Research Development & Training

U. P. Kanpur

CONTENTS

FIRST SEMESTER

SECOND SEMESTER

THIRD SEMESTER

FOURTH SEMESTER

FIFTH SEMESTER

SIXTH SEMESTER

PREFACE

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

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

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

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

Director
Institute of Research Development &Training.
Kanpur

ACKNOWLEDGEMENTS

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

1. Principal Secretary, Technical Education Department, U.P. Govt.

2. Special Secretary, Technical Education Department, U.P. Govt.

3. Director, Technical Education, UP &I.R.D.T., Kanpur, for taking keen interest in the review of this curriculum.

4. Secretary, Board of Technical Education, UP for initiating this project of review of curriculum.

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

6. Faculty/Subject Experts from U.P. Government polytechnics

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

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN DAIRY ENGINEERING

1)	Name of the Programme	:	Diploma Programme Dairy Engineering
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	:	As prescribed by the Board)
5)	Pattern of the Programme	:	Semester Pattern
6)	NSQF Level	:	Level - 5
7)	Ratio between theory and	:	45 : 55 (Approx.)

2- EMPLOYMENT OPPORTUNITIES OF DIPLOMA HOLDERS IN DAIRY ENGINEERING

Before taking up the assignment for revision of curriculum a preliminary survey regarding job potential and man power assessment was conducted. It was revealed that diploma pass outs may have opportunities in the following field.

S.NO	DEPARTMENT/ORGANISATION	POSITION/DESIGNATION
1.	Pradashik Co-operative Dairy Federation U.P.	Dairy Supervisor/ Senior Technician
2.	Pradashik Co-operative Dairy Pradashik Co-operative Dairy	Dairy Supervisor/ Senior Technician
3.	Pradashik Co-operative Dairy Federation Rajasthan	Dairy Supervisor/ Senior Technician
4.	Glaxo India Ltd.	Dairy Supervisor/ Senior Technician
5.	Dalmia Dairy, Bharatpur	Dairy Supervisor/ Senior Technician
6.	R.M.I. Kotkapura, Punjab	Dairy Supervisor
7.	Anand Dairy, Karnal Haryana	Dairy Supervisor
8.	H.M.T. Aurangabad, Maharashtra	Skilled Worker
9.	Kanpur Dugdh Utpadak Sahkeri Sangathan	Dairy Supervisor
10.	National Dairy Reaserch Institute, Karnal	Reaserch Asst.
11.	Aumul Dairy	Dairy Supervisor
12.	Dairy Milk Plant, Rampur	Dairy Supervisor

Self Employment:

A diploma pass out in dairy engineering can start his entrepreneurial activities with following small scale dairy plant

1. Manufacturer of dairy products.
2. Ancillary unit for dairy plant.
3. Repair of air conditioners, coolers, fridges etc.
4. Small scale packaging industries.
5. Repair of pumps & compressors.

JOB ACTVITIES :

(A) GENERAL:

1. OPERATION OF DAIRY PLANT:

1.1 Supervises the operation of dairy plants.

1.2 Supervises the process control.

1.3 Training of crafts man.

1.4 Manages labour materials and utilities.

1.5 Safety of workers and equipments.

2. MICROBIOLOGICAL ANALYSIS :

2.1 Analysis of sample.
2.2 Interpretation of results of analysis.

3. ERECTION AND COMMISSIONING OF DAIRY PLANT :

3.1 Reading and inter-preting the sketches, drawings.

3.2 Preparing inventory control and costing.

4. INSPECTION AND TESTING OF DAIRY EQUIPMENT :

4.1 Inspection and testing performance of individual equipment.

4.2 Fault finding or trouble shooting and its rectification.

5. MARKETING :

5.1 Explaining the salient features and performance of the product and comparison with regard to other such available equipments in the market.

5.2 Preparing estimates and contract documents.

5.3 Booking of orders and making relevant documents and correspondence.

5.4 Servicing of equipments and instruments.

5.5 Inventory control and determination of material requirement.

5.6 Preparation of tender documents and inviting tenders.

5.7 Placing orders and receiving the supplies.

6. PROJECT PREPARATION AND EVALUATION :

6.1 To scrutinize the project reports for Dairy plants from the point of view of feasibility and finances involved.

7. TEACHING, RESEARCH AND TRAINING :

7.1 To assist the teachers in imparting instructions to students.

7.2 To set up laboratory equipments for experimental work.

7.3 Preparation of specifications of various equipments and instruments.

7.4 Preparing of tender.

7.5 Receipt of supplies and their inspection and testing according to specification.

7.6 Maintains the equipments and instruments in the laboratory.

(B)SELF EMPLOYMENT:

(a) Setting up of small scale dairy plant
(b) Setting up an ancillary industry for medium/large dairy plants.
(c) Set up Dairy Equipment manufacturing unit and Plant Erection.
(d)Dairy Plant Repair and Maintenance unit.

3-LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN DAIRY ENGINEERING

AT THE END OF THE PROGRAMME, A DIPLOMA HOLDER IN DAIRY ENGINEERING WILL BE ABLE TO:

Sr. No.	Learning Outcomes
(A) KNOWLEDGE :	
1	Understand the various operation and processes and their application in different dairy plants
2	Understand various instruments used in process control of dairy plants including use of computer.
3	Understand the organization and his place in it. Understanding the general procedures of stores, purchase and inventory etc.
4	Understand the techniques of installation, erection and commissioning of equipments / instruments in dairy plants
5	Understand, interpret and prepare plant layout.
6	Understand, interpret and prepare project reports.
7	Understand safety goals, waste control and waste treatment (effluent control)
8	Understand the energy conservation and balance.
9	Develop attitude for safety consciousness
(B) SKILL :	
10	Acquire skill in operation, testing and adjustment of dairy equipment/materials used in dairy plant.
11	Acquire the skill in diagnosis of common faults and troubles in process, equipment and instrument and their rectification, repair and overhauling.
12	Acquire skill in reading interpreting and prepare plant layout and flow diagrams.
13	Acquire skill in preparing erection schedule/charts and knowledge of coordination of the organisation using CPM and PERT.
14	Develop skill in operation of dairy plants.
15	Develop skill in use of instruments in dairy plant.
16	Develop skill in communication oral/written/through devices.
17	Develop skill in repair and maintenance of dairy instruments and equipments.

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.	Communicate effectively in English withothers	– Communication Skills – Student Centred Activities (SCA)
2.	Apply basic principles of Mathematics andScience to solve engineering problems	– Applied Mathematics – Applied Physics – Applied Chemistry
3.	Prepare computerized reports, presentations using IT tools and computer applicationsoftware	– Basics of Information Technology
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	– General Workshop Practice
5.	Use appropriate procedures for preventing environmental pollution and energy conservation	– Environmental Studies – Energy Conservation
6.	Applyconcepts of mechanics to solve Engineering problems	– Applied Mechanics
	(A) KNOWLEDGE :	–
7.	To understand the various operations and processes and their application in different dairy plants.	- Dairy Technology - Hydraulics & Pneumatics - Refrigeration
8.	To understand various instruments used in process control of dairy plant including use of computers.	- Instrumentation & process control - Basics of Information Technology - Refrigeration
9.	To understand the organization and his place in it. Under- standing the general procedure of stores, purchase and inventory etc.	- Industrial Management & Entrepreneurship Development - Dairy Engineering
10.	To understand the technique of installation, erection and commissioning of equipments/ instruments in dairy plants.	- Dairy engineering - Steam Engineering & Heat Engines. - Workshop Practice
11.	To understand, interpret and prepare plant layout.	- Dairy plant layout & Design
12.	To understand, interpret and prepare project reports	- Project on Dairy Plant Layout& Design

13.	To understand safety goals, pollution control and waste treatment	- Dairy microbiology
14.	To understand the energy conservation and balance.	- Dairy chemistry
15.	To develop attitude for safety consciousness.	- Dairy Microbiology
SKILL :		
16.	To acquire skill in operation, testing and adjustment of Dairy equipment / materials used in Dairy plant.	- Workshop Practice. - In-Plant training - Industrial Training/Field Exposure - Workshop Practice
17.	To acquire the skill in diagnosis of common faults and troubles in process - equipment and instrument and their rectification, repair and overhauling.	- Workshop Practice - In plant Training - Instrumentation & Process control - Refrigeration
18.	To acquire the skill in reading, interpreting and prepare plant layout and flow diagrams	- Engineering Drawing - Dairy Engineering Lab - Project on Dairy Plant Layout& Design. - Dairy Technology Lab - Dairy Technology Lab - In plant Training
19.	To acquire skill in preparing erection schedule/ charts and knowledge of coordination of the organization using CPM and PERT.	- Industrial Management - In plant Training - Instrumentation & Process Control
20.	To develop skill in operation of Dairy plants	- In plant Training - Refrigeration - Dairy Technology
21.	To develop skill in use of industry.	- Instrumentation & Process Control - Dairy Engg. Lab - In plant Training
22.	To develop skill in communication oral/ written/ through devices.	- Communication Techniques
23.	To develop skill in repair and maintenance of Dairy instruments and equipments	- In plant Training - Refrigeration lab - Instrumentation & Process Control

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

1. Communication Skills
2. Environmental Studies
3. Energy Conservation
4. Industrial Management and Entrepreneurship Development

b) Applied Sciences

5. Applied Mathematics
6. Applied Physics
7. Applied Chemistry

c) Basic Courses in Engineering/Technology

8. Engineering Drawing
9. General Workshop Practice
10. Basics of Information Technology
11. Workshop Technology

d) Applied Courses in Engineering/Technology

12. Introduction To Dairy Engineering and Technology
13. Applied Mechanics and Machine Component
14. Steam Engineering and Heat Engines
15. Dairy Engineering
16. Dairy Microbiology
17. Dairy Chemistry
18. Hydraulics and Pneumatics
19. Refrigeration
20. Dairy Plant Layout, Maintenance and Automation
21. Instrumentation Process and Control

a) Industrial Training

22. In Plant Training
23. Project on Dairy Plant Layout and Design

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-I	6	-	-	-	-	-
2.	*Applied Mathematics - I	5	-	-	-	-	-
3.	*Applied Physics – I	7	-	-	-	-	-
4.	Introduction To Dairy Engineering and Technology	7	-	-	-	-	-
5.	*Engineering Drawing-I	8	-	-	-	-	-
6.	General Workshop Practice-I	8	-	-	-	-	-
7.	Applied Mechanics and Machine Component	6	-	-	-	-	-
8.	*Applied Mathematics - II	-	5	-	-	-	-
9.	*Applied Physics -II	-	7	-	-	-	-
10.	*Applied Chemistry	-	7	-	-	-	-
11.	Workshop Technology	-	5	-	-	-	-
12.	Dairy Technology-I	-	8	-	-	-	-
13.	*Basics of Information Technology	-	6	-	-	-	-
14.	General Workshop Practice-II	-	8	-	-	-	-
15.	Field Exposure (Assessment In III Semester At Institute Level	-	-	-	-	-	-
16.	*Energy Conservation	-	-	5	-	-	-
17.	Steam Engineering and Heat Engines	-	-	10	-	-	-
18.	Dairy Engineering-I	-	-	10	-	-	-
19.	Dairy Microbiology	-	-	10	-	-	-
20.	Dairy Chemistry	-	-	10	-	-	-
21.	Field Exposure	-	-	-	-	-	-
22.	*Communication Skill-II	-	-	-	6	-	-
23.	*Hydraulics and Pneumatics	-	-	-	8	-	-
24.	Dairy Engineering-II	-	-	-	14	-	-
25.	Refrigeration-I	-	-	-	15	-	-
26.	*Universal Human Values	-	-	-	3	-	-
27.	In Plant Training-I(4 Weeks)	-	-	-	-	-	-
28.	*Industrial Management and Entrepreneurship Development	-	-	-	-	5	-
29.	Dairy Engineering-III	-	-	-	-	12	-
30.	Dairy Technology-II	-	-	-	-	10	-
31.	Refrigeration-II	-	-	-	-	12	-
32.	Economic Analysis and Cost Accounting	-	-	-	-	6	-
33.	In Plant Training-I(4 Weeks)	-	-	-	-	-	-
34.	In Plant Training-II(8 Weeks)	-	-	-	-	-	-
35.	*Environmental Studies	-	-	-	-	-	10
36.	Dairy Plant Layout, Maintenance and Automation	-	-	-	-	-	10
37.	Instrumentation Process and Control	-	-	-	-	-	10
38	Project on Dairy Plant Layout and Design	-	-	-	-	-	14
39	In Plant Training-II(8 Weeks)	-	-	-	-	-	-
40	Student Centred Activities (SCA)	1	2	3	2	3	4
	TOTAL	**48**	**48**	**48**	**48**	**48**	**48**

7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN DAIRY ENGINEERING

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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*Communication Skills-I	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
1.2	*Applied Mathematics - I	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
1.3	*Applied Physics – I	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.4	Introduction To Dairy Engineering and Technology	4	-	3	5	20	20	40	50	2 ½	40	3	90	130
1.5	*Engineering Drawing-I	-	-	8	2	-	40	40	60	3	-	-	60	100
1.6	General Workshop Practice-I	-	-	8	2	-	40	40	-	-	60	4	60	100
1.7	Applied Mechanics and Machine Component	4	-	2	5	20	30	50	50	2 ½	60	3	110	160
#Student Centred Activities (SCA)		-	-	1	1	-	30	30	-	-	-	-	-	30
Total		**22**		**26**	**28**	**100**	**180**	**280**	**310**	**-**	**200**	**-**	**510**	**790**

* Common with other diploma programmes

\# Student Centred 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.

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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics - II	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
2.2	*Applied Physics -II	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.3	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.4	Workshop Technology	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
2.5	Dairy Technology-I	5	-	3	3	20	10	30	50	2 ½	20	4	70	100
2.6	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
2.7	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100
2.8	Field Exposure (Assessment In III Semester At Institute Level	-	-	-	-	-	-	-	-	-	-	-	-	-
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**25**		**23**	**27**	**100**	**140**	**240**	**250**	**-**	**180**	**-**	**430**	**670**

* Common with other diploma programmes

\# Student Centred 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.

\+ After the II Sem Exam. Student of II Sem Dairy Engg will go for a two week visit of a small/medium size dairy plant. It will be structured and supervised by the institution. Purpose of the visit is to give students an exposure of industrial setup and that of simple tools, instruments and the skill there in day to day use. Every student will submit the institution a report of his visit. The report will in variably

contain the description of his observations about (1) Products/Work (2) Tools and Equipment's Used. He will be evaluated at the institution level In III Sem. for 30 marks for the report presented. See Annexure -I

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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
3.2	Steam Engineering and Heat Engines	6	-	4	5	20	30	50	50	2 ½	50	3	100	150
3.3	Dairy Engineering-I	6	-	4	5	20	30	50	50	2 ½	50	3	100	150
3.4	Dairy Microbiology	6	-	4	5	20	30	50	50	2 ½	50	3	100	150
3.5	Dairy Chemistry	6	-	4	5	20	30	50	50	2 ½	50	3	100	150
3.6	Field Exposure	-	-	-	2	-	30	30	-	-	-	-	-	30
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**27**	**-**	**21**	**26**	**100**	**190**	**290**	**250**		**220**	**15**	**470**	**760**

* Common with other diploma programmes

\# Student Centred 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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skill-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	*Hydraulics and Pneumatics	5	1	2	5	20	10	30	50	2 ½	20	3	70	100
4.3	Dairy Engineering-II	6	2	6	5	20	30	50	50	2 ½	50	3	100	150
4.4	Refrigeration-I	7	2	6	5	20	10	30	50	2 ½	20	3	70	100
4.5	*Universal Human Values	2	-	1	2	-	20	20	-	-	30	3	30	50
4.6	In Plant Training-I(4 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**24**	**5**	**19**	**22**	**80**	**110**	**190**	**200**		**140**	**-**	**340**	**530**

***** Common with other diploma programme

Student Centred 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.

+ 4 weeks structured and supervised, branch specific, task oriented In-plant training-I to be organized After IV Semester theory exam. Students will submit a report. There will be 60 marks for this Training. These marks will be awarded in V Semester by the external examiner with In Plant Training-II. (Small/Mid-sized Dairy Plant)

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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	*Industrial Management and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
5.2	Dairy Engineering-III	6	2	4	5	20	30	50	50	2 ½	50	3	100	150
5.3	Dairy Technology-II	6		4	7	20	30	50	50	2 ½	50	3	100	150
5.4	Refrigeration-II	6	2	4	7	20	30	50	50	2 ½	50	3	100	150
5.5	Economic Analysis and Cost Accounting	4	-	2	7	20	30	50	50	2 ½	50	3	100	150
5.6	In Plant Training-I(4 Weeks)	-	-	-	-	-	20	20	-	-	40	Viva	40	60
5.7	In Plant Training-II(8 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**27**	**4**	**17**	**31**	**100**	**170**	**270**	**250**		**240**	**-**	**490**	**760**

* Common with other diploma programme

\# Student Centred 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 weeks training structured and supervised, branch specific, task oriented In-plant Training-II to be organized after V Semester Theory exam. Students will submit a report. There will be 150 marks for this training. These marks in VI Sem. will be awarded by the examiner. (Examination marks : 100, Sess. marks : 50). Due to which the 6th semester course has been reduced and it will be completed in eight weeks.

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		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Environmental Studies	6	-	4	3	20	10	30	50	2 ½	20	3	70	100
6.2	Dairy Plant Layout, Maintenance and Automation	8	2	-	5	20	-	20	50	2 ½	-	-	50	70
6.3	Instrumentation Process and Control	8	2	-	6	20	-	20	50	2 ½	-	-	50	70
6.4	Project on Dairy Plant Layout and Design	-	-	14	4	-	50	50	-	-	100	Viva	100	150
6.5	In Plant Training-II(8 Weeks)	-	-	-	2	-	50	50	-	-	100	Viva	100	150
#Student Centred Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30
Total		**22**	**4**	**22**	**21**	**60**	**140**	**200**	**150**	**-**	**220**	**-**	**370**	**570**

* Common with other diploma programme

Student Centred 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

.

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 Voice
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 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.

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 Revathi Srinivas; 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/UBTE/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, Crammer'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**.**
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, 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 modulii 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 (to perform minimum six experiments)

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, New Delhi
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	08	10
6	12	16
7	10	14
Total	**70**	**100**

1.4 INTRODUCTION TO DAIRY ENGINEERING & TECHNOLOGY

L	T	P
4	-	3

RATIONALE

As the name implies, this paper is to give beginner a ready and rough perception of mechanical engineering just to facilitate his grasp of studies in the later years.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-Basic idea dairy business
2-General idea of the dairy plant and different equipment's used in the flow system of milk and the complete working of raw milk receiving dockyard
3-Milk and its constituents
4-Different physical and chemical properties of milk
5- Basic process of cleaning washing and sterilization

DETAILED CONTENTS

1. **INTRODUCTION TO DAIRY & DAIRY TECHNOLOGY:** **(26 Periods)**

A. INTRODUCTION TO DAIRY:

Dairy development in India and other country, Milk Procurement, transportation. Principles of co-operative system in dairy development. Definition of market milk, milk industry in India and other countries. Milk procurement and transportation. Co-operative dairies.

B. MILK RECEPTION:

Raw milk receiving at reception docks-platform, tests and quality control, tests of milk. weighing and recording of milk and receiving tank, road tankers, storage tanks, can washers. different types of milk pumps.Can washing manual and Mechanical.

2. **INTRODUCTION TO DAIRY ENGINEERING :** **(30 Periods)**

A. INTRODUCTION :

Sanitary features, sanitary pipes and fittings stainless steel pipes, glass pipes, plastic tubing, pipe and fitting standards, sanitary pipe and fitting. Sanitary pumps, centrifugal pump. Positive displacement pump specification, stuffing box, rotary seal. Materials used in dairy plant - Plastic, Rubber, Different types of stainless, glass, copper and other alloys

B. MILK RECEIVING EQUIPMENT:

Milk cans, different types and uses, Milk receiving tanks, Weighing balance, Dump tanks, Chilling-Different types of Chillers(Heat exchangers), Bulk milk cooler, Different types Of chillers for cottage industry.

Can Washing- Manual can washing, Different steps and methods Mechanical can washing, Rotary and Straight through can washer. Detailed construction and working, Cleaning and sanitization of All milk receiving equipments, Maintenance of can washer.

LIST OF PRACTICALS

DAIRY ENGINEERING

1. Study of sanitary pipe fittings.
2. Study and dismantling and assembling of following pumps - Reciprocating Pump, Centrifugal Pump, Pasitive displacement pumps.
3. Care and maintenance of different type of pumps.
4. Study, operation, cleaning and maintenance of milk receiving equipments, weight tank, tanks, flow meters, pipes.
5. Study, operation and control of different types of can washer.
6. Study and maintenance of can washers.
7. Study of bulk milk cooler

DAIRY TECHNOLOGY

1. Study of different components of milk
2. Performing of different types of RMRD test for milk.
3. To find out CLR for milk
4. To find out specific gravity of milk.
5. Manual cleaning, washing and sterilization of cans.
6. Operation of can washer and bottle washer.
7. Manual cleaning of different tanks, pumps, pasteurizers.

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.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1- DAIRY TECHNOLOGY Vol-1 & Vol-2 BY- Shivashraya Sing Publisher- Nipa ISBN-13 9789383305087 & 88
2-DAIRY SCIENCE & TECHNOLOGY BY-Gavin White Publisher- Callisto
3-Milk & Dairy Product Technology By -Edgar Spreer Publisher-
4-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab Mahal
5-Dairy Development and Income Distribution in India
6-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication

Websites for Reference:

http://ecoursesonline.iasri.res.in/course/index.php?categoryid=7
https://milkyday.com/blog/2020/08/24/milk-processing-equipment-for-small-scale-dairy-farm/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	26	46
2	30	54
Total	**56**	**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 GENERAL WORKSHOP PRACTICE – I

(^Common with Mechanical Engineering and Agriculture 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. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop
4. Smithy 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. SMITHY SHOP

4.1. General Shop Talk

4.1.1 Purpose of Smithy shop

4.1.2 Different types of Hearths used in Smithy shop

4.1.3 Purpose, specifications, uses, care and maintenance of various tools and equipments used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.

4.1.4 Types of fuel used and maximum temperature obtained

4.1.5 Types of raw materials used in Smithy shop

4.1.6 Uses of Fire Bricks & Clays in Forging workshop.

4.2 Practice

4.2.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

4.2.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting

a) Demonstration — Making cube, hexagonal cube, hexagonal bar from round bar

4.2.3 Practice of Simple Heat treatment processes like Tempering, Normalizing Hardening etc

4.3. Job Practice: Job Preparation

Job I Making a cold / hot, hexagonal / octagonal flat chisel including tempering of edges.

Job II Production of utility goods e.g. hexagonal bolt / square shank boring tool, fan hook (long S-type) [Two jobs are to be done by the students].

Job III To prepare a cube from a M.S. round by forging method.

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.

1.7 APPLIED MECHANICS AND MACHINE COMPONENTS

L	T	P
4	-	2

RATIONALE

The subject Applied Mechanics deals with fundamental concepts of mechanics which are useful for the students for further understanding of the second & final year subjects like S.O.M. and theory and design of steel & masonry structures as well as RCC designs. The subject enhances the method ability of the students.

LEARNING OUTCOMES

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

- Understand the concepts of forces and force systems.
- Understand the concepts of equilibrium.
- Solve and analyze real world problems pertaining to applied mechanics like levers and safety valves.
- Understand the physics of mechanical and thermal systems.
- Understand the working and applications of mechanical auxiliaries.
- Understand the basics of mechanisms of machines and their related velocity and acceleration profiles.

DETAILED CONTENTS

1. **Introduction:** **(3 Periods)**

   Mechanics and its utility. Concept of scaler and vector quantities. Effect of a force. Tension & compression. Rigid body. Principle of physical independence of force. Principle of transmissibility of a force.

2. **System of Forces :** **(6 Periods)**

   Concept ofcoplaner and non-coplaner forces including parallel forces. Concurrent and non-concurrent forces. Resultant force. Equilibrium of forces. Law of parallelogram of forces. Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a praticle,conditions of equilibrium of coplaner concurrent force system.

3. **Moment & couple:** **(6 Periods)**

   Concept of Varignon's theorem. Generalized theorem of moments. Application to simple problems on levers-Bell crank lever, compound lever, steel yard, beams and wheels, lever safety valve, wireless mast, moment of a couple; Properties of a couple ; Simple applied problems such as pulley and shaft.

4. **General Condition of Equilibrium:** **(6 Periods)**

General condition of equilibrium of a rigid body under the action of coplaner forces, statement of force law of equilibrium, moment law of equilibrium application of above on body.

5. **Friction:** **(6 Periods)**

Types of friction: statical, limiting and dynamical friction, statement of laws of sliding friction, Coefficient of friction, angle of friction; problems on eqilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

6. **Centroid and Moment of Inertia :** **(6 Periods)**

Centroid of plane areas, volumes and composite bodies, Moment Of inertia of simple geometric sections (without derivation),Parallel and perpendicular aixi theorem, Radious of gyration

7. **Thermal Engg.** **(6 Periods)**

A. SOURCES OF ENERGY:

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work.Zerothlow of thermodynamics

Basic ideas, conventional and nonconventional forms-Thermal, Hydel, Tidal, wind, Solar, Biomass and Neuclear and their uses.

8. **MACHINE COMPONENTS:** **(12 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.
(vi) 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. Selection of ball bearing and roller bearing for given application using design data book.

(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. Selection of spring by design data book, simple numerical problem.

(viii)Transmission of Motion By Belts, Ropes & Pulleys, Chain & Sporckets :

Open and cross belt drive, determination of velocity ratio. Effect of thickness and slip on the velocity ratio (Concept only, No mathematical treatment), Method of prevention of slip. Determination of velocity ratio in compound belt drive, use of stepped pulley. Classification and uses of ropes in transmission operation. Chains and their classifications, their application in power transmission, their comparison with other drive systems

9. **MECHANISMS: (5 Periods)**

Definition of link, Frame and mechanism. Difference between machine and machanism, kinematic pairs, lower and higher pairs. Velocity diagram for four bar mechanism, slider crank mechanism, quick return mechanism. Introduction to Cam and its use.

LIST OF PRACTICAL

1. To verify the law of Polygon of forces.
2. To verify the law of parallelogram and triangle of forces.
3. To verify the law of principle of moments.
4. To find the coefficient of friction between wood, steel, copper and glass.
5. To find the reaction at supports of a simply supported beam carrying point loads only.
6. Study and demonstration of the following

1. (a) Bio Gas Plant.
   (b) Wind Mill.
   (c) Solar Cooker.
   (e) Voltaic Cell Type Soalr Energy Converter.

2. Key's, Key ways and Splined shaft e.g. Jib head key, Flat key, Saddle key, Woodruff key, Feather key, Pin key, Splined shaft.
3. Pins- Split pin, Taper cotter type split pin, Cottor pin, Foundations Bolts- Lewis rag bolt, Fish tail bolt and Square head bolt.
4. Friction clutch and Coupling- Cone cluch, Plate cluch (Single Pair); Muff coupling, Flange coupling, Universal or Hook's joint coupling. Flexible coupling- Belt and Pin Type, Coil spring type.
5. Bearings- Plane, Bush, Split step bearings, Ball Roller bearings, Thrust bearings.
6. Gears- Spur gear, Single and Double herical gears, Bevel gears.
7. Gear Trains- Simple spur gear train, Compound gear train, Epicyclic gear train.
8. Compressor and Tension helical springs.
9. Slider Crank Mechanism.

Performance Practicals

10. Determine the angle covered in forward and return stroke of Quick Return Mechanism of available shaper in machine shop.

11. Estimate the amount of ash and moisture in given sample of coal or coke

NOTE:

Field visits are recomended for equipments not available in the institution such as biogas plant, wind mill. No need to purchase them. No actual installation of this lab in a separate room wanted. Equipment of this lab can be accommodated in applied mechanics lab or else where.

INSTRUCTIONAL STATREGY:

Teacher should focus on the basic concepts used in various operations in dairy engineering and technology.

MEANS OF ASSESSMENT:

Theory classes / quizzes.
Practical / viva-voce.
Assignments.

RECOMMENDED BOOKS

1. A text book of applied mechanics by R.S.Khurmi
2. A text book of applied mechanics by S.Ramamurtham
3. A text book of applied mechanics by R.K.Rajput
4. A text book of applied mechanics by Birinder singh,KPH publications new delhi
5. Elements of mechanical engineering by J.K.Kapoor.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	3	8
2	6	12
3	6	12
4	6	10
5	6	10
6	6	10
7	6	10
8	12	20
9	5	8
Total	**56**	**100**

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: (20 Periods)

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 Simposns 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 its measurement.
- 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-Voice

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 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. Fuels and 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. Primming 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 Electrobytes); 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
2. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric 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 & Shiksha Vij, 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**

2.4 WORKSHOP TECHNOLOGY

L	T	P
5	-	-

RATIOANELE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Fabricate welding joints using gas welding arc welding, TIG and MIG welding of mild steel and stainless steel materials.
- Select suitable (most appropriate) process electrodes, various parameters of process for given job.
- Explain principle of operations of modern welding processes.
- Inspect various welding joints and castings.
- Prepare pattern for given job.
- Select material and type of patterns, cores.
- Prepare sand moulds manually and on machine.
- Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.
- Cast a mould.
- Identify a suitable furnace, alloying elements
- Carry out deburring of castings.
- Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).

DETAILED CONTENTS

1. Welding (14 Periods)

1.1 Welding Process
Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

1.2 Gas Welding

Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes

1.3 Arc Welding

Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification, B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.

1.4 Other Welding Processes

Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints. Welding defects and inspection.

1.5 Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, other welding process, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

2. Pattern Making (10 Periods)

Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores

3. Moulding and Casting (14 Periods)

3.1 Moulding Sand

Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand,Testing of moulding sand. Safety precautions in foundry.

3.2 Mould Making

Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines squeeze machine, jolt squeeze machine and sand slinger.

3.3 Casting Processes

Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, centrifugal casting.

3.4 Gating and Risering System
Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

3.5 Melting Furnaces
Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace

3.6 Casting Defects
Different types of casting defects, Testing of defects: radiography, magnetic particle inspection and ultrasonic inspection.

4. Metal Farming Process (10 Periods)

4.1 Press Working- Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing trimming, punching, notching, shaving, gearing, embossing, stamping.

4.2 Forging- Open die forging, closed die gorging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging.

4.3 Rolling- Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies.

4.4 Extrusion and Drawing- Type of extrusion- Hot and Cold, Direct and indirect, pipe drawing, tube drawing, wire drawing.

5. Plastic Processing (08 Periods)

5.1 Industrial use of plastics, situation where used.
5.2 Injection moulding-principle, working of injection moulding machine.
5.3 Compression moulding-principle, and working of compression moudling machine.
5.4 Potential and limitations in the use of plastics

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

MEANS OF ASSEMENTS

– Assignment & Quiz,
– Mid-Term and End-Term written test,

- Actual Lab & Practical Work,
- Viva Voce

RECOMMEMDED BOOKS

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
5. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishng House, Roorkee.
6. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	14	25
2	10	20
3	14	25
4	10	20
5	08	10
Total	**56**	**100**

2.5 **DAIRY TECHNOLOGY-I**

L	T	P
5	-	3

RATIONALE

T0 manufacture various milk products from the milk. Various processes are done. The student is expected to posses the knowledge and methods to produce the quality milk products of BIS standards.

LEARNING OUTCOMES

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

1- Fully understand the processing of milk i.e. chilling, filtration, clarification, pasteurization, ultra high treatment, sterilization etc

2-Cream Separation process and it's complete Technology. 3-Manufacturing Technology of special milks, Butter and Ghee.

4- Manufacturing process and Technology of Indigenous Milk Products like Khoa, Cheena, Paneer Dahi, Shrikhand etc.

5-Different standard of the Milk and Milk products.

6- Food safety standards in India and FDA certification

DETAILED CONTENTS

1. **PROCESSING OF MILK:** **(14 Periods)**

   Milk chilling, milk filtration and clarification, milk pasteurization, U.H.T. and vacuum pasteurization. Bottle washing, fluid milk filling, Bulk can filling Homogenization of milk, storage of milk.

2. **SPECIAL MILK AND CREAM SEPARATION:** **(14 Periods)**

   Special milk-toned, double toned, recombined, standardized milk, flavored and chocolate milk and sterilized milk. Separation of cream, different types of creams. Vitamin "D" milk.

3. **BUTTER:** **(14 Periods)**

   Conversion of cream in to butter, Equipment for butter making in Dairy industry, packing and storage of butter. Attributes of butter, its keeping quality. Renovation of spoiled butter. Defects in butter quality, causes and remedies.

4. **GHEE & BUTTER OIL:** **(14 Periods)**

   Manufacturing process of ghee and butter oil from fresh cream. Cultured cream and butter, ghee making equipments. Ag mark: for Ghee.

5. **INDIGENOUS MILK PRODUCTS:** **(14 Periods)**

Preparation of Khoa, Channa, Panir, Dahi and Srikhand. BIS standards for milk and milk products. Food safety standard and Authority of India (FSSAI), Standard of the milk and milk products, FDA certification

DAIRY TECHNOLOGY LAB-I

LIST OF EXPERIMENT

1. Preparation of butter and Table butter.
2. Operation of can washers and bottle washers.
3. Operation of pasteurisers, cream separators with milk.
4. Preparation of flavored milk.
5. Preparation of standardized milk, toned and double toned milk.
6. Preparation of Sterilized milk.
7. Preparation of Dahi.
8. Preparation of Khoa.
9. Preparation of Ghee.
10. Manual cleaning of places of various storage tanks fitting and equipment.

INSTRUCTIONAL STATREGY

The teacher should focus on explaining the concepts with practical examples.

MEANS OF ASSESSMENT

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

1- DAIRY TECHNOLOGY Vol-1 & Vol-2 BY- Shivashraya Singh Publisher- Nipa ISBN-13 9789383305087 & 88

2-DAIRY SCIENCE & TECHNOLOGY BY-Gavin White Publisher- Callisto

3-Milk & Dairy Product Technology By -Edgar Spreer Publisher-

4- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press

5-Technology of Dairy Products : By-J.V.Parekh and Mukund Lal Naware Publisher: CBS Publisher

6-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication

7-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher

8-Dairy Technology : By-V.P Singh & Neelam Sachan : Publisher: Kalayani Publisher

9- Outlines of Dairy Technology ; By – Sukumar Dey ; Publisher- Oxford University Press (Indian Branch)

Websites for Reference:

http://ecoursesonline.iasri.res.in/course/index.php?categoryid=7

https://milkyday.com/blog/2020/08/24/milk-processing-equipment-for-small-scale-dairy-farm/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	14	20
2.	14	20
3.	14	20
4.	14	20
5.	14	20
Total	70	100

2.6 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 Addrsses, 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 Anushka Wirasinha, 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

2.7 GENERAL WORKSHOP PRACTICE –II

(Common with Mechanical Engineering and Agriculture 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 Welding Shop
4 Foundry Shop
5 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 III **M**aking 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.
2.1 Introduction and demonstration of hand tools used in sheet metal shop.
2.2 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, galvanised corrugated sheet, aluminium 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 rivetted Butt Joint.

3 WELDING SHOP – I

3.1 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.

3.2 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

4 FOUNDRY SHOP

4.1 Study of metal and non metals
4.2 Study and Sketch of the Foundry tools
4.3 Study and sketch of Cupola and pit furnace
4.4 To prepare green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)
4.5. Casting of non ferrous (lead or aluminium)

5 MACHINE SHOP

5.1 Study and sketch of lathe machine
5.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.
5.3 Plain and step turning and knurling practice.
5.4 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.

2.7 FIELD EXPOSURE-I

The purpose of this course is to train the students to learn working in factory situations under supervision of factory staff and polytechnic staff. The whole department faculty should be deputed for this purpose. Head of faculty should procure seats for giving summer training for students with the assistance of Director, Board of Apprenticeship Training.

A small project like study of material handling system, Plant layout study, Inventory control, Work study, Process control rejection and rework study, Inspection system and Quality control, etc. may be allotted.

3.1 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors 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 its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

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 equipments.
- 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 Tonne 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

6.2 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers

6.3 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 Machine
9.7 Colour 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

PRACTICAL EXERCISES

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

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

Important Links:

(i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.
(ii) Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.

(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

(iv) **Central Pollution Control Board (CPCB),** Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

(v) Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.

(vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

3.2 STEAM ENGINEERING & HEAT ENGINES

L	T	P
6	-	4

RATIONALE

The heat energy is still a major means of power in the world. Knowledge of Steam Engg. and Heat Engines is very important for Dairy Engineers. The paper presents a introduction to sources of heat and its application.

LEARNING OUTCOMES

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

- Learn various types of boilers, their construction and working.
- Learn draught phenomenon in steam generators.
- Understand the detailed study of steam generation processes and performance parameters.
- Understand the phenomenon of heat exchange in mechanical systems.
- Learn the concepts and working of internal combustion engines.

DETAILED CONTENTS

STEAM ENGINEERING

1. **STEAM GENERATORS:** **(14 Periods)**

Classification of Boilers, Difference between fire tube and water tube boilers. Names of different types of boilers used in dairy plants, their merits and demerits. Principle of working of economic boilers, electric steam boilers. Function and working of different boiler mountings and accessories (simple line diagrams.)

2. **BOILER DRAUGHT:** **(10 Periods)**

Purpose of draught, Concept of different types of draught such as natural, induced and forced draught.

3. **BOILER PERFORMANCE:** **(10 Periods)**

Boiler trial, equivalent evaporation rating of boiler, thermal efficiency. sources of energy and simple numerical problems on boiler trials, boiler management and maintenance, selection of boilers, importance of boiler testing. Boiler safety problems in boiler operation, their identification, remedies and repair and maintenance.

4. **CONDENSERS:** **(10 Periods)**

Types of condensers. Importance of condenser in a steam power plant. Principle of working of a surface and jet condenser with simple line diagrams. (details not required.) Simple calculations related to condensers.

HEAT ENGINES

5. **HEAT TRANSFER :** **(15 Periods)**

Conduction and convection, Concept of heat transfer through combined effect, Heat transfer through fins, Mean temperature difference for parallel and counter flow. Effectiveness of heat exchangers. Simple numerical problems for heat transfer
(Heating and Cooling).

6. **RECIPROCATING STEAM ENGINE :** **(10 Periods)**

Working principle. A brief concept of engine details.

7. **I.C. ENGINES:** **(15 Periods)**

Introduction and classification of IC Engine, working principle of 2-stroke and 4-stroke I.C. Engines (petrol and Diesel). General idea of mixture formation. Purpose and use of fuel equipment. Ignition, Importance of cooling and lubrication.

HEAT ENGINE LAB

LIST OF EXPERIMENTS

1. To study and sketch a boiler installed in the laboratory.

2. To study and sketch fire tube boiler i.e. a Lancashire boiler.

3. To study the construction and working of various mountings.
   (a) Feed check value.
   (b) Safety valve, (dead weight safety valve, lever safety valve and rams bottom safety valve).
   (c) Stop valve.

4. To study the construction and working of various accessories of boiler.

   (a) Air-preheater.
   (b) Green's Economizer.
   (c) Superheater.

5. To study and sketch a two-stroke petrol engine.

6. To study and sketch four stroke I.C. Engine:

   (a) Petrol Engine.
   (b) Diesel Engine.

7. To study and sketch Cooling system of a 4-stroke petrol Engine.

8. To study and sketch Lubrication system of a 4 stroke I.C. Engine.

9. To study and sketch steam condenser.

(a) Surface condenser.
(b) Jet condenser.

10. To study and sketch the fuel supply system of 4 stroke Diesel Engine.

11. To measure the BHP of an I.C. engine.

INSTRUCTIONAL STATREGY: Teacher should mainly focus on the detailed study of boilers, heat engines and internal combustion engines. Some aids / animations should also be demonstrated.

MEANS OF ASSESSMENT:

- Theory classes.
- Practical /Viva voce
- Assignments/ quizzes.

RECOMMENDED BOOKS :

1. Heat engines volume-1 by Dr.N.C.Pandey
2. Thermal engineering by R.K.Hegde
3. Thermal engineering by M.M.L.Patel.
4. Power generation by kapil goyal.

ONLINE RESOURCES:

- www.swayam.in
- www.urise.up.gov.in
- www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	14	20
2	10	12
3	10	12
4	10	12
5	15	16
6	10	12
7	15	16
Total	84	100

3.3 DAIRY ENGINEERING - I

L	T	P
6	-	4

RATIONALE

Milk is an important ingredient for health and therefore it is universally utilized by human being of all age groups. The supply terminals are normally situated at distant places from the processing units. Therefore, effective methods of milk collection and storage are required to avoid microbiological contamination of milk . The students are required to be trained in handling of milk at preprocessing stage.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-Milk storage system and Storage equipments used in the dairy plant.
2-All heat exchanging equipments used in milk processing in a dairy plant
3- Pasteurization and sterilization of Milk and Milk products.
4-Different type of conveyors used in Dairy Plant
5 different types of filling and packaging methods and equipments used for packaging the fluid milk and Milk products in Dairy plant

DETAILED CONTENTS

1. **STORAGE EQUIPMENT:** **(20 Periods)**

Insulated storage tank. refrigerated storage tanks specification for the storage tanks. Milk transport tank. Milk processing equipments, filters, clarifiers. Bactofuge separators-warm milk seprators, cold milk spearators, Triprocess and self desludging centrifugal. Bottle washers, purpose and types, operation, maintenance and trouble shotting.

2. **HEAT EXCHANGING EQUIPMENT:** **(24 Periods)**

Pasteurizing plants, purpose and special requirement. High temperature short time pasteurizer, utilities, regeneration, holding time. Metering pump and drive F.D.V. UHT (Ultra High Temperature) Pasteurizers. Flavour treating systems. Vaceator. Electric conduction pasteurization. direct steam
heater. Milk sterilization. Indirect heating system,
comparison between them.

3. **INSTALLATION OF INFLOOR AND ONFLOOR CONVEYOR: (20 Periods)**

Different types of conveyors used in dairy industry, their drives, take up units. conveyor components, Case stackers and unstacks, Plastic Milk Crates, handling of dispenser milk containers, handling of ice cream.

4. **FILLING AND PACKAGING EQUIPMENTS : (20 Periods)**

Different types of filling and packaging materials, their composition and uses Bottle filler, Flexible packaging, Gravity fillers, Asceptic fillers, Sachet machines, Care and maintenance of fillers, Asceptic canning.

LIST OF EXPERIMENT

1. Study of constructional details, dismantling, assembling, adjustment, and maintenance, commissioning of clarifiers and separators.

2. Study of constructional details, dismantling, assembling adjustment operation, control and maintenance of:-

   (a) H.T.S.T. pasteurizer
   (b) Batch pasteurizer
   (c) Sterilizer

3. Study the working, operation, maintenance, adjustments of bottle washing machine.

4. Study of constructional details, dismantling, assembling adjustment, operation, control, maintenance of bottle filling and capping machine.

5. Study of constructional details, dismantling, assembling, adjustment, operation control and maintenance of fluid milk packaging machine.

6. Study of constructional details, disassembling, assembling, adjustment, operation and control of different types of bulk milk cooler and storage tanks.

7. Study the batch type sterilizer for bottled milk.

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**.**

MEANS OF ASSESSMENT

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,

- Viva Voce

RECOMMENDED BOOKS

1-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab
2- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press
3-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication
4-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher
5- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
6-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
7- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
8- Dairy Engineering : Advanced Technologies and Their Applications; By- Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher-Apple Academic Press
9- Novel Dairy Processing Technologies ; Techniques, Management and Energy Conservation; By- Megh R. Goyal, Anit Kumar, Anil K.Gupta Publisher: CRC Press

Online Resources

1. https://agrimoon.com/
2. Swayam.gov.in
3. https://www.researchgate.net/
4. https://www.perlego.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	24	28
3	20	24
4	20	24
Total	84	100

3.4 **DAIRY MICROBIOLOGY**

L	T	P
6	-	4

RATIONALE

The chemical changes in the milk are caused due to micro-organism. The study of different type of micro-organism is essential for maintaining the nutritive value and taste of milk products. Disintegration of milk may result the unhygienic effect on the human body and various types of deceases may be caused. Therefore, micro-biological pollution should be controlled.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-Microorganism types, structure, growth in the milk and different products during processing.
2-M measurement of bacterial growth nutrition milk
3-Hygenic Milk production
4 Microbiological test of milk and Milk products.
5- Waste management for Dairy Plant

DETAILED CONTENTS

1. **INTRODUCTION TO MICROBIOLOGY:** **(20 Periods)**

General concept regarding classification and nomenclature of micro organisms. Principles of staining, morphology and structure of bacteria, yeast and moulds Growth, reproduction and spore formation in micro organisms. Bacteriological techniques for enumeration, isolation and identification of bacteria. Measurement of bacterial growth . Nutrition and metabolism of Bactria. Effect of physical and chemical factors on growth and death of micro organisms.

2. **PRINCIPLE OF HYGENIC MILK PRODUCTION:** **(24 Periods)**

Sources of contamination of milk, relative importance and methods of their control. Growth of different types of micro-organisms in milk and their role in spoilage. Farm and dairy sanitation, cleaning and sanitization of dairy equipment's, different methods of controlling bacterial growth in milk, effect of cooling pasteurization, sterilization and ultra-high temperature on Bactria in milk, milk borne diseases. Quality control tests for milk, psychrophilic, mesophilic, thermoduric and thermophilic Bactria. Starter culture and their use in preparation of curd, butter, cheese, yogurt & acidophilus milk. microbial spoilage of evaporated and condensed milk, processed cheese ice-cream and other milk products.

3. **DAIRY WASTE MANAGEMENT :** **(20 Periods)**

Characterization of the dairy waste (solids, liquids & gases) and its treatment through chemical, physical & biological methods and their utilization.

4. **MICROBIOLOGIAL TEST :** **(20 Periods)**

Standard plate count, Total plate count, Coliform test, Yeast And mould test, Phosphatase test, Methylene blue reduction test, ETP water test, BOD and COD, SWAB test, Pathogens tests.

List of Experiment

1. Familiarity with equipments used in Microbiological work and common bacteriological techniques.
2. Motility of bacteria, yeast and molds.
3. Preparation of smears, simple staining, gram staining and study of morphology of bacteria, yeast and molds.
4. Direct microscopic count.
5. Standard plate count technique.
6. To conduct Dye-Reduction and presumptive and utensils.
7. Examination of sterility of dairy equipment coliform tests.
8. Micro-organisms in air.
9. Examination of various milk products with respect of the
   (a) Total plate count.
   (b) Total coliform count.
   (c) Total yeast and Mold counts.

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.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1- Dairy Microbiology Handbook; The Microbiology of Milk and Milk Products; By-R K Robinsion; Publisher-

2-Applied Dairy Microbiology; By-Elmer H Marth, James Steele ; Publisher; Taylor & Francis
3-Dairy Microbiology; A practical approach ; By- Photis Papademas ; Publisher-CRC Press
4-Dairy Microbiology; By- Pradeep Parihar :Publisher- Student Edition,2008
5- Fundamental of Micobiology; By-I Edward Alcamo; Jones and Bartlett

6- A comprehensive Dairy Microbiology; By-JS Yadav , Sunita Grover and V K Batish
7- Food and Dairy Microbiology; By- Dr M K Rao ; Publisher- Mangalam publishers & Distributors
8- Dairy Microbiology, KC Mahanta

WEBSITES FOR REFERENCE:

- www.swayam.in
- www.urise.up.gov.in
- www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	24	28
3	20	24
4	20	24
Total	84	100

3.5 **DAIRY CHEMISTRY**

L	T	P
6	-	4

RATIONALE

Several milk products are manufactured from milk. The quality and variety of finished products require a qualitative and quantitative study of composition of milk. The student having knowledge about the initial essential constituents of milk like proteins, lactose, enzymes, etc., will be very useful for milk processing plants.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-Milk composition of buffalo, cow, sheep, goat etc. and composition .
2-Physical and chemical properties of milk and its measurement.
3-Details of Milk Fat, Proteins, Lactose, Enzymes.
4- Vitamins and pigments present in milk
5- different factors affecting the composition of milk

DETAILED CONTENTS

1. **COMPOSITION OF MILK:** **(08 Periods)**

Average gross composition of colostrum and milk of cow, buffalo, sheep and goat. Detailed composition of cow milk; factor affecting the composition of milk; basic differences between cow and buffalo milks.

2. **PHYSICAL PROPERTIES OF MILK:** **(08 Periods)**

Colour, specific gravity, index of refraction, surface tension, viscosity, specific heat and its significance in dairy industry, boiling point and freezing point ; acidity, pH and buffering capacity. Electrical conductivity, Osmotic pressure of milk.

3. **MILK FAT:** **(06 Periods)**

Composition of milk fat; factors affecting composition of milk fat quality; physico-chemical constants of butter fat; hydrolysis; oxidation rancidity; saponification and hydrogenation.

4. **MILK PROTIENS:** **(06 Periods)**

General properties and classification of milk proteins; casein, lactalbumin and lactoglobulin and their general properties.

5. **LACTOSE:** **(04 Periods)**

General physical and chemical properties of lactose; hydrolysis of lactose; chemistry of fermentation of lactose into lactic acid; crystallization of lactose & purification.

6. **ENZYMES:** **(06 Periods)**

Definition and function, classification of milk enzymes and their roles in different metabolic reactions.

7. **VITAMINS AND PIGMENTS IN MILK:** **(06 Periods)**

General qualitative and quantitative study.

8. **COMPOSITION AND PHYSICO CHEMICAL CHANGES** : **(06 Periods)**

Composition and physico chemical changes in preparation of dairy products, such as cream, butter, ghee, condensed milk, whole milk powder and skim milk powder, baby food, Ice- cream, cheese, paneer, chhenna, khoa, and dahi. Nutritive value of milk and milk products.

9. **MINOR CONSTITUENTS :** **(06 Periods)**

Minor constituents and effect of metal in milk and milk products. Detection of adulteration of milk & milk products. Preservation in milk and their detection.

LIST OF EXPERIMENTS

1. Determination of Sp. gravity of milk by lactometer.
2. Determination of fat by Gerber methods and by milk tester.
3. Determination of percentage of S.N.F. by lactometer.
4. Determination of lactose content by polarimetric and volumetric methods.
5. Determination of protein content of milk by kjeldahl method.
6. Common platform test of milk such as C.O.B, alcohol and sediment test.
7. Determination of acidity of milk.
8. Determination of freezing point of milk.
9. To analyze the following milk products-cream, ghee, butter, ice-cream, khoa, chhenna.
10. Estimation of strength of various sanitizers and detergents.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models 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.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1- Outlines of Dairy Technology ; By – Sukumar Dey ; Publisher- Oxford University Press (Indian Branch)
2-Text book of Dairy Chemistry ; By- M P Mathur, D Datta Roy, P. Dinakar ; Publisher-ICAR New Delhi
3- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
4-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
5- Fundamentals of Dairy Chemistry; By- Webb .B. H ;Publisher-CBS Publisher
6- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
7-A Text Book of Dairy Chemistry ; By – MP Mathur ;Publisher-ICAR
8- Dairy Chemistry ; By- Hary Synder Publisher; Nabu Press
9- Fundamentals of Dairy Chemistry; By-Webb Johnson and Alford; Publisher-CBS
10-दुग्ध रसायन एवं पशु पोषण- डॉ० तेज बहादुर सिंह
11- दुग्ध रसायन एवं पशु पोषण-विनय सिंह

WEBSITES FOR REFERENCE:

1. https://agrimoon.com/
2. Swayam.gov.in
3. https://www.researchgate.net/
4. https://www.perlego.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	12
2	10	12
3	10	12
4	10	12
5	10	12
6	8	9
7	8	9
8	10	12
9	8	10
Total	84	100

3.6 **FIELD EXPOSURE**

After the II Sem Exam. Student of II Sem Dairy Engineering will go for a two week visit of a small/medium size dairy plant.

It will be structured and supervised by the institution. Purpose of the visit is to give students an exposure of industrial setup and that of simple tools, instruments and the skill there in day-to-day use.

Every student will submit the institution a report of his visit.

The report will in variably contain the description of his observations about

(1) Products/Work

(2) Tools and Equipment's Used.

Students will be evaluated at institution level In III Sem. for 30 marks for the report presented.

4.1 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

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 Revathi Srinivas; 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/BTE/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**

4.2 HYDRAULICS AND PNEUMATICS

L	T	P
5	1	2

RATIONALE

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

LEARNING OUTCOMES

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

- Explain fluid properties, their units and conversion.
- Measure different types of pressures.
- Maintain different types of pressure gauges.
- Calculate flow and discharge of various liquids.
- Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.
- Calculate pipe friction and losses in pipelines.
- Specify hydraulic machines for different applications.
- Apply Pascal's law in practical applications.
- Explain the functions of various components used in hydraulic and pneumatic system.
- Maintain hydraulic and pneumatic system.

DETAILED CONTENTS

1. Introduction (06 Periods)

   Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.

2. Pressure and its Measurement (07 Periods)

   2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
   2.2 Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems
   2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

3. Flow of Fluids (09 Periods)

Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venturi-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem simple problems.

4. Flow through Pipes (10 Periods)

4.1 Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction; siphon, power developed. Water hammer, anchor block, syphon, surge tank (concept only).

4.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof)

5. Hydraulic System (05 Periods)

Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press.

6. Water Turbines and Pumps (14 Periods)

6.1 Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, Cavitations.

6.2 Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.

6.3 Construction, working and operation of centrigual pump. Performance, efficiencies and specifications of a centrifugal pump, pitting, cavitation, priming.

7. Introduction to Oil Power Hydraulics and Pneumatics (05 Periods)

7.1 Introduction to oil power hydraulic and pneumatic system

7.2 Statement of Pascal law and its applications

7.3 Industrial applications of oil power hydraulic and pneumatic system

8. Components of Hydraulic Systems (06 Periods)

8.1 Basic components of hydraulic system, function of each component in a hydraulic circuit.

8.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,

8.3 Filters- definition and purpose, classification

8.4 Seals and packing- classification of seals, sealing materials.

9. Components of Pneumatic Systems (08 Periods)

9.1 Basic components – function of each component

9.2 Air compressors - Introduction

9.3 Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tandem cylinder, double ended cylinder, duplex cylinder.

9.4 Air filter, regulator and lubricator – their necessity in pneumatic circuit.

9.5 Installation, maintenance and application of air cylinders.

LIST OF PRACTICALS

1. Measurement of pressure head by employing.
   i) Piezometer tube
   ii) Single and double column manometer
2. To find out the value of coefficient of discharge for a venturi meter.
3. Measurement of flow by using venturi meter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.
9. Direct operation of single and double acting cylinder.
10. Automatic operation of double acting cylinder in single cycle using limit switch.
11. Operation of double acting cylinder with quick exhaust wall.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.
3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.
10. e-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.

Website for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	08
2	07	10
3	09	12
4	10	15
5	05	08
6	14	20
7	05	07
8	06	08
9	08	12
Total	**70**	**100**

4.3 DAIRY ENGINEERING - II

L	T	P
6	2	6

RATIONALE

To produce various types of milk products, different types of equipment's and their operation is the essential requirement of dairy plant. Therefore the student should posses the knowledge of handling , operating and maintenance of these equipment's to manufacture the different types of finished milk products.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-Construction and working of different ice cream equipments used in Dairy plant.
2- construction and working of Homogenizers, Cream ,Butter and Ghee making equipments.
3-Details in of Different equipments for Cheese and Casein Manufacturing.
4-Modern Equipments for handling all the important Dairy Products.
5-Maintenance of all these equipments.
6-All precautions in installation and operations of Cream, Ghee, Butter, Cheese and Casein Manufacturing equipments.

DETAILED CONTENTS

1. **ICE CREAM EQUIPMENTS:** (20 Periods)

Ice cream freezer batch type freezer, Continuous type freezers, type of designs, air incorporation, overrun, control systems, freezing cylinder, dasher, scrapping blades, controls of refrigeration, packing of ice cream, hardening methods, storing, transportation, cabinets, dismantling, cleaning and assembling of ice cream freezer, daily and periodical maintenance, calculation of freezing point and refrigeration requirement of mixes, refrigeration requirement of freezer, condition affecting of freezer.

2. **HOMOGENISERS:** (20 Periods)

Theory of homogenization, design, material, single stage and two stage homogenizers, efficiency of homogenization, gear, piston, valves, gauges, starting, operation, dismantling, cleaning, assembling, horsepower, relation to power, daily and periodical maintenance, lubrication, checking for condense water in oil, spare parts.

3. **CREAM, BUTTER AND GHEE HANDLING EQUIPMENT:** (24 Periods)

Cream ripening tanks, design, material, automatic control, operation, cleaning, maintenance of Continuous Butter making equipment. Wooden churn, metal churn, design of barrel foil and roll less types of churns, gear box, rear frame, low mounting, high mounting motor, speed of churn, power consumption, washing, cleaning, daily and periodical maintenance, pumping of butter trolley, butter packing machines, type, design, operation, cleaning and maintenance, Ghee pans, construction, cleaning, packing and storage.

4. **CHEESE AND CASEIN EQUIPMENTS:** (20 Periods)

Cheese vats, tanks, design, material, dimension, manual agitation, mechanical agitation, curing, mills, cheese hoops, presses, transportation, curing rooms, storage rooms, continuous cheese making, casein, (acid and rennet) casein vats, pressure dryers, air and steam requirements, capacity, dimension etc. Daily and periodical maintenance, lubrication, spare parts.

DAIRY ENGINEERING LAB -II

Study of constructional details, dismantling, assembling, adjustment, operation, control and maintenance of:

1. Homogenizer.

2. (a) Batch type ice cream freezers.
   (b) Continuous ice cream freezers.

3-Different types of butter churns.
4-Continuous Butter Making machines.

5- Cheese vats accessories.

6- Casein dryers.

7- Ghee pans and continuous ghee making machine.

8-Packaging machines and materials for ghee,
9-Packaging machines and materials for butter and ice cream
10-Packaging of Different Cheese products.
11-Water softening unit.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, 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 more knowledge in the students.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab
2- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press
3-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication
4-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher
5- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
6-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
7- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
8- Dairy Engineering : Advanced Technologies and Their Applications; By- Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher-Apple Academic Press
9- Novel Dairy Processing Technologies ; Techniques, Management and Energy Conservation; By- Megh R. Goyal, Anit Kumar, Anil K.Gupta Publisher: CRC Press

WEBSITES FOR REFERENCE:

- www.swayam.in
- www.urise.up.gov.in
- www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	20	24
3	24	28
4	20	24
Total	**84**	**100**

4.4 REFRIGERATION - I

L	T	P
7	2	6

RATIONALE

To avoid microbiological disintegration and ladder preparation of milk air conditioning and refrigeration are required to produce low temperature. The students are required to posses the knowledge of various methods of creating low temperature.

LEARNING OUTCOMES

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

- Understand the basic and applied thermodynamics used in refrigeration.
- Learn the calculations of refrigeration.
- Understand the uses and mechanisms of refrigerants.
- Learn the details of various aids/auxiliaries subjected to refrigeration systems.
- Learn the details of refrigeration plants like performance analysis and charging.
- Learn to test the refrigeration effects produced.
- Understand the trouble shootings in refrigeration plants and their remedies

DETAILED CONTENTS

1. First and Second laws of thermo-dynamics. Introduction and necessity of refrigeration, meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Reversed carnot cycle and its representation on P-V and T-S diagram. Basic vapor compression refrigeration cycle and its components. Representation on P-H and T-S diagram. Actual Vapour Compression Cycle. Volumetric efficiency. **(30 periods)**

2. Refrigerants particularly ammonia and freon. Leak Detection of refrigerants, Air Refrigeration cycle. Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system

3. Refrigeration Equipments:
    - **Compressors:** General discussion, types of equipment. Reciprocating compressors, open and hermetic compressors, cylinder arrangement. Number of cylinders, cylinder heads, stage compression, reciprocating compressor drives, reciprocating compressor valves. Cooling and lubrication Rotary compressors, centrifugal compressors.
    - **Condensers:** Air-cooled and water-cooled condensers. evaporative condensers and cooling towers. Screw compressor, Lithium Bromide type and Evaporating compressors.
    - **Expansion Valves:** Function, various types such as Automatic & Thermostatic, capillary tube, thermostatic expansion valve, low side and high side float valves, and application of various expansion valves.
    - **Evaporators:** Types and selection, refrigeration controls,

- **Compressor:** Motor Control-Thermostatic motor control and pressure motor control, solenoid valve. Low- and high-pressure controls, Compressor capacity controls, oil separator. Dry expansion flooded system, direct expansion and brine cooling. Ice bank system.

(35 periods)

4. Performance and capacity of refrigeration plants. Charging of plant. Maintenance of refrigeration plant. Ice plant, common defects and remedies. Introduction to Vapour absorption Refrigeration system. **(26 periods)**

REFRIGERATION-I LAB

LIST OF EXPERIMENTS

1. To learn the installation of refrigeration plant:

   (a) To study how to cut, bend and Flavia copper tubing.

   (b) To study how to evaluate refrigeration system.

   (c) To study how to charge refrigeration plant.

2. To study different parts and operation of ice plant using ammonia as refrigerant.

3. To study the different parts and learn the operation of bulk milk cooler.

4. To dismantle an open type compressor, study its parts, assemble it again.

5. To dismantle a sealed unit compressor, study its parts and assemble it again.

6. To study different refrigerant unit at different operating condition.

7. To test the condensing unit at different operating condition.

8. Fault tracing on refrigeration equipment.

9. Refrigeration plant maintenance.

10. To dismantle& assemble rotary type of compressor and study their parts.

11. To dismantle and assemble a centrifugal compressor and study its parts.

12. To dismantle and assemble a gear type compressor and study its part.

13. To study and sketch of a domestic refrigerator.

14. To study and sketch a water cooler.

INSTRUCTIONAL STATREGY: Teacher should make the students able to learn the cryogenics of dairy plants through different offline/online supplements.

MEANS OF ASSESSMENT: Theory classes.
Assignments /quizzes
Lab work /viva voce /field visits.

RECOMMENDED BOOKS :

1. Refrigeration and air conditioning by Arvind kumar Sharma.
2. A textbook of refrigeration and air conditioning by R.S.Khurmi,S.Chand publications.
3. A textbook of refrigeration and air conditioning by R.K.Rajput.
4. Refrigeration and air conditioning by C.P.Arora

WEBSITES FOR REFERENCE:

- www.wikipedia.com
- www.nptel .ac.in
- www.swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	24	24
2	27	28
3	27	28
4	20	20
Total	98	100

4.5 **Universal Human Values**

L-T-P
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 (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- 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 Purblishers.
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. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, Amravati.
7. A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, 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**

4.6 **IN-PLANT TRAINING-I**

Students after appearing in theory exams will undergo a four week in-plant training in a market milk plant/large or medium-sized dairy plant to familiarize them with plant actual problems and environments.

The students shall prepare a report of this training and submit to their institution within one week of completion of training.

Viva-Voce shall be conducted on this by head of department.

IN-PLANT TRIAINING - I
(TRAINING SCHEDULE)

4 weeks structured, branch specific, task oriented Summer-in-plant training to be organized during summer vacation after Second year Examination.

The student during the vocational training must under take training in the following & submit the training report in the format given at annexure - III.

1. R.M.R.D. (Raw Milk on Receiving Dock)

   Weighing machines, washing machines, loading and unloading of milk.

2. Processing of milk

   Chilling, Pasteurizers, Cream separators, Homogenizers, Storage tanks.

3. Production of milk products

   Ghee, Khoa, Chhena, Paneer, Cheese, Milk powder.

4. Packaging and packaging machines

   Milk, Butter, Milk Powder, Ghee, Other products.

5. Transportation

   Transportation of milk & milk products.

6. Store procedures & quality control

   Store procedures of raw materials & dairy products.

7. Time office, Finance & Accounts

   Cash book maintenance, Salary distribution, factory schedule.

5.1 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 mindset 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 organisations
   1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organisation: 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, organising, staffing, directing and controlling
4.3 Principles of management (Henri Fayol, F.W. Taylor)
4.4 Concept and structure of an organisation
4.5 Types of industrial organisations and their advantages
4.6 Line organisation, staff organisation
4.7 Line and staff organisation
4.8 Functional Organisation

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 Behavioural 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 organisations 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/UBTE/NITTTR, Chandigarh.

Websites for Reference:
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**

5.2 DAIRY ENGINEERING-III

L	T	P
6	2	4

RATIONALE

To produce dry milk for infants' food and for other needs of human being, the different types of operations with various types of equipment are done. The student should posses the knowledge of handling, operating and maintenance of these equipment's to manufacture dry milk product.

LEARNING OUTCOMES

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

1-Details of construction and working are all type of Evaporators used in Dairy plant
2-Evaporator accessories used
3-Mechanical and thermos-recompression systems used with evaporator
4- calculation of steam requirements for evaporation.
5-Construction and working of milk drying equipments.
6- Modern spray dryers working operations and maintenance.
7-Continuous and batch membrane Separation systems for Dairy Plant.

DETAILED CONTENTS

1. **EVAPORATORS:**

Objectives, single and multiple operation. Types of evaporators (single pan, falling film, rising film, forced circulation, plant centrifuging and expanding flow type.) Performance of tubular evaporators, evaporator capacity boiling point elevation, effect of liquid head, and friction on temp. Material and Enthalpy balances of single effect evaporation and multiple effect evaporation, maintenance of evaporators.

2. **VAPOUR RECOMPRESSION SYSTEM:**

Mechanical recompression. Thermo-recompression systems. Heat pump cycle (Low temperature concentration) condensers and other ancillaries.

3. **DRYING EQUIPMENTS:**

(i) Different Types of Drying Equipment:

Classification of different drying systems, spray drying system.

(ii) SPRAY DRYING SYSTEMS:

Pressure spray nozzles, centrifugal discs spraying, thermodynamics and engineering aspects of air entering and leaving the dryer, cyclone separators, bag filters, nano spray dryer, swans on spray dryer, operation, care and maintenance of spray dryers.

4. **MEMBRANE SEPRATION SYSTEMS:**

Ultrafiltration process and Di filtration process equipments. Different materials used for membrane separation, Batch and continuous ultra filtration, Reverse Osmosis Processes, Comparison between ultrafiltration and R.O. systems. Nanofiltration, Principal working and material used for Nanofiltration.

DAIRY ENGINEERING III LAB

Study of constructional details, dismantling, assembling, adjustment, operation, control of-

1- Different types of evaporators.
2- Different accessories used in Evaporator.
3- Calculation of Evaporator Performance.
4- Condensers,
5- low temperature concentrators.
6- Spray dryer and controls,
7- Cyclone separators and bag filters.
8- C.I.P. systems for Evaporators and its circuits.
09- Maintenance of Evaporators.
10- Maintenance of Drum and Spray Dryers

INSTRUCTIONAL STATREGY

The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab Mahal
2- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press
3-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication

4-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher
5- Dairy Science and Technology Hand Book ; By Y .H. Hui Publisher; John Wiley
6-Dairy Engg Practical Book ; By-Seema Tanwar , V.D Mudgal, S K Jain ; Publisher- Satish Serial Publishing House.
7- Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
8- Dairy Engineering : Advanced Technologies and Their Applications; By- Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher-Apple Academic Press
9- Novel Dairy Processing Technologies ; Techniques, Management and Energy Conservation; By- Megh R. Goyal, Anit Kumar, Anil K.Gupta Publisher: CRC Press

WEBSITES FOR REFERENCE:

1. https://agrimoon.com/
2. Swayam.gov.in
3. https://www.researchgate.net/
4. https://www.perlego.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	30	26
2	30	26
3	26	24
4	26	24
Total	**112**	**100**

5.3 DAIRY TECHNOLOGY-II

L	T	P
6	-	4

RATIONALE

Various milk products are manufactured from milk which are served as special dishes in hotels and special function without spoiling the nutrition value of milk. Preparation of these articles is a specialized job. A student aware of preparation and packaging of these dairy products will be useful in the dairy plant and entrepreneur.

LEARNING OUTCOMES

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

1- The Technology of making cottage cheese, cheddar cheese, and Processed Cheese.
2-Defects in cheese their causes and their remedies .
3-Technology of different types of Casein manufacturing and their uses.
4-By products of casein manufacturing.
5-technology of ice cream manufacturing
6-technology of condensed and dried Milk products
7-Packaging of dairy products

DETAILED CONTENTS

1. **MANUFACTURE OF CHEESE:**

   Basic principles underlying the manufacture of Cheese, different varieties of cheese. Manufacture of cheddar cheese and processed cheese, their defects, causes and remedies. Average composition and yield of different types of cheese.

2. **MANUFACTURE OF CASEIN & OTHER BY-PRODUCTS:**

   Basic principles involved in Casein manufacture, classification of caseins, Manufacture of different types of lactose, whey protein and different types of casein. Defects, their causes and remedies, manufacture of caseinates.

3. **ICE-CREAMS:**

   Composition of different varieties of ice-creams. Selection of different ingredients used in ice-cream. Manufacturing procedures for batch and continuous ice-cream and dried ice- cream mixed defects, their causes and remedies.

4. **CONDENSED AND DRIED MILK PRODUCTS:**

Manufacturing, packaging and storage of sweetened condensed milk. Concentration of milk by Membrane system. Manufacturing of evaporated milk and infant foods, instant powders and other formulated products.

5. **PACKING OF DAIRY PRODUCTS:**

Different systems and materials of packaging of dairy products, primary and secondary packages, flexible packages and metal containers methods for sterilization of packaging materials. Modern packaging materials for UHT products, Lactose, Whey powder, Sodium Caseinate, etc.

DAIRY TECHNOLOGY-II LAB

LIST OF PRACTICALS

1. Preparation of starter culture.
2. Preparation Cheddar Cheese, Cottage Cheese and Processed Cheese.
3. Preparation of ice cream.
4. Preparation of different types of casein.
5. Demonstration of preparation of Spray Dried milk powder (skim and whole milk powder)
6. Preparations of evaporated milk and sweetened, condensed milk.
7. Use of packing machines for processed products.
8. Manual cleaning and cleaning in place of various fitting and equipment's.
9. Cleaning of Dairy Floors.

INSTRUCTIONAL STATREGY

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.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1 - DAIRY TECHNOLOGY Vol-1 & Vol-2 BY- Shivashraya Singh Publisher- Nipa ISBN-13 9789383305087 & 88
2-DAIRY SCIENCE & TECHNOLOGY BY-Gavin White Publisher- Callisto
3-Milk & Dairy Product Technology By -Edgar Spreer Publisher-
4- Dairy Engineering : Advanced Technologies and Their Application: By Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher- CRC Press

5-Technology of Dairy Products : By-J.V.Parekh and Mukund Lal Naware Publisher: CBS Publisher
6-Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication
7-Dairy Products manufacturing Technologies By-Jagdish Prasad : Publisher: Kalayani Publisher
8-Dairy Technology : By-V.P Singh & Neelam Sachan : Publisher: Kalayani Publisher
9- Outlines of Dairy Technology ; By – Sukumar Dey ; Publisher- Oxford University Press (Indian Branch)
10-दुग्ध प्रौद्योगिकी एवं गुणवत्ता नियंत्रण- इन्द्रजीत जौहर,भाटी एवं लवानिया |

WEBSITES FOR REFERENCE:

1. https://agrimoon.com/
2. Swayam.gov.in
3. https://www.researchgate.net/
4. https://www.perlego.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	19
2	16	19
3	16	19
4	20	24
5	16	19
Total	**84**	**100**

5.4 REFRIGERATION - II

L	T	P
6	2	4

RATIONALE

Microbiological disintegration of milk can be delayed at reduced temperatures. Therefore the student of Dairy Engineering is supposed to have ample knowledge of Airconditioning and refrigeration system.

LEARNING OUTCOMES

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

- Understand the concepts of refrigeration parameters through psychometric analysis.
- Learn the establishments and operational procedure of cold storage plants.
- Understand the sub units of refrigeration units.
- Learn the design of devices of thermal importance.

DETAILED CONTENTS

1. **PSYCHROMETRY:**

Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air. Psychrometers, Sub freezing conditions, Psychrometric charts. Process involving air vapor mixtures. Humidity measurements, humidity control and overload protection. **(30 periods)**

2. **COLD STORAGE:**

Types of loads in cold storages and their calculations. Product condition on entering. Product chilling. Quick freezing. Sharp freezing of packaged materials. Equipment selection. Construction of cold storage and freezing rooms. Insulating materials and their characteristics. Condensation problems in insulation, recommended thickness. Insulating materials, pipes and rooms, protection of insulation. Water vapor barriers. **(30 periods)**

3. **REFRIGERATION PLANT:**

Testing of refrigeration equipment's and their performance. Compressor capacity and its control. Condensing water control. Ice cream handling chambers and equipments, Equipment design. Design of condenser and cooling tower for different applications. Design of evaporator. Refrigeration piping. **(24 periods)**

LIST OF PRACTICALS

1. To study different parts and operation of Air Cooler.

2. To study different parts and operation of room, Airconditioning Unit.

3. To charge a sealed unit refrigeration system of an air conditioner. With the given refrigerant & Air conditioner with the given refrigerant.

4. To charge an open unit refrigeration system of an air conditioner with the given refrigerant.

5. Cold storage design and equipment selection.

6. To learn how to fire different insulations for different applications (Thermocol, Fiber glass etc.)

7. Study of ice cream hardening room design equipment. Selections.

8. Study of construction details, dismantling, assembling, adjustment, operation, control and maintenance of different types of compressors and thermo-recompressors.

INSTRUCTIONAL STATREGY:
Teacher should make the students able to learn the cryogenics of dairy plants through different offline/online supplements.

MEANS OF ASSESSMENT: Theory classes.
Assignments /quizzes
Lab work /viva voce /field visits.

RECOMMENDED BOOKS :

1. Refrigeration and air conditioning by Arvind kumar Sharma.
2. A textbook of refrigeration and air conditioning by R.S.Khurmi,S.Chand publications.
3. A textbook of refrigeration and air conditioning by R.K.Rajput.
4. Refrigeration and air conditioning by C.P.Arora

WEBSITES FOR REFERENCE
www.wikipedia.com
www.nptel .ac.in
www.swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	30	36
2	30	36
3	24	28
Total	84	100

5.5 ECONOMIC ANALYSIS AND COST ACCOUNTING

L	T	P
4	-	2

RATIONALE

This subject deals with basic concepts of economics and financial accounting which are useful for the students for further understanding of demands and supply, marginal utility of demand, GDP, NNP etc. This subject is aimed to developed the basic financial skills and economics concepts in the students so as to enable them to activity contribute in individual, business, government and global financial context.

LEARNING OUTCOMES

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

- Explain the Basic Concept of economics and financial Accounting
- Differentiate among the idea of demand & supply, marginal utility, elasticity of demand
- Describe the market type, market situation and market & Normal Price
- Determine the price of milk and other milk items based on the concepts of pricing and demand
- Calculate the selling price of product
- Calculate unit cost of product
- Explain the role if accounting in decision making

DETAILED CONTENTS

1. **ECONOMIC ANALYSIS :**

Basic concepts- wants, goods, wealth, utility, consumption, demand and supply consumer behavior law of diminishing marginal utility and equi-marginal utility, determinates of demand, individual consumer demand and market demand, elasticity of demand,. Consumer surplus theory of production- concepts of firm and industry, basic factors of production and their role, production function for a single product, nature of production function, laws of returns, concepts of costs-fixed and variable costs, short run and long run costs, average and marginal costs, economics and break even analysis, Concept of market- types of market, pricing and output under market situations, market price and normal price, price determination under perfect completion monopoly, oligopoly and monopolistic completion, National income- GDP,GNP, NNP, disposable personal income, per capita income, inflation,

2. **FINANCIAL ACCOUNTING :**

Introduction, definition, objectives, common terms and different systems of accounting, Double entry system of book keeping, Preparation of financial statements, Banking transaction recording and bank reconciliation statements. Recording of transaction in cash book purchase book, purchase returns book and sales return book. Capital and revenue expenditure classification, Depreciation Final accounts with adjustments, Errors and corrections analysis of financial statements, User of financial information in decision marketing.

3. COST ACCOUNTING:

Cost Concept, Objectives, importance and scope of cost accounting, classification, method and techniques of cost accounting, distinguish between cost accounting and financial accounting & management accounting, Role of cost accounting in decision making.
Limit Costing: Definition, objectives and limitations of unit costing, Tender & Quotation, method of unit costing, Job costing, job order, key differences between job costing & process costing.
Breakdown analysis-Cost volume, profit relationship, application of marginal costing, techniques of fixing selling price.

LIST OF PRACTICAL

- Demand schedule and supply schedule, Law of diminishing utility, Production function law of diminishing returns, Computation of elasticity's cost of milk production and processing computation of depreciation, break even analysis

- Project appraisal ledger and trial balance, cash book, adjustments, capital and revenue expenditure, depreciation, errors and corrections.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Taxmann's Cost & Management Accounting, Ravi M Kishore
2. Introduction to Cost Accounting, Nishi Malhotra
3. Horngren’s Cost Accounting, Srikant M. Datar, Madhav V. Rajan

WEBSITES FOR REFERENCE:

- www.swayam.in
- www.urise.up.gov.in
- www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	35
2	20	35
3	16	30
Total	**56**	**100**

5.6 **IN-PLANT TRAINING–I**

4 weeks in-plant training-I organized after examination in IV Semester to be assessed in this semester.

The marks will be awarded by the external examiner in the in the 5th semester. The marks will be of 60 marks for this exposure (Examination marks : 40, Sessional marks : 20).

The student during the vocational training must undertake training in the following & submit the training report in the format given as below:

1. R.M.R.D. (Raw Milk on Receiving Dock)

   Weighing machines, washing machines, loading and unloading of milk.

2. Processing of milk

   Chilling, Pasteurizers, Cream separators, Homogenizers, Storage tanks.

3. Production of milk products

   Ghee, Khoa, Chhena, Paneer, Cheese, Milk powder.

4. Packaging and packaging machines

   Milk, Butter, Milk Powder, Ghee, Other products.

5. Transportation

   Transportation of milk & milk products.

6. Store procedures & quality control

   Store procedures of raw materials & dairy products.

7. Time office, Finance & Accounts

   Cash book maintenance, Salary distribution, factory schedule.

5.7 IN-PLANT TRAINING–II

8 weeks training structured and supervised, branch specific, task oriented In-plant Training-II to be organized after V Semester Theory exam in large dairy plant.

Students will have to submit a report.

There will be 150 marks for this training.

These marks in VI Sem. will be awarded by the examiner.

(Examination marks : 100, Sess. marks : 50).

6.1 ENVIRONMENTAL STUDIES

L	T	P
6	-	4

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 Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and 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**

6.2 **DAIRY PLANT LAYOUT,MAINTENANCE AND AUTOMATION**

L	T	P
8	2	-

RATIONALE

The functioning of a dairy plant is very much dependent on the layout & power maintenance schedule, followed in the plant. Energy in the form of steam & electricity is utilized in processing of milk products. Therefore safety measures are to taken for the personal employed in the plant. A student should have basic knowledge about maintenance & safety of the plant.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-The idea of Dairy plant Repair and Maintenance of each and every section and equipments.
2-For establishment of a Dairy plant all the steps i.e. Location, Layout, Process flow, flow pattern etc.
3-Arrangement of different sections in plant.
4-Area and space requirement calculation according to capacity of section and equipments.
5-Maintenance schedule and lubrication .
6-Dairy Plant Automation ,its advantages , disadvantages, Factors, control systems and automated process control

DETAILED CONTENTS

1. **INTRODUCTION:**

   Plant maintenance, brief concept and its meaning, types and advantages. Wear in machines and their causes, mechanical wear and corrosive wear. Defects due to wear in equipment.

2. **DAIRY PLANT LAYOUT :**

   General introduction to the subject, location of dairy plant selection of site, consideration of general points, designing a dairy plant. Planning and principles of dairy layout process schedule, floor plan, Selection of flow pattern, arrangement of different sections and equipment. Area and space requirements, of process room, workshop, office rooms and a auxiliary services in relation to plant maintenance of dairy building including colour conditioning.

3. **ORGANISATION OF REPAIR AND MAINTENANCE:**

   Need of organization, function of maintenance , definition of repair and maintenance. Types of maintenance (only brief concept). Preparation for assembly and disassembly, Definition of preventive maintenance, advantage of preventive maintenance. Principle and practice of developing preventives for dairy plants.

4. **LUBRICATION:**
   Lubrication principle. Types of lubricants and their specifications. Selection of lubricants for dairy equipments.
5. **AUTOMATION :**

Introduction to automation of process in dairy plant. Advantages and disadvantages of automation, different factors for automation and their effects. Economic aspects of automation level, general control system for automated process. Automatic air-actuated valves and controls. Automatic controls like thermostats for temperature control, FDV in HTST unit, Vacuum control in evaporation plant.

INSTRUCTIONAL STATREGY

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.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1-Dairy Plant Engineering And Management : By Tufail Ahmad Publisher- Kitab Mahal
2- Dudh Udyog ; By-Dr. Anil Kumar Kulkarni : Publisher:Continental Publication
3-Dairy Process Engg (Practical Book) ; By VD Mudgal , KK Meena ; Publisher- Satish Serial Publishing House
4-Milk and Dairy Product Technology; By- Edgar Sprur, Taylor & Francis ; Publisher- Taylor and Francis
5- Dairy Engineering : Advanced Technologies and Their Applications; By- Murlidhar Meghwal, Megh R. Goyal, Rupesh S. Chavan Publisher-Apple Academic Press
6-Dairy Plant Design & Layout; By-Sunil M. Patel, A. G.Bhadania Publisher;Agrimoon
7-A Text Book of Dairy Plant Layout and Design; By-Prof Lalat Chander ;Publisher- ICAR

WEBSITES FOR REFERENCE:

1. https://agrimoon.com/
2. Swayam.gov.in
3. https://www.researchgate.net/
4. https://www.perlego.com/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	20	30
3	14	25
4	06	15
5	14	15
Total	**64**	**100**

6.3 INSTRUMENTATION AND PROCESS CONTROL

L	T	P
8	2	-

RATIONALE

Precision measurement of process parameters such as pressure, level density, speed, temperature, flow, moisture etc. is very essential for successful running of a process industry. Various telemetric and manual control circuits are to be handled by technicians employed in these industries. Therefore, to equip the diploma student in instrumentation and control engineering with the knowledge and skill of principles and circuitry for measurement of these parameters will be useful in world of work.
.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to;
1-General instrumentation system for a plant
2-Pressure instrumentation and different instruments for measuring the pressure with its calibration
3-Temperature instrumentation level instrumentation and different equipments used for measurement of temperature and level.
4-Measurement of density, Flow controls and measurement.
5-Various control systems in a dairy plant

DETAILED CONTENTS

1. **INTRODUCTION:**

1.1 Introduction of a process, chemical engineering process and process variable, listing of different process variable and their definitions, Introduction and definition of the term process instrumentation as applicable to the field of engineering.

1.2 Block diagram of a general instrumentation system, Elements of an instrument.

2. **PRESSURE INSTRUMENTATION:**

2.1 Definition.

2.2 Units KCS, Bar, Pascal, MPa, N/M2, PSI, WCL and conversion of one unit into another.

2.3 Importance of pressure measurement.

2.4 Types of pressure, atmospheric pressure, absolute pressure, gauge pressure, vacuum pressure.
2.5 Liquid column manometers principle, Manometers liquid, 'U' tube manometer, inclined and well type over manometer, advantage of inclined and well type over U' tube , ring manometer, Bell type, dp gauge.

2.6 Uses of manometers for differential pressure measurement.

2.7 Electric pressure elements-Diaphram, capsule, Bellows, Bourdon tube (different types) construction.

2.8 Measurement of pressure of corrosive fluids-diaphragm seal, liquid seal.

2.9 Measurement of static and dynamic pressure.

2.10 Pressure switch and regulators.

2.11 Calibration of pressure gauge (Dead weight pressure gauge tester) construction and working operation.

3. **TEMPERATURE INSTRUMENTATION:**

Temperature scales, thermometers, mercury in glass thermometers, Bimetallic thermometers, pressure spring thermometers, thermo-couples resistance thermometers, pyrometers, Manometer, pressure elements, Differential pressure. Direction operated pressure regulators, pilot operated pressure regulators.

4. **LEVEL INSTRUMENTATION:**

Direct liquid level measurement. Direct and indirect devices, measurement, Direct and indirect operated device. Flow rate of flow meters, differential pressure meters, variable area meters, total flow meters, positive displacement meters, velocity meters, integrators. Rate control, ratio control, cascade control. Humidity absolute humidity, measuring relative humidity measuring dew point and moisture, Transmission pneumatic transmission, electrical transmission.

5. **MEASUREMENT OF DENSITY:**

Definition relationship between density, pressure at the bottom of column of liquid and weight of a given volume

5.1 Liquid level method.

5.2 Displacement method

5.3 Hydrometer method

6. **CONTROLS:**

Study the working of various control system, control elements, control actions, pneumatic control system, electric control, final elements. Chromatography, electrolytic conductivity. Applicants temperature steam heat, gas or oil heat, electric heat.

INSTRUCTIONAL STATREGY

The teacher should focus on explaining the concepts with real world examples.

MEANS OF ASSESSMENT

- Theory Quiz
- Assignments

RECOMMENDED BOOKS

1. Fundamentals of Instrumentation and Process control by Dr Rahul kumar , Motion Press
2. A practical Guide for Control and Instrumentation engineers By Ankur Banarji, Book APE
3. Instrumentation and control Systems by K Padma Raju, YJ Reddy/ MC Graw Hill
4. Industrial Instrumentation and control by SK Singh
5. Instrumentation Engineers hand book- process instrumentation by Ashish Gupta
6. Instrumentation and process control by Onkar Nath Pandey/Meri Pustak.com

WEBSITES FOR REFERENCE:

- www.swayam.in
- www.urise.up.gov.in
- www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	10
2	14	20
3	14	20
4	16	15
5	14	15
6	12	20
Total	**80**	**100**

6.4 **PROJECT ON DAIRY PLANT LAYOUT AND DESIGN**

L	T	P
-	-	14

RATIONALE

Major 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, 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. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- 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.

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 projects given to students should be such for which someone is waiting for solution. Model of the suggested project activities are given below:

To establish a Dairy Plant of capacity 4 lac liter/day .Raw milk available is 5.2% Fat and 8.2% SNF manufacturing the following products-(Take standard specification of products)

Standard Milk, Toned Milk, Double Toned Milk, Skimmed Milk Powder, Ghee, Butter

Any three of the indigenous Products---

Ice Cream/ Casein Powder/ Cheese/ Chena/ Panner/ Peda/ Yoghurt/Shree Khand/Any other modern products.

Also calculate the all requirements for Plant i.e. refrigeration, steam, water, electricity, Raw materials and other all requirements for Dairy plant. Balance the Raw milk input Fat & SNF to the total of Fat & SNF of all the products.

Each and every student must be given different capacity Plant establishment with different Products and different production volume of products.

At the end of the project student will submit a written report of his/ their accomplishment and face a viva voce examination individually.

NOTE: Each student has to take one project individually and one to be shared with a group of four-five students depending upon cost and time involved. There is no binding to take up the above projects as it is only a suggestive list of projects.

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
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not

eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	**Overall grade**
i)	More than 80	***Excellent***
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes

1. **This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**

2. **The criteria for evaluation of the students have been worked out for 150 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**

3. **The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**

4. **It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

Project Report may include following topics:

1. Arrangement of different sections in a dairy building.
2. Operational layout.
3. Design of dairy (market milk plant), capacity 10000 liters per day (Small dairy).
4. Design of dairy (milk and milk products), capacity 30,000 liters per day (Medium dairy).
5. Design of dairy capacity 50,000 liters per day with provision for future expansion (Large dairy) .
6. Design of dairy (milk and milk products) capacity one lac liters per day (Large dairy).
7. Model planning group project I on layout planning (Market Milk Plant/Milk and Milk product).
8. Model planning group project II on layout planning (Fluid Milk and Milk products)

A project problem on Dairy plant layout and design shall be given to students to be completed by them under the guidance of their H.O.D. Students are required to prepare detailed project report. Viva shall be conducted on this by external examiner deputed by board.

6.5 **IN-PLANT TRAINING -II**

(8 Weeks)

Students after appearing in V semester theory examinations will under go a 8 weeks in plant training in a Milk Product Plant to familiarize them with plants actual problems and environment.

The students shall prepare a report of this training and submit to their Institution within one week of completion of training.

IN-PLANT TRIAINING - II
(TRAINING SCHEDULE)

8 weeks structured, branch specific, task oriented Summer-in-plant training to be organized during summer vacation after Final year Examination.

The student during the vocational training must under take training in the following & submit the training report in the format given at annexure - III.

1. Manufacture of Dairy Engineering equipment

   Study of raw materials to be used in the manufacture of dairy plant equipment & machinery.

2. Fabrication, Erection & Operation of dairy plant

   Study of fabrication, erection and operational aspects of Dairy Engineering equipment's & machinery.

3. Time office, Finance & Accounts

   Cash book maintenance, Salary distribution, factory schedule.

4. Store procedures & quality control

   Store procedures of raw materials & dairy products.

5. Pollution aspects

   Study of plant sanitation, environment & pollution control aspects.

6. Maintenance aspects

   Study of maintenance aspects including preventive & breakdown of dairy plant.

10. **RESOURCE REQUIREMENT**

10.1 PHYSICAL RESOURCES

(A) Space requirement

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

(B) Equipment requirement:

Following Laboratories are required for Diploma Programme in Dairy Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Applied Mechanics And Machine Component
- Basics of Information Technology/Computer Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Electrical Shop
- Smithy Shop
- Fitting and Plumbing Shop
- Sheet Metal Shop
- Welding Shop
- Foundry Shop
- Machine Shop
- Electrical Technology and Electronics Laboratory
- Dairy Engineering and Dairy Technology Laboratory
- Hydraulic and Pneumatic Laboratory
- Thermal Engineering Laboratory
- Refrigeration Laboratory
- Dairy Chemistry and Microbiology Laboratory
- Instrumentation Process and Control Laboratory
- Environmental Engineering Lab
- Energy Conservation Lab

EQUIPMENT REQUIREMENT FOR DAIRY ENGINEERING

Sr. No.	Description	Qty	Total Price (Rs)
	COMMUNICATION LABORATORY		
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	*Miscellaneous*	*LS*	*1,500*
	APPLIED PHYSICS LABORATORY		
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.	Gravesand'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 Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers	8	8,000

	Sensitivity : 20 microamperes per scale division,		
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	*Miscellaneous*	*LS*	*3,000*
APPLIED CHEMISTRY LABORATORY			
1.	*Digital Balance*	*1*	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	2	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000
14.	Decicators	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 (NH_3 - 2.5 ltr, NH_4Cl – 1 kg) - Zinc sulphate- 500g - H_2SO_4- 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		
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 wooder joints	1	1,000
6.	Model of different screw threads	1	1,000
7.	Model of various locking devices	1	1,000
8.	Model of various joints	1	1,000
9.	Cut section Model of various couplings	1	3,000
10.	Miscellaneous	LS	5,000
	BASICS OF IT LABORATORY/COMPUTER LABORATORY		
1.	Computer System with latest configuration	30	8,00,000
2	Printer (MFP)	1	25,000
3	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitiser	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000
8.	AutoCAD/Solid Works/Unigraphics/Pro-C (any one software)	30 user	5,00, 000
9.	LCD Projector	1	35,000
10.	UPS	60	1,20,000
11.	Software (latest windows, latest MS Office)	1	1,00,000
12.	Scanner	1	10,000
13.	*Miscellaneous*	*LS*	*5,000*

CARPENTRY SHOP			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	*Miscellaneous*	*LS*	*1,500*
PAINTING AND POLISHING SHOP			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
ELECTRICAL SHOP			
1.	Tool kit (Plier, Srew driver, Knife, Steel rule, hammer, sciber, pincer steel tape etc.)	20	20,000
2.	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.(as per requirement)		8,000
3.	Electric Iron	1	1,500
4.	Electric kettle	1	1,500
5.	Ceiling fan/table fan	1	2,500
6.	Desert cooler	1	5,000
7.	Lead acid battery	2	8,000
8.	Battery Charger	1	6,000
9.	Miscellaneous		3,000
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
SMITHY SHOP			
1.	Black smithy forge (with open hearths, accessories to match the forge)	20	40,000
2.	Wrought iron anvils	20	20,000
3.	Swage blocks	4	8,000
4.	Blower with accessories, motor switch etc	1	6,000
5.	Work benches with vices	2	6,000

6.	Power hammer	1	20,000
7.	Tools and accessories – hammers, swages, tongs, pokers, pullers etc	20	10,000
8.	Miscellaneous	LS	1,500
FITTING AND PLUMBING SHOP			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribers	4	24,000
3.	Surface plates	5	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 – chiesels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	*Miscellaneous*	*LS*	*1,500*
SHEET METAL			
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	1	20,000
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminium)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00
10.	Miscellaneous	LS	1,000
WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000

2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000
16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000
FOUNDRY SHOP			
1.	Moulding boxes	40	8,000
2.	Ladles	5	2,000
3.	Tool Kits	10 set	5,000
4.	Quenching tanks	2	5,000
5.	Portable grinder	1	3,000
6.	Pit furnace with blower	1	10,000
7.	Miscellaneous	LS	*1,000*
MACHINE SHOP			
1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000
6.	Work bench	3	10,000
7.	Precision instruments	1	10,000

8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	Miscellaneous	LS	5,000
APPLIED MECHANICS & MACHINE COMPONENT LABORATORY			
1.	Polygon of Forces Apparatus	4	60,000
2.	Universal Force Table	2	5,000
3	Principle of Moment Apparatus Bell Crank lever	4	6,000
4.	Combined Inclined plane & Friction apparatus	4	6,000
5.	Simple wheel and axle	2	5,000
6	Differential wheel and axle	2	7,000
7.	Double sleave Pulley Block	1	8,00
8	Centre lathe	8	8,00,000
9	Allgerared head Lathe	2	4,00,000
10	C.N.C. Trainer Lathe Center height 100 mm, swing over carriage 60mm, distance between center 200 mm, Max. machining diameter-50 mm, Max. lengitndial travem-300 mm, Spindle speed 40-2000 RPM, Automatic lubrication paints provided.	2	1,20,0000
12	Planing Machine	1	1,00,000
13	Shaping Machine	3	2,40,000
14.	Slotting Machine	1	50,000
15	Universal Milling Machine 3 Axis, Travel X-300mm, Y-250 mm Z-125 capable of milling acrylic, Al., Wood, etc. Compatible with FM5/DNC	1	4,00,000
16	Universal Tool Cutter and Grinder	1	2,50,000
17	Two Wheel bench Grinder (Wheel size 150x16x12 mm) (Wheel standard Accessories single pahse motor .25 HP high speed)	1	10,000
18	Bench Drilling Machine 13 mm capacity, 5 HP, AC 230 Volt Single Phase 1400 rpm motor with starter switch 30 mm capacity drill chuck V belt 100 mm machine vice	1	20,000
19	Power Hacksaw motorized with coolant pump, vice, length gauge, machine drive belt guard, 1 H.P. A.C. 440/3/50/1440 rpm electric motor with starter. Capacity to cut 175 mm. round and 150x150 mm. square rod, Blade size 350x25 mm.	1	20,000
20	Marking off Table Black granite Surface, flat nonmagnetic, non glaring, Planning Accuracy as per I.S. size 1000mm x 630mm x 150mm of grade B with slab carbide scriber.	1	10,000

21	Surface Plates size 450 x 450 mm cost iron surface plate planed and hand swapped and seasoned, Brown & sharp type ribbing, complete with lifting handles & wooden surface cover. Conforming to I.S. 2285-1963	1	10,000
22	Surface Plates size 450 x 600 mm cost iron surface plate planed and hand swapped and seasoned, Brown & sharp type ribbing, complete with lifting handles & wooden surface cover. Conforming to I.S. 2285-1963	1	10,000
23	Cylindrical grinding machine (Plain)	1	1,50,000
24	Surface grinder table size 12"x8". (Planer type)	1	20,000
25	Turret/Capstan lathe	1	3,00,000
26	Tools & Instruments-Cutters drill set, taps, dies, drill chucks, milling machine cutters tapper, reamers, micrometers verniers, gear tooth verniers, dial gauges, calipers, steel rules and Hand Tools Such as hammers, chiesels etc.	LS	40,000

HYDRAULICS & PNEUMATIC LABORATORY			
1.	Piezometer tube	2	100
2.	U tube differential manometer	2	2,000
3.	Bourdon's Tube pressure gauge	1	1,000
5.	Hydraulic jack	1	4,000
6.	Hydraulic press Working Model	1	5,000
7.	Bernoulli's apparatus	1	15,000
8.	Venturi meter apparatus with differential manometer	1	10,000
9.	Pipe friction apparatus	1	15,000
10.	Reciprocating pump- Cut Section Model	1	20,000
11.	Centrifugal pump	1	25,000
12	Working Model of Pelton Wheel Turbine	1	20,000
13	Working Model of Francis Turbine	1	20,000
14	Working Model of Kaplan Turbine	1	20,000
15	Hydraulic Circuit Trainer Kit	1	50,000
16	Pneumatic Circuit Trainer Kit	1	50,000
17	Working Model of Hydraulic Brake system	1	50,000
18	Working Model of Hydraulic Ram	1	5,000

THERMAL ENGINEERING LABORATORY			
1.	Throttling Calorimeter	2	10,000
2.	Testing for Determination of Dryness fraction of steam	1	50,000
3.	Cut section model of 4-stroke single cylinder Petrol and Diesel engine	1	30,000
4.	Gravimetric Analysis	1 each	20,000 each
5.	Model of Various Boiler Mounting and Accessories -Steam Stop Valve, Safety Valves, Blow off Cock, Water Level Indicator, Low Water High Pressure Safety Valve, Pressure Gauge, Economiser, Pre Heater (Air), Super Heater Model only.	1 each	10,000
6.	Exhaust Analyser for Petrol and Diesel engine	1 each	25,000 each
7.	Single Stage Reciprocating Air Compressor	1	50,000
8.	Rotary Compressor, Air Compressor	1	25,000
9.	Flash Point Apparatus	1	10,000
10.	Pyrometer, Infrared, Thermocouple	2	5,000 each
11.	Lancashire boiler model	1	10,000
12.	Model of impulse turbine	1	5,000
13.	Model of reaction turbine	1	5,000
14.	Model of surface condenser	1	5,000
15.	Bab Cox & Wilcox Boiler Model	1	10,000
16.	Single cylinder 2 stroke petrol engine test rig	1	45,000
17.	Single cylinder 4 stroke petrol engine test rig	1	50,000
18.	Multicylinder petrol engine test rig (Morse test rig)	1	2,00,000

DAIRY CHEMISTRY & DAIRY MICROBIOLOGY LABORATORY A- DAIRY CHEMISTRY			
1.	Westphal balance	2	16,000
2.	Lactometers	15	3,000
3.	Lactometer Jars.	15	4,500
4.	Buretere (50 Ml)	15	2,250
5.	Pipettes (10 Ml)	3 x 12	1,800
6.	Pipettes (11 Ml)	3 x 12	1,800
7.	Pipettes (1 Ml)	3 x 12	1,800

8.	Gerber centrifuge for 12 tests electric and manually operated	1	7,500
9.	Cream Butyrometer	10	45,000
10.	Butter Butyrometer	10	40,000
11.	Cheese Butyrometer	10	55,000
12.	Skim milk Butyrometer	20	10,000
13.	Lock stoppers	3 Gross	9,00
14.	Lock stopper keys	15	3,00
15.	All glass apparatus (micro type)	2	5,000
16	Kjeldel flasks (150 Ml)	50	20,000
17.	Kjeldel flasks (300 Ml)	50	30,000
18.	Digestion heater unit for protein estimation(6 sets)	2	30,000
19.	Phosphatase Kit for Measuring the efficiency for pasteurization	1	25,000
20.	Impaired moisture balance	1	22,000
21.	Hot air oven thermostatically controlled temp rang 60-120 0C	1	24,000
22.	Moisture dishes with lids aluminum 70 mm diam 70 ml. capacity	30	1,500
23.	Thermostatic Cryoscope for freezing point of milk	1	30,000
24.	Other glass wares	LS	10,000
B-DAIRY MICROBIOLOGY LABORATORY			
1.	Serological Water bath	1	12,000
2.	Colony Counter	1	7,000
3.	Ph-meter for Lab	1	8,000
4.	SSAutoclave	1	20,000
5.	Microscope, Compound type	10	2,50,000
6.	Dilution bottles glass	100	1,000
7.	Petri dishes	5 x 12	1,800
8.	Copper case for petri dishes	2	8,000
9.	Copper case for pipettes (Microbiological)	1	8,000
10.	Incubator (165 Litres capacity)	1	30,000
11.	Refrigerator thermostatic	2	30,000
12.	Beakers, test tubes, measuring flasks cylinder etc	LS	10,000

DAIRY ENGINEERING & DAIRY TECHNOLOGY LABORATORY			
1.	Cream seperater (Capacity 100 lts. per hour, hand operated)	1	30,000
2.	Cream seperator (capacity 100 lts per hour electrically operated)	1	40,000
3.	Plate Heat Exchanger (Capacity 100 lts. per hour)	1	90,000
4.	Pasteurizer with temperature controller recorder with FDV and other control units - capacity 200 lph	1	3,00,000
5.	Straight through Can Washer- capacity 3 cans per minutes .	1	4,00,000
6.	Rotary can washer 3 cans per minutes	1	3,00,000
7	Butter Churner (Roller type) 20 Kg. butter per batch for Lab	1	80,000
8.	Stainless steel centrifugal pump (capacity 50 lts, per hour).	2	40,000
9.	Sanitary stainless steel rotary pump (capacity 100 lts. per hour)	1	50,000
10.	Jacketed Rectangular cheese vat (capacity 50 lts.)	1	1,00,000
11.	Jacketed storage tank (vertical) with agitator (capacity 50 lts.)	1	1,00,000
12.	Refrigerated Bulk Milk cooler with all accessories (Capacity 50 lts.)	1	1,50,000
13.	Jacketed ghee pan without agitator vertical capacity 50 litre	1	75,000
14.	Pipe expander 1" and 1-1/2" size	2 Set	5,000
15.	Stainless steel pipes 1/2" to 1-1/2" sizes, fillings (union, nut, coupling yoke type clamp type) valves 1/2", 1" (two way & three way type).	1 Set	20,000
16.	Homogensier 50 lts/hour capacity	1	2,50,000
17.	Spray dryer with all accessories capacity100 Kg/day	1	10,00,000
18.	Ice-cream freezer - Batch type capacity 25 Kg./hr	1	1,00,000
19.	Ice-cream freezer -Continuous type capacity 50 Kg./hour	1	2,50,000
20.	Casein making equipment 50 Kg./batch cap	1	1,00,000
	NOTE: Since equipments listed at Sl. 4,5,6,12,16,17,19,20 are costly, hence efforts may be made that students should study these items in some Dairy Plant during In Plant Training-I and II.Ie. After 4th and 5th Semester respectively. **SPECIAL RECOMMENDATION:(Optional)**		

	All the above equipments are costly and there is no meaning of seprate units for practical purposes.So, it is strongly recommended that--- In place of the items 3,4,5,6,12,13,16,17,18,19,20, a small capacity actual working Milk Plant (Pilot Plant) of minimum capacity 100 litre per day to 500 litre per day should be installed in the institute. Plant will be included with manufacturing equipment of market milk (with packaging unit), Butter, Ghee, Cheese, Casein, Dried milk, etc with its all operative accessories. This plant will be more effective for the student Training at institute level , So highly recommended by committee.	One unit	Rs 30.00 Lakh

Sr. No.	Description	Qty	Total Price (Rs)
REFRIGERATION LAB-I LABORATORY			
1.	Sealed unit refrigeration service kits containing all sort of tools	5	4,000
2.	Refrigeration unit open type service lits containing all sorts of tools	10	6,000
3.	Gage mainfeld (various sizes)	3	6,00
4.	Presure gages (low & high)	3	2,000
5.	Vaccum pump/4 H.P. with motor trolley type	2	6,000
6.	Gas charging slamp	1	3,000
7.	Gas cylinders Freon 12, 5Kg capacity	2	2,00
8.	Gas cylinders Freon 22, 5Kg capacity	1	2,00
9.	Gas cylinders for Ammonia 5 Kg.	2	8,00
10.	General tech. tools viz. Bench Vices spanners (open ring, box) Allenkey pliers, adjustable and pipe wrnches etc.	10 Set	10,000
11.	Chargin Noses	30 Set	3,600
12.	Moisture indicators frenons	10	1,000
13.	Liquid indicators freons.	10 Set	1,000
14.	Moisture indicators Ammonia	2	1,50
15.	Copper tubing (A nealed) 1/4 dia	100 M	2,500
16.	Copper tubing (A nealed) 3/8 dia	50 M	1,500
17.	Copper tubing (A nealed) 1/2dia	50 M	2,000

18.	Copper tubing (Harddrawn) 1" dia	50 M	3,000
19.	Ammonia Black Iron pipe tubing 1/2"dia	50 M	4,00
20.	Ammonia Black Iron pipe tubing 1"dia	50 M	6,00
21.	Ammonia Black Iron pipe tubing 1-1/2"dia	50 M	8,00
22.	Tube fitting copper & brass different sizes & types	-	4,000
23.	Tube fitting ammonia iron different sizes & types	-	2,000
24.	Line shut off valves (freon) diferent sizes	50	2,000
25.	Line shut off valves (Ammonia) 1/4	20	1,000
26.	Gauge Freon-12	50 KG	1,500
27.	Gauge Ammonia	50 KG	1,000
28.	Leak detector haltide.	10	1,000
29.	Leak detector electronics	2	4,000
30.	Capacitiors different capacities	10	5,00
31.	Insulation Glass Wool	20 KG	2,00
32.	Insulation Thermocol Sheets	50 Sheet	5,00
33.	Insulation Plaster of paris	20 KG	2,00
34.	Insulation Slag wool	40 KG	2,00
35.	Electronic Motor I.H.P.A.C.	1	1,600
36.	Starting relays- Voltage type	4	2,00
37.	Starting relays- Current type	4	2,00
38.	Starting relays- Box type	5	3,00
39.	Overload relays.	10	4,00
REFRIGERATION LAB-II- Air Conditions LABORATORY			
1.	Air conditioner 1 ton without reversibly single phase	1	2,000
2.	Expansion valves- Low side float valve 5 TY(Ammonia)	1	3,00
3.	Expansion valves- High side float valve 5TY(Ammonia)	1	3,00
4.	Expansion valves- Ammonia Expansion valve 5 TY	2	2,000
5.	Thermostaic Switches- For air conditioner ITY	2	3,00
6.	Thermostaic Switches- For ammonia systems 5 TR	1	5,00
7.	Pressure stats for air conditioner(ITR)	1	3,00
8.	Pressure state for ammonia plant (5TR)	1	5,00

9.	Solenoid valves different capacities For freon system	3	1,600
10.	Solenoid valves different capacities For ammonia systems	1	5,00
11.	Stop watches	2	4,00
12.	Siling psychormeters	15	7,50
13.	Aspiration psychrometers	1	2,500
14.	Bellos types psychrometers	1	5,00
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
16.	Dry and Wet bulb wall hygrometer	2	2,00
17.	Fortins Barometer	1	1,000
18.	Hair Hygrometer	2	5,00
19.	Humidistats	2	2,000
20.	Kata thermometer	6	1,500
21.	Dial type hygrometer	6	9,00
22.	Pannel Board showing temp pressure at different stages	6	10,000
23.	Device for measuring flow of refrigerant	6	9,00
24.	Pannel Board for making electric connections	2	2,000
25.	Evaporator Cooler- Pannel Board for determining its performance	2	1,000
26.	Pocket type thermometers	6	3,00
27.	Voltage stabilizer (Automatic) 3 Phase	6	1,500
28.	Exhaust fans	6	1,000
29.	Electric oven fitted with temperature control experimental types	1	5,000
30.	Electric Heaters	5	2,50
31.	Work Benches	10	3,000

ENVIRONMENT ENGINEERING LABORATORY			
1.	pH Meter	01	500
2.	Turbidity Meter	01	5000
3.	Oven with Temperature Controller and Forced Air Circulation Type	01	20000
4.	B.O.D. Incubator	01	25000

5.	Water Analysis Kit	01	5000
6.	High Volume Sampler	01	40000
7.	Electrical Balance for weighing upto 1/10 of milligram (capacity)	01	1000
ENERGY CONSERVATION LABORATORY			
1	Clamp meter	02	5000
2	Multimeter	02	2000
3	Power Analyser	01	20000
4	Different types of lamps (LS) – 60 W lamp, 230 V , 100 V – 200 W lamp – 500 W lamp – 100 W lamp, 110 V, 150 V	10	500
5	Lux meter	02	5000
6	Centrifugal pump, 1 kW	1	15,000
7	Standard window A.C.	01	20000
8	Anemometer	02	5000
9	Thermometer	03	2000
10	Flow meter	02	10000
11	Pumping set with at least two pumps of different capacity.	1 set	10000
12	Pressure gauge fitted on discharge lines	1 set	2000
13	Variable Frequency Drive	02	50000
14	A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switch.	1	3000
15	Stop watch	2	1000

16	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	1	10000
17	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25000

ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY			
1.	Wattmeter	5	10,000
2.	Ammeter	5	10,000
3.	Voltmeter	5	7,500
4.	DC shunt motor	1	5,000
5.	Single phase variac	1	2,500
6.	Single phase transformer	1	5,000
7.	Resistive load	1	4,000
8.	Multimeter	1	4,000
9.	CRO	1	15,000
10.	Regulated supply	1	8,000
11.	Signal generator	1	5,000
12.	3-phase inductor motor	1	5,000
13.	3-phase variac	1	8,000
14.	DC shunt generator coupled with motor and starter	1	25,000
15.	Rheostat	2	2,500
16.	Tachometer	1	5,000

NOTE:

1. The specifications and price of equipment mentioned above used as broad guidelines for purchase of equipment.
2. Any other items not mentioned in the list of equipment can be purchased as provision has been made for purchase under the item miscellaneous for each lab/shop.
3. Any additional equipment, already available in the institute, may be used for demonstration to the students.

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

(C) Furniture Requirement

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

10.2 Human Resources Development:

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

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

1. Presentations of Case Studies
2. Debate competitions
3. Poster competitions
4. Industrial visits
5. Visual Aids

COURSE OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial and residential areas. A student 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 equipments.
Identify areas of energy conservation and adopt conservation methods in various systems.
Evaluate the techno economic feasibility of the energy conservation technique adopted.

INSTRUCTIONAL STRATEGY

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

REFERENCE BOOKS

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

Important Links:

- Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.www.beeindia.gov.in.
- Ministry of New and Renewable Energy (MNRE), Government of India.www.mnre.gov.in.
- Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh.www.upneda.org.in.
- Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

- Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.
- Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

10. **EVALUATION STRATEGY**

10.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learningendeavor is to ensure the quality of the product which can be accessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

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

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

10.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

Theory
Practical Work (Laboratory, Workshop, Field Exercises)
Project Work
Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

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

Section-II

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

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of theorder of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

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

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise

of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

10.3 ASPECTS OF QUESTION PAPER SETTING

Validity and reliability are the most important considerations in the selection and construction of evaluation procedures. First and foremost are the evaluation tools to measure the specific outcomes for which they are intended to measure. Next in importance is reliability, and followingthat is a host of practical features that can be classified under the heading of usability.

For weightage of marks assigned to formative (internal) and summative (external) evaluation and duration of evaluation has been given in the study and evaluation scheme of the curriculum document. Teachers/Paper-setters/Examiners may use Manual for Students' Evaluation developed by IRDT U.P. Kanpur to bring objectivity in the evaluation system. The working group found it very difficult to detail out precisely the contents of subject on languages and therefore teachers may send guidelines to respective examiners for paper setting to maintain objectivity in evaluation.

11. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

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

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every course teacher to readthem carefully, comprehend and start using them.

(A) Broad Suggestions:

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

2. State Board of Technical Education (BTE) may make the academic plan available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics in turn are supposed to prepareinstitutional academic plan by referring state level BTE plan.

3. HOD of every Programme Department along with HODs and in charges of other departments viz. English, Maths, Physics, Chemistry etc. are required to prepare academic plan atdepartment level referring institutional academic plan.

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

(B) Course Level Suggestions

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

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library exercises, field visits, study tours,camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities withina stipulated period of 16 weeks which is made available to them in the academic plan at BTE level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L processeffectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available, course to be taught, different learning experiences required to bedeveloped etc.

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

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

4. Teachers are required to plan for guided library exercises by identification of coursespecific experience requirement, setting time, assessment, etc. The tutorial, assignment andseminar can be thought of as terminal outcome of library experiences.

5. Concept and content-based field visits with appropriate releases (day-block) may be planned and executed for such content of course which otherwise is abstract in nature and no otherrequisite resources are readily available in institute to impart them effectively.

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

7. Planning of progressive assessment encompasses periodical assessment in semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive explicit feedback to every student. It has to be planned properly; otherwise very purpose of the same is lost.

8. The co-curricular activities like camp, social gathering, study tour, hobby club etc.

may be used to develop generic skills like task management, problem solving, managing self, collaboratingwith others etc.

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

10. While imparting instructions, emphasis may be laid on the development of cognitive, psychomotor, reactive and interactive skills in the students.

11. Teachers may take working drawings from the industry/field and provide practices inreading these drawings.

12. Considerable emphasis should be laid in discipline specific contracting and repair andmaintenance of machines, tools and installations.

13. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

14. Case studies and assignments may be given to students for understanding of EnterpriseResource Management (ERM).

15. Students be made aware about issues related to ecology and environment, safety, concernfor wastage of energy and other resources etc.

16. Students may be given relevant and well thought out minor and major project assignments,which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment (wage and self).

17. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, Research Institutes and other relevant field organizations in thestate.

List of Participants:

The following experts have participated in workshop for Developing the Curricula Structure and Contents of Three-year Diploma Programme in Dairy Engineering for UP State ,workshop held on 10th December 2021, 16th and 17th June 2023 at Institute of Research Development & Training U.P. Kanpur:

1. Shri SK Vaish, Principal, Government Polytechnic, Bargarh Chitrakoot.
2. Shri SP Verma, Lecturer Dairy Engineering, JLN Polytechnic, Mahmudabad, Sitapur.
3. Shri Chandrabhan, Lecturer Dairy Engineering, JLN Polytechnic, Mahmudabad, Sitapur.
4. Shri VK Dwivedi, Assistant Lecturer, Dairy Engineering, Government Polytechnic Etawah.
5. Ms. Kalpana Devi, Lecturer Mathematics, Govt. Polytechnic Lucknow.
6. Shri Pankaj Singh, Lecturer Mechanical Engineering,
7. Smt. Premantusha, Lecturer Mechanical Engineering, Govt. Polytechnic Lucknow.
8. Shri Gaurav Kishor Kanaujiya, Assistant Professor/Coordinator, IRDT Kanpur