Curriculum for

Diploma Programme in

AGRICULTURAL ENGINEERING

For the State of Uttar Pradesh

Prepared by:

Curriculum Development Centre
Institute of Research Development & Training
U. P. Kanpur

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PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has 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 12 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.

Manoj Kumar
Director
Institute of Research Development &Training,U. P.
Kanpur

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1. **SALIENT FEATURES OF DIPLOMA PROGRAMME IN AGRICULTURAL ENGINEERING**

1) Name of the Programme : Diploma Programme in Agricultural 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 : 60 (or as prescribed by the Board)

5) Pattern of the Programme : Semester Pattern

6) NSQF Level : Level - 5

7) Ratio between theory and : 47 : 53 (Approx.)

Practice

8) Industrial Training:

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

9) Ecology and Environment :

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

10) Energy Conservation:

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

11) Industrial Management & Entrepreneurship Development:

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

12) Student Centred Activities:

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

13) Project work

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

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN AGRICULTURAL ENGINEERING

The following are the major employment opportunities for diploma holders in Agricultural Engineering:

- After pursuing diploma course in Agricultural Engineering student offers job opportunities in Horticulture, Poultry farming, Plant science, Soil science, Food science, Animal science, etc.

- A diploma in Agricultural Engineering give provide the skills and knowledge to deal with agricultural sales, agriculture business, food production, etc.

1. Agriculture
   (a) Ground water cell
      (Tubewell & minor irrigation)   Supervisor/J.E.
   (b) Soil & Water Conservation   Supervisor/J.E.
   (c) Non Conventional Energy Sources   Supervisor/J.E.
   (d) Agricultural Engineering   Supervisor/J.E.
2. Minor Irrigation & Tubewell Corporation   Supervisor/J.E.
3. Command Area Development Project   Supervisor/J.E.
4. Soil Conservation   Supervisor/J.E.
5. Agro Industrial Corporation
   (a) Work Shop   Foreman/Supervisor
   (b) Marketing of Tractors, Implement,
      Seeding & Harvesting Equip.   Supervisor
6. Development Corporation
7. National Seed Corporation   Supervisor
8. State Formers Corporation   Supervisor
9. Fertilizer Carporation of India
   (a) Feed plant   Incharge
   (b) Fertilizer Plant   Incharge
10. Ware Housing Corporation   J.E.
11. UP State Krishi Utpadan Mandi Parishad   J.E.
12. Rice Mills   Supervisor
13. State Forest Department   Supervisor Machinary
                                         (Soil Conservate)
14. Banks, UP State Coop Krishi Avam Gramya
    Bank Ltd.   Tech. Supervisor/J.E.
15. Research & Extention Deptt. of Agriculture   Research Assistant
16. Manufactures of Tractors & Agro implements   Supervisor/Foreman/
                                         Sales Representative
17. Teaching Institute   Asstt.Lect./Foreman
18. Mandal Vikas Nigam   J.E.
19 Krishi Vigyan Kendra   J.E.
20. Town & Country Planning   J.E.
21. Gram Vikas Sansthan,Bakshi Ka Talab Supervisor
22. U.P. Jal Nigam   Supervisor/J.E.

22. U.P. Khadi Gramodyog   Supervisor/J.E.
23. Tractor Krishi Yantra Workshop   Supervisor/Foreman
24. Auto Tractors Ltd.   Supervisor/Foreman
25. Appropriate Technology Deve. Association   J.E.
26. Zila Gram Vikas Abhikaran   A.D.O.
27. Entrepreneurs
    (a) Manufacturers of
    i. Agricultural implements
    ii. Pump sets
    iii.Fibre Processing
    iv. Crop Processing
    (b) Repair & Maintenance Centre of
       Agri.Implements,Pump Set etc.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN AGRICULTURAL ENGINEERING

After undergoing this programme, students will be able to:

1.	Surveys the land and water resources of command areas.
2.	Supervises Land levelling operations
3.	Prepares plans for surface & sub surface water conveyance system.
4.	Supervises construction of farm structures.
5.	Assists in planning and execution of the schemes for (i) Rain fall (ii) Run off (iii) Water harvesting and its recycling (iv) Water shed management
6.	Interprets production drawings.
7.	Procures raw materials.
8.	Assists in quality control in production process of the products
9.	Controls labour for optimum production.
10.	Diagonose faults in equipment/machinary.
11.	Estimates the repair cost including requirement of spares.
12.	Procures spares and prepare their inventory.
13.	Tests the equipement and machinary for desired performance.
14.	Conducts demonstration of various products.
15.	Markets the products.
16.	Provides costumer hire service.
17.	Assists farmer in arranging finance for land development work.
18.	Plans and executes land reclamation works.
19.	Supervises land development work.
20.	Performs after sales service to agricultural impliments.
21.	Survey for the feasibility of tubewells.
22.	Installs trial bores for the area where such sources are lacking
23.	Selects bore size for a given situation.
24.	Selects pumps, power units and pipe line for a pump house.
25.	Prepare estimates and cost for distribution lines for installation of tube wells.
26.	Supervises installation and trial run of a tube well.
27.	Supervises rejovination of old choked tube wells.
28.	Assists in determining aquifer parameters by performing pump test.
29.	Supervises operations, maintenance and repair of irrigation pumping sets.
30.	Demonstrates and populerise use of improved agricultural implements.
31.	Guides the farmers for the efficient use of tubewells, pumping sets and other lifting devices like wind mill etc.
32.	Collects data for pri & post monsoon water table of observation well.
33.	Supervises installation & maintenance of biogasplant, wind mills, solar pumps, solar crop dryer and other non conventional energy equipments.

34.	Guides the farmers in arranging finance for purchasing non conventional energy source equipments.
35.	Guides the fabricators for standard design and quality of equipments.
36.	Guides the farmers for operation and maintenance of tractors and other allied equipments
37.	Supervises the construction of drainage & irrigation system of fields.
38.	Plans and constructs soil and water conservation structure.
39.	Plans the layout of farms.
40.	Supervises operation maintenace & servicing of land development equipments.
41.	Supervises installation, errection and commissioning of seed processing plants.
42.	Supervises storing of processed seeds.
43.	Supervises storage of food grains.
44.	Operates and maintains grain handling equipments and storage structures.
45.	Supervises handling, operations & Maintenance of rice processing machinary.
46.	Assists farmers in preparing loan application for agricultural equipments.
47.	Prepares feasibility report for loan.
48.	Scrutinises applications for loand with reference to assets & liabilities.
49.	Does liason between bank & loanee.
50.	Suggests new schemes for advances for new Bank Loan.
51.	Assists in testing and evaluation of finished products as per BIS.
52.	Trains the trade men.
53.	Conducts experiments on soil and water
54.	Helps in research and extension works to engineers.
55.	Supervises flow operation of the manufacture of tractors & other implements.
56.	Estimates the cost of maierials and equipments.
57.	Establishes services & costermer hiring service centres for related agricultural deptt.
58.	Supervises handling, operation & maintenance of vegetable & fruit storage machines
59.	Prepares ketchup, Jam, Jelly and squash of different fruit & vegetable.
60.	Supervises the preservation of different fruit & vegetable

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas/subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Prepare and interpret drawings of engineering components.	– Engineering Drawing
2.	Prepare simple jobs as per specifications.	– General Workshop Practice

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
3.	Use appropriate practices for conservation of energy and prevention of environment pollution.	– Environmental Studies – Energy Conservation
4.	Interpret factory acts and laws.	– Industrial Management and Entrepreneurship Development
5.	Communicate effectively in English in oral and written form with others.	– Communication Skills – Student Centred Activities (SCA)
6.	Manage resources effectively at workplace.	– Industrial Management and Entrepreneurship Development
7.	Prepare detailed project proposal and report.	– Project Work
8.	Use computer and IT tools for creating document, making spread sheet and making presentation.	– Basics of Information Technology
9.	Solve real life problems by application of acquired knowledge and skills.	– Project Work
10.	Handle the customers effectively.	– Industrial Management and Entrepreneurship Development
11.	Apply concepts of Mechanics to solve engineering problems.	– Applied Mechanics – Mechanics of Solids
12.	Apply basic principles of Mathematics and Science to solve engineering problems.	– Applied Mathematics – Applied Physics – Applied Chemistry

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

Communication Skills
Environmental Studies
Energy Conservation

b) Applied Sciences

Applied Mathematics
Applied Physics
Applied Chemistry

c) Basic Courses in Engineering/Technology

Engineering Drawing
General Workshop Practice
General Engineering
Basics of Information Technology

d) Applied Courses in Engineering/Technology

Agricultural Science
Mechanics of Solids
Applied Mechanics
Material and Rural Construction Technology
Hydraulics and Hydraulic Machines
Soil Science and Soil Mechanics
Surveying and Levelling
Industrial Management and Entrepreneurship Development
Agricultural Equipment Workshop Practice
Frame Power Engineering and Non conventional Energy
Electrical Engineering and Rural Electronics
Agricultural Engineering Drawing
Minor Irrigation and Tubewell Engineering
Post Harvest Technology and Agro Based Industry
Estimating and costing
Agricultural Industrial Finance and Rural Entreperneurship
Green House Technology, Hydroponics and Aquaponics Engineering
Dairy and Food Engineering
Irrigation and Drainage Engineering, rain Water Harvesting
Soil Water conservation and Land reclaimation Engineering
R.C.C. and Steel Structure
Frame and land Development Machinery

e)   Industrial Training

Project Work

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	*Communication Skills-I	6	-	-	6	-	-
2.	*Applied Mathematics - I	5	-	-	-	-	-
3.	*Applied Physics – I	7	-	-	-	-	-
4.	*Applied Chemistry	7	-	-	-	-	-
5.	*Engineering Drawing-I	8	-	-	-	-	-
6.	General Workshop Practice-I		-	-	-	-	-
7.	Agricultural Science	6	-	-	-	-	-
8.	*Applied Mathematics - II	-	5	-	-	-	-
9.	*Applied Physics -II	-	7	-	-	-	-
10.	+Applied Mechanics	-	7	-	-	-	-
11.	Material and Rural Construction Technology	-	8	-	-	-	-
12.	*Engineering Drawing -II	-	8	-	-	-	-
13.	General Workshop Practice-II	-	8	-	-	-	-
14.	*Applied Mathematics-III	-	-	5	-	-	-
15.	Hydraulics and Hydraulic Machines	-	-	8	-	-	-
16.	Soil Science And Soil Mechanics	-	-	9	-	-	-
17.	Surveying And Levelling	-	-	9	-	-	-
18.	Agricultural Equipment Workshop Practice	-	-	8	-	-	-
19.	*Basics of Information Technology	-	-	6	-	-	-
20.	*Communication Skill-II				6		
21.	Mechanics of Solids	-	-	-	7	-	-
22.	Frame Power Engineering and Non conventional Energy	-	-	-	7	-	-
23.	Electrical Engineering and Rural Electronics	-	-	-	7	-	-
24.	Agricultural Engineering Drawing	-	-	-	8	-	-
25.	*Environmental Studies	-	-	-	5	-	-
26.	*Energy Conservation	-	-	-	5	-	-
27.	*Industrial Management and Entrepreneurship Development	-	-	-	-	5	-
28.	Minor Irrigation and Tubewell Engineering	-	-	-	-	9	-
29.	Post Harvest Technology and Agro Based Industry	-	-	-	-	9	-
30.	Estimating and Costing	-	-	-	-	5	-
31.	Agricultural Industrial Finance and Rural Entrepreneurship	-	-	-	-	7	-
32.	Green House Technology, Hydroponics and Aquaponics Engg.	-	-	-	-	10	-
33.	Dairy and Food Engineering						5
34.	Irrigation and Drainage Engineering, Rain Water Harvesting						8
35.	Soil Water Conservation and Land Reclaimation Engineering						12
36.	R.C.C. and Steel Structure						10
37.	Frame and Land Development Machinery						8
38.	Project Work						2
39.	Student Centred Activities (SCA)	1	5	3	3	3	3
Total		48	48	48	48	48	48

7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN AGRICULTURAL 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	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
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	Agricultural Science	4	-	2	4	20	15	35	50	2 ½	30	3	80	115
#Student Centred Activities (SCA)	-	-	-	1	1	-	30	30	-	-	-	-	-	30
Total		23	-	25	27	100	155	255	310		150	-	460	715

* 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 Mechanics	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.4	Material and Rural Construction Technology	6	-	2	6	20	15	35	50	2 ½	30	3	80	115
2.5	*Engineering Drawing -II	-	-	8	2	-	40	40	60	3	-	-	60	100
2.6	General Workshop Practice-II	-	-	8	2	-	40	40	-	-	60	4	60	100
	#Student Centred Activities (SCA)	-	-	5	1	-	30	30	-	-	-	-	-	30
Total		21	-	27	25	80	145	225	260	-	130	-	390	615

*   Common with other diploma programmes
+   Common with diploma in Chemical Engg. and Civil Engg.
\#   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.

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	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
3.2	Hydraulics and Hydraulic Machines	6	-	2	5	20	10	30	50	2 ½	20	3	70	100
3.3	Soil Science And Soil Mechanics	5	-	4	5	20	20	40	50	2 ½	40	3	90	130
3.4	Surveying And Levelling	3	-	6	5	20	20	40	50	2 ½	50	6	100	140
3.5	Agricultural Equipment Workshop Practice	-	-	8	3	-	25	25	-	-	50	6	50	75
3.6	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
#Student Centred Activities (SCA)	-	-	-	3	1	-	30	-	-	-	-	-	-	30
Total		19	-	29	25	80	145	225	200	-	220	-	420	645

* 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	Mechanics of Solids	4	1	2	5	20	10	30	50	2 ½	20	3	70	100
4.3	Frame Power Engineering and Non conventional Energy	5	-	2	5	20	20	40	50	2 ½	40	3	90	130
4.4	Electrical Engineering and Rural Electronics	5	-	2	5	20	20	40	50	2 ½	40	3	90	130
4.5	Agricultural Engineering Drawing	-	-	8	4	40	-	40	100	3	-	-	100	140
4.6	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
4.7	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
	#Student Centred Activities (SCA)	-	-	3	1	-	30	30	-	-	-	-	-	30
	Total	24	1	23	30	160	110	270	400	-	160	-	560	830

* 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.
Industrial training of 4 weeks duration to be organised after 4th semester exams

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	
	Industrial Training (4 Weeks)	-	-	-	2	-	-	-	-	-	50	-	50	50
5.1	*Industrial Management and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
5.2	Minor Irrigation and Tubewell Engineering	5	-	4	5	20	5	25	50	2 ½	10	1	60	85
5.3	Post Harvest Technology and Agro Based Industry	5	-	4	5	20	20	40	50	2 ½	50	3	100	140
5.4	Estimating and Costing	5	-	-	4	40	-	40	100	4	-	-	100	140
5.5	Agricultural Industrial Finance and Rural Entrepreneurship	5	-	2	4	20	20	40	50	2 ½	50	Viva	100	140
5.6	Green House Technology, Hydroponics and Aquaponics Engg.	5	-	5	5	20	20	40	50	2 ½	50	Viva	100	140
	#Student Centred Activities (SCA)	-	-	3	1	-	30	30	-	-	-	-	-	30
	Total	30	-	18	30	140	95	235	350	-	210	-	560	795

*   Common with other diploma programme

\$ 4 weeks structured and supervised, branch specific, task oriented industrial training to be organised after IV Semester.There will be 50 marks for this exposure.Training shall be in any one of the following fields;

      i. Soil & Water Conservation Training Centre.

      ii. Minor irrigation.

      iii. Agro processing unit iv. Construction unit

\#   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.

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	Dairy and Food Engineering	5	-	-	5	20	-	20	50	2 ½	-	-	50	70
6.2	Irrigation and Drainage Engineering, Rain Water Harvesting	4	-	4	5	20	10	30	50	2 ½	20	3	70	100
6.3	Soil Water Conservation and Land Reclaimation Engineering	4	-	8	6	20	20	40	50	2 ½	50	3	100	140
6.4	R.C.C. and Steel Structure	6	-	4	5	20	20	40	50	2 ½	50	3	100	140
6.5	Frame and Land Development Machinery	4	-	4	4	20	20	40	50	2 ½	50	3	100	140
6.6	Project Work	2	-	-	4	-	50	50	-	-	100	3	100	150
#Student Centred Activities (SCA)	-	-	-	3	1	-	30	30	-	-	-	-	-	30
Total		25	-	23	30	100	150	250	250	-	270	-	520	770

\#   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 Grammer   (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

TOPIC WISE DISTRIBUTION OF PERIODS AND 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   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 Voice

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**

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 (1st and 3rd 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 1st angle only
   4.5   Three views of orthographic projection of different objects. (At least one sheet in 3rd 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 for 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 AGRICULTURAL SCIENCE

L T P
4 - 2

RATIONALE:

Agricultural science is a basic subject for a diploma holder in agricultural engineering. This subject a learner has already read in highschool agricultural course. The revision and an advance knowledge of the subject is necessary for studying agricultural technology subjects.

The course contents of this subject has been developed to inculcate the skill of dentification of the crops, common weeds, insceticide, fungicide and fertilizer as well as the skill in preparation of seed beds and seed treatment for different seeds and crops.

LEARNING OUTCOMES

After completing the course, the students will be able to understand role and importance of variety of crops, including crops as forage and crops for human consumption, their management and production and their contribution to future sustainable developments.

DETAIL CONTENTS

1. Introduction to Crop production related to engineering.

2. Elementary idea of Certain physiological processes, osmosis, photosynthesis, transipiration, Evaporation and respiration. Factors affecting these processes.

3. Agronomical Sequences-Monoculture,mixed cropping, multiple cropping, relay ropping;their adoptability advantages and disadvantages.

4. Classification of crops: Detail study of cereals crops (wheat, paddy and maize) legume crops (soyabean, moong and arhar),cash crops (potato, sugarcane), oil seed crops, sunflower (mustard,groundnut) and fruit crops (mango, apple and guava) including their production practices, Elementary exposure pest deseases and their control.

5. Identification of weeds and method of weed control for various crops (crops of item 4), Use of weed as green fertilizer and composite material fabrication.

6. Cropping scheme and crop rotation their importance for different agro climatic condition.

7. Plant Propagation : Seed propogation and vegitative propagation, their merits and demerits.

8. Mashroom Cultivation : Introduction and requirements, Method of cultivation.

9. Preparation of bio-insectsides by the use of Neem leafs, Tobacco, Dhatura and other plants

10. Waste Land Development : Concept and uses.

PRACTICAL EXERCISES

1. Identification of crops, vegetable seeds & fertilizers.

2. Identification of common weeds,insecticide,fungicide & weedcide.

3. Seed treatment before sowing the crops.

4. Seed bed preparation of sugarcane, potato, maize, Paddey and wheat.

5. Practice of prunning and some vegetative propagation like cutting, budding and airlayering.

6. Raised bed farming system (Tatura System).

INSTRUCTIONAL STRATEGY

Teacher may use demonstration and animatin that can make the subject interst and develop agricultural skill in the student. In additions student give more emphasis on explaing practical application of crop production and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

1. Post Harvest Technology of Cereals pulse and oil seeds, Dr A. Chakarvorty
2. Unit Operation of Agricultural Engineering,K. M Sahai and K. K. Singh
3. Processing and Conveying equipment design, P.S.Phirke
4. Prevention of Fruit and vegetable, Girdhari lal,G. S. Siddappaa, G. L Tondon
5. Post Harvest Tescnology of Fruit and vegetables Vol.-I and General Concept and Principle Vol-2 Technology, D. R Verma and D. R. Jauhri

6. Principle of Agricultural Processing A Text Book,P. H. Pandey

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	5	10
2.	6	12
3.	6	12
4	6	12
5	6	12
6	6	12
7	5	10
8	6	12
9	5	10
10	5	10
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 MECHANICS

L T P
5 - 2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:
- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1.   Introduction   (06 periods)

    1.1   Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.

    1.2   Definition, basic quantities and derived quantities of basic units and derived units

    1.3   Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration

    1.4   Concept of rigid body, scalar and vector quantities

2.   Laws of forces   (12 periods)

    2.1   Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

    2.2   Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition

    2.3   Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces,

resolving a force into two rectangular components

    2.4   Free body diagram

    2.5   Equilibrant force and its determination

    2.6   Lami's theorem (concept only)

           [Simple problems on above topics]

    2.7   Type of Load, supports, Beams- analysis for simply supported, cantilever beams

3.   Moment   (14 periods)

    3.1   Concept of moment

    3.2   Moment of a force and units of moment

    3.3   Varignon's theorem (definition only)

    3.4   Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)

    3.5   Parallel forces (like and unlike parallel force), calculating their resultant

    3.6   Concept of couple, its properties and effects

    3.7   General conditions of equilibrium of bodies under coplanar forces

    3.8   Position of resultant force by moment

           [Simple problems on the above topics]

4.   Friction   (14 periods)

    4.1   Definition and concept of friction, types of friction, force of friction

    4.2   Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

    4.3   Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.

    4.4   Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

           a) Acting along the inclined plane Horizontally

           b) At some angle with the inclined plane

5.   Centre of Gravity   (10 periods)

    5.1   Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies

    5.2   Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

    5.3   Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

           [Simple problems on the above topics]

6.   Simple Machines   (14 periods)

    6.1.   Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines

    6.2.   Simple and compound machine (Examples)

6.3. Definition of ideal machine, reversible and self locking machine

6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency

6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application [Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

INSTRUCTIONAL STRATEGY

Applied Mechanics being a fundamental subject, the teacher are expected to emphasize on the application of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham,Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	8
2	12	18
3	14	20
4	14	20
5	10	14
6	14	20
Total	**70**	**100**

2.4 MATERIAL & RURAL CONSTRUCTION TECHNOLOGY

L T P
6 - 2

RATIONALE

This course aims to equip the technician of agricultural engineering with the knowledge of building materials and construction methods so that they may be able to construct the related structures efficiently and economically as well as can select the materials properly for the desired works.

LEARNING OUTCOMES

After undergoing this course, the students will be able to understand different types of materials their characteristics and various materials used for construction work.

DETAILED CONTENTS

(1) **MATERIALS**   (24 Periods)

1. Non Metallic Materials

(a) Stone:

Formation of rocks, classifcation of rocks, quarrying of stones, characteristics and uses of following building stones: Granite, Sand stone, Lime Stone, Marble & Slate.

(b) Bricks

Characteristics,classification as per IS, special types of bricks - Fire Bricks, surkhi, brick ballast, general idea of tiles.

(c) Lime

Slaking of lime, commercial names, IS classification, characteristics, storage, precautions in handling and uses of lime.

(d) Cement

Natural and aritficial cement, characteristics of cement, types of cement, their properties and uses. Method of storage, names of different factories of Northern India.

(e) Timber

Definition, types - hard wood, soft wood, defects of timber seasoning of timber - water seasoning and kiln seasoning, preservation of timber, market forms of timber, brief study of common Indian timbers, ply wood, hard board and batten boards (only properties and uses.)

(f) Paints and Varnishes:

Objects of paints & varnishes, types of paints, characteristics, defects, selection of paints, storage of paints.Types of varnishes, characteristics and uses of varnishes.

(g) Plastics

Polymers and various composite material, classification, properties, and uses, linoleum, plastic coated paper, polythene sheets, thermocole and PVC.

(2) METALLIC MATERIALS   (30 Periods)

(a) Ferrous Metals:

  Classification of iron.
  i. Cost Iron : Types as per BIS,their properties and uses.
  ii.Classification according to carbon contents and as per BIS ,properties of various steel and uses.
  iii.Alloy Steel: Effects of various alloying elements, properties of common steel alloy steel.

(b) Non ferrous Metals:

  Basic idea of important ores ,properties and uses of following metals: Alluminium,Zink,Copper, Tin and Lead.

(3) Miscellaneous:
  Prop-erties and uses of following materials: Asbestos, cork,felt, attaparcha, mica, adhesives, bakelite, china clay and fibre glass. Leather, Canvass, Jute, rubber and other advance materials

(3) CONSTRUCTION METHODS   (30 Periods)

(a)   Introduction: Components of a building, section of a wall showing foundation, footing,D.P.C.,position of doors and windows,ventilators,lintels, flooring, roofing, and parapet etc. and give general idea of terms related to buildings.

(b)   Foundation: Constructional details of spread footing .(Thumb rules only)

(c)   Brick masonry: Study of various types of brick bonds with special emphasis on English and Flemish bonds,L,T & Cross junctions.

(d)   Damp Proof Course: Materials & Method used.

(e)   Doors and windows: Types and uses of doors, windows and ventilators.
(f)   Plastering and Pointing : Types and Methods.

(g)   Concrete :
(i)   Lime Concrete - Ingradient, specifications, preparation and uses.

(ii)   Cement Concrete - Ingradient, prepration, laying, compaction, curing, use of local aterials as formwork, application of ferro cement.

(h)   Lintels : Wooden, RCC and RB lintels.

(i)   Floors : Common types, construction metods, drainage and cleaning of floors.

(j)   Roofs : Roofing materials and timber trusses (sheds for cattle and work places. Bamboo structures and its composite (Such as jute, canvas and bamboo sticks and other agricultural Bi products). Composite roof sheets from agricultural waste Materials.

Rural Construction:

(a)   Rural Buildings : Cattle shed, barns, poultry house, grain bin and godowns, their construction details, capacity and functional requirement.

(b)   Rural Sanitation : Constructional details of septic tank, soak pit, aqua privy and PRAI latrines.

(c)   Farm Road : Kachcha Road, Tar Macadum and Pakka Road.

(d)   Rural Drainage : Specification as per BIS standards.

(e)   Rural Water Supply : Construction and working of India Mark -II pump, Over head tank and laying of pipe lines.

(f)   Appropriate technology for low cost building construction by locally available materials

PRACTICAL WORK

1. Identification of different types of stones .

2. Identification of different types of timber.

3. To conduct field test of cement.

4. To determine normal consistancy of cement.

5. To determine setting time of cement.(a) Initial setting time (b) Final setting time.

6. To determine water absorbtion of bricks.

7. To determine compressive strength of brick.

8. To determine fineness of cement by sieve method.

9. To make brick bonds (English and Flemish bonds only)

10. To visit construction sites and write specific report about following activities:Earth work in foundation, flooring, plastering, pointing, white washing and colour washing and installation of India Mark-II pump and Laying of water pipe line.

11. Make a roof sheet at polytechnic agricultural waste material, Cement, coarse sand mixture.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

- Agricultural Engineering Through Work Example, Dr Radhey Lal
- CIGR Handbook of Agricultural Engineering Vol-IV Agro Processing, F.W. Bakker
- Principle of Agricultural Engineering Vol. I and II Michael and Ojha

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	24	20
2.	30	40
3.	30	40
Total	**84**	**100**

2.5 ENGINEERING DRAWING - II

L T P
- - 8

RATIONALE

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

Note:

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Detail and Assembly Drawing   (02 sheets)

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

2. Screw Threads   (03 sheets)

   2.1 Thread Terms and Nomenclature

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

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

3.   Nuts and Bolt   (02 sheets)

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

4.   Locking Devices   (02 sheets)

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

5.   Keys and Cotters   (03 sheets)

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

6.   Rivets and Riveted Joints   (04 sheets)

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

7.   Couplings   (02 sheets)

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

*8.   Use of CAD software   (02 sheets)

       Draw any two joints/coupling using CAD software from the following:
       i)   Sleeve and cotter joint

    ii)   Knuckle joint
    iii)   Spigot and socket joint
    iv)   Gib and cotter joint
    v)   Flange coupling
    vi)   Muff coupling

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

−   Sketches
−   Drawing
−   Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi

2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi

3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House (Pvt. Ltd.), Anand

4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

5. AutoCAD 2010: For Engineers & Designers by Prof. Sham Tickoo & D. Sarvanan; Wiley India Pvt. Ltd., Delhi.

2.6 GENERAL WORKSHOP PRACTICE –II
(Common for 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 $\pm .25$ 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.

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

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

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

3.1   APPLIED MATHEMATICS –III

L   T   P
5   -   -

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Matrices   (16 Periods)

    1.1   Algebra of Matrices
           Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian,   Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.
           Definition and Computation of inverse of a matrix.
    1.2   Elementry Row/Column Transformation
           Meaning and use in computing inverse and rank of a matrix.
    1.3   Linear Dependence
           Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing   rank   through   determinants, Elementary row transformation and through the concept of a set of independent   vectors, Consistency of equations.

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

2.   Differential Calculus   (15 Periods)

    2.1   Function of two variables, identification of surfaces in   space, conicoids
    2.2   Partial Differentiation :
        Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain
        rule, Higher order derivatives, Euler's theorem for homogeneous functions,
        Jacobians.
    2.3   Vector Calculus :
        Vector function, Introduction todouble and triple integral,differentiation and
        integration of vector functions,   gradient, divergence and curl, differential
        derivatives.

3.   Differential Equation   (15 Periods)

    3.1   Formation, Order, Degree, Types, Solution :
        Formation   of differential equations through   physical,   geometrical,
        mechanical   and electrical considerations, Order, Degree of a differential
        equation, Linear, nonlinear equation.
    3.2   First Order Equations :
        Variable seperable, equations reducible to seperable   forms,   Homogeneous
        equtions, equations reducible to homogeneous forms, Linear and Bernoulli
        form exact equation and their   solutions.
    3.3   Higher Order Linear Equation :
        Property of solution, Linear differential equation with constant coefficients
        (PI for   X$= e^{ax}$, Sinax, Cosax, X^n, e^{ax}V, XV
    3.4   Simple Applications
        LCR circuit, Motion under gravity, Newton's law of cooling,   radioactive
        decay, Population growth, Force vibration of   a mass point attached to
        spring with and   without damping   effect. Equivalence of electrical and
        mechanical system

4.   Integral Calculus   (12 Periods)

    4.1   Beta and Gamma Functions :
        Definition, Use, Relation between the two, their use in evaluating integrals.
    4.2   Fourier Series :
        Fourier series of f(x),-n<x<n, Odd and even function,Half range series.

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

5.   Probability and Statistics   (12 Periods)

  5.1   Probability :
           Introduction, Addition and Multiplication theorem and simple problem.
  5.2   Distribution :
           Discrete and continuous distribution, Binomial Distribution, Poisson
           Distribution, Normal Distribution..

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

3.2 HYDRAULICS AND HYDRAULIC MACHINES
(Common With Civil Engineering)

L T P
6 - 2

RATIONALE

Subject of Fluid Mechanics is a basic engineering subject and helps in solving fluid flow problems in the field of Civil Engineering. The subject deals with basic concepts and principles in hydrostatics, hydro kinematics and hydrodynamics and their application in solving fluid -mechanics problems.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:
- interpret the different terms related to fluids.
- calculate the pressure exerted by fluids on the walls of containers.
- Calculate discharge through pipes, irrigation channels, water supply pipe lines.
- use different flow measurement devices like venturimeter, mouthpiece, notches, weir, orificemeter
- calculate size of the pipe for carrying a particular discharge.
- prepare the details like dimensions, slope of the irrigation, canals and water courses
- differentiate between different type of water pumps used in the field.
- measure the loss of head in pipes and channels

DETAILED CONTENTS

1. Introduction   (02 Periods)

    1.1   Fluids: Real and ideal fluids
    1.2   Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics

2. Properties of Fluids (definition only)   (08 Periods)

    2.1   Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility. Newton's Law of viscosity, Newtonian and Non-Newtonian fluids, simple numerical problems.

3. Hydrostatic Pressure   (12 Periods)

    3.1   Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
    3.2   Total pressure, resultant pressure, and centre of pressure.

3.3 Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems) Pressure on curved surfaces (concept only).

4. Measurement of Pressure   (08 Periods)

4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
4.2 Piezometer, simple manometer and differential manometer, micro manometers, Bourden gauge and dead weight pressure gauge, numerical problems related to manometers.

5. Fundamentals of Fluid Flow   (10 Periods)

5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow, stream line, stream tubes, streak line and path line.
5.2 Discharge and continuity equation (flow equation) {No derivation}, Simple numerical problems.
5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy
5.4 Bernoulli's theorem; statement and description (without proof of theorem), Simple numerical problems.

6. Flow Measurements   (10 Periods)

Brief description with simple numerical problems of :
6.1 Venturimeter and orificemeter
6.2 Pitot tube
6.3 Orifices and mouthpieces
6.4 Current meters
6.5 Notches and weirs

7. Flow through Pipes   (12 Periods)

7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment
7.2 Critical velocity and velocity distributions in a pipe for laminar flow
7.3 Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula), Simple numerical problems related to flow through pipes and siphons.
7.4 Hydraulic gradient line and total energy line. Simple numerical problems.
7.5 Pipes in series and parallel

7.6   Water hammer phenomenon and its effects (only definition and description)

8.   Flow through open channels   (14 Periods)

      8.1   Definition of an open channel, uniform flow and non-uniform flow
      8.2   Discharge through channels using
             i)   Chezy's formula (no derivation)
             ii)   Manning's formula (no derivation)
      8.3   Most economical channel sections (no derivation, only simple numerical problems)
             i)   Rectangular
             ii)   Trapezoidal
      8.4   Head loss in open channel due to friction
      8.5   Concept of specific energy and specific force- hydraulic jump.

9.   Hydraulic Machines   (8 Periods)

Hydraulic pump, reciprocating pump, centrifugal pumps (No numerical and No derivations), impulse and reaction turbines (may be demonstrated with the help of working models)

PRACTICAL EXERCISES

1. To verify Bernoulli's Theorem
2. To find out venturimeter coefficient
3. To determine coefficient of velocity (C_v), Coefficient of discharge (C_d) Coefficient of contraction (C_c) of an orifice and verify the relation between them
4. To perform Reynold's experiment
5. To verify loss of head in pipe flow due to
    a. Sudden enlargement
    b. Sudden contraction
    c. Sudden bend
6. Demonstration of use of current meter and pitot tube
7. To determine coefficient of discharge of a rectangular notch and triangular notch.

INSTRUCTIONAL STRATEGY

Fluid Mechanics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentation
- Viva-Voce

RECOMMENDED BOOKS

1. Fluid Mechanics and Hyraulics by Jagdish Lal; Delhi Metropolitan Book Co. Pvt Ltd.
2. Hydraulics and Fluid Mechanics by Modi, PN, and Seth, SM; Delhi Standard Publishers Distributors.
3. Hydraulics and Hydraulics Machines by Khurmi RS ; S Chand and Co., Delhi
4. Laboratory Manual for Fluid Mechanics by Poonia MP and Jakhar OP; Standard Publishers Distributors, Delhi
5. Fluid Mechanics by Birinder Singh; Kaption Publishing, New Delhi.
6. Fluid Mechanics by Sarao A.S; Tech. India Publication, New Delhi
7. 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	02	02
2	08	08
3	12	14
4	08	10
5	10	12
6	10	12
7	12	14
8	14	18
9	08	10
Total	**84**	**100**

3.3 SOIL SCIENCE & SOIL MECHANICS

L T P
5 - 4

RATIONALE

A diploma holder in agricultural engg. has to work with various types of soils in the field. This subject is aimed to equip the students with the capability of identifying various types of soils, their properties and behaviour in the field conditions.

In addition to above the knowledge of soil mechanics is also necessary in connection with the contruction of rural roads, farm structures, storage bins and embankment or filling of earth while leveling the land.

The curriculum of this subject has been developed to cater the above mentioned needs.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to work with various types of soils in the field. This subject is aimed to equip the students with the capability of identifying various types of soils, their properties and behaviour in the field conditions.

In addition to above the knowledge of soil mechanics is also necessary in connection with the contruction of rural roads, farm structures, storage bins and embankment or filling of earth while leveling the land.

The curriculum of this subject has been developed to cater the above mentioned needs.

DETAILED CONTENTS

A. **SOIL SCIENCE** (17 Periods)

1   Origin and classification of soils : Origin of soils, weathering of rocks and formation of horizon, composition of soils, structure of soils, classification of soils (based on agricultural needs), IS classifcation of soil, triangualar classifcation of soil. Distinction between clay, loam & silt.
     (4 Periods)

2. Physical propertion of soil: Texture, particle density, structure, bulk density, porosity, air & water in soil, temperature, cosistancy and organic matter.   (4 Periods)

3.   Chemistry of soils: Soil-water plant relation, soil mineral and chemical classification.(Acid soil, calcareous soil and salion soil) elementary exposure. Method of reclamation of   acid & alkaline soil.
          (4 Periods)

4. Introduction to Bio-Fertilizers, its importance.   (5 Periods)

B. **SOIL MECHANINCS** (53 Periods)

5. Introduction : Natural, residual and transported soil. weight volume relationship, determination of soil unit weights, water content and void ratio. Structure of soil : granular and cohesive soil. Soil colloids and Brownian motion. (9 Periods)

6. Grain Size distribution: Sieve analysis, Stock's law, hydro-meter analysis (basic concept only), grain size accumulation curves their plotting and interpretation, IS soil classifcation. (10 Periods)

7. **Engineering properties of soil:** (8 Periods)

a. Consistancy of soil: Atterburg's limite, method of determination of liquid limit and plastic limit,plasticity index, plotting of flow curve on semilog graph.

b. Permeability of soil: Darcy's law, coefficient of permeability, parameters affecting permeability, determintion of permeability by constant and variable head permameters,quick sand condition, seepage through soils.

c. Compaction and consolidation of soil: Concept of compaction and consolidation, difference between them, optimum moisture content, dry density, Procter compaction test, use of optimum moisture content in embankment,

d. Shear strength of soil : Definition of shear strength, Coulomb's law, direct shear box test and shear vane test.

e. Bearing capacity of soil : Definition, net, ultimate and safe bearing capacity,plate load test.

f. Subsurface investigation : Preliminary expolaration, test pit,different methods of boring, augers, mehtods of sampling, sealing of samples, disturbed, representative and undisturbed samples, split spoon sampler.

8. **Earth Pressure and Retaining Structures :** (10 Periods)

8.1 Definition of earth pressure, active and passive earth pressures, terms and symbols relating to a retaining wall.

8.2 Relation between movement of wall and earth pressure

8.3 Ka and Kb by Rankin's Method.

9. Shallow and Deep Foundations (10 Periods)

9.1 Definitions of shallow and deep foundations

9.2 Types of shallow and deep foundations

9.3 Application of Terzaghi's bearing capacity formulae for different types of foundations.

10. Stabilization of Soils by Lime & Cement Concept of stablization, materials used, advantages of lime & cement as stablizing agents. Strength of stablized soil.
(6 Periods)

PRACTICAL EXPERCISES

A. SOIL SCIENCE :

1. Determination of moisture tension with Tensionmenter.

2. Determination of wilting point.

3. pH value determination.

4. Classifcation of soil and field identification test.

B. SOIL MECHANICS:

5. Determination of grain size distribution by sieve analysis.

6. Determination of liquid limit and plastic limit.

7. Determination of permeability by constant and variable head permameter.

8. Determination of shear strength by direct shear box test.

9. Determination of OMC by Procter compaction test.

10. Determination of field density by core cutter method and sand replacement method

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	17	40
2.	53	60
Total	**70**	**100**

3.4 SURVEYING AND LEVELLING

L T P
3 - 6

RATIONALE

The course aims to enable the students to do land and water survey, prepare maps/plans for (i) Simple Irrigation works like laying of pipe lines and drainage channels, (ii) Road alignment. It also enable them to carry out field levelling and make contour maps of the farms and forest etc.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to understand the land and water survey, prepare maps/plans for (i) Simple Irrigation works like laying of pipe lines and drainage channels, (ii) Road alignment. It also enable them to carry out field levelling and make contour maps of the farms and forest etc.

DETAILED CONTENTS

1.   **INTRODUCTION:**

   Definition of Surveying and levelling,perpose,leniar and angular units of measurement, instruments used for taking these measurements.Basic principle of Surveying, classification of survey.

2.   **MEASUREMENT OF DISTANCES:**

   Instruments used, types of chain, chaining of a line, ranging , line ranger, reciprocal ranging, setting out a right angle, optical square, cross staff, offset-right and oblique, errors in chaining,types of errors, correction of length measured by a faulty chain,chaining on sloping ground.

3.   **CHAIN SURVEY:**

   Definition of terms -Survey station, base line, tie line, check line, running measurement, refrence sketch etc. Triangulation of an area,well conditioned triangle, method of booking a survey line, plotting of a survey line, symbols and conventional sign , permissible errors. Obstacles in chain survey.

4.   **MEASUREMENT OF AREA:**

   Direct measurement of area on paper by planimeter,Simpson's rule, average ordinate rule,trapezoidal rule, enlargment and reduction of a plan, pentagraph and ediograph.

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5. **COMPASS SURVEY:**

Perpose , concept of meridians- magnetic, true and arbritrary. Bearing of a line, types of bearing, systems of bearing,fore bearing and back bearing,dip and declination,conversion of bearing from one system to other, calculation of included angles from bearings, calculation of bearings when included angles and bearing of some line is given,local attraction,causes, detection and correction of local attraction, constuction, principle and working of prismatic and surveyor's compass. Traversing by compass, closed and open traverse, plotting of a traverse- included angle metod and deflection angle method.

6. **LEVELLING:**

Definition of terms,levelling, level and horizontal surfaces. Datum-standard and ordinary, reduced level, bench mark,types of bench marks. Methods of levelling,direct and indirect levelling,their scope and utility. Direct levelling- simple, compound and reciprocal levelling, Levelling instruments, hand level, clinometer,levelling staves,merit and demerits of different types of staves and their use. Levelling field book. Fly levelling and check levelling.Differential levelling and its precision. Profile levelling, longitudinal levelling, cross sectional levelling,plotting of profile.Method of drawing longitudinal and cross section of a channel,drainage and road.

7. **PLANE TABLE SURVEY :**

Plane table and its acessories, adjustments of aplane table,centering, levelling and orientation. Methods of planetabling- radiation, intersection, traversing and resection.Errors in plane table survey, advantages and disadvantages of plane table survey.

8. **THEODOLITE :**

Types of theodolyte, different parts of a transit theodolite,different axes of a theodolite, relation between them, temporary adjustment of a theodolite, elementary knowledge of reading bearing by a theodolite.

9. **CONTOURING:**

Definition of contour line, grade contour, horizontal equivalent,vertical interval.Contours of a hill, pond, valley, ridge, vertical cliff, valley line, ridge or water shed line. Method of drawing contours- direct and indirect method of contouring.

10. **MINOR INSTRUMENTS:**

Abney's level, Cylone ghat tracer, Tangent Clinometer.

PRACTICAL EXERCISES

1. To find out distance between two unapproachable objects.

2. Plan of a small area by means of chain surveying.

3. Plan of a small area by means of compass surveying.

4. Plan of a small area by means of plane table survey.

5. Contour map of an area with atleast 3 meter up and down area.

6. Plan for land aquisition and checking it with sajra plan.

7. To plot the longitudinal section of a canal showing the ground level for atleast 1 km length.

8. To determine the elevation difference between two points by levelling with atleast five shifting of instruments.

9. To find out bearing with the help of theodolite

10. Use of minor instruments.

11. Calculation of area of a map with the help of planimeter.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaining practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	2	10
2.	2	10
3.	6	12
4	2	10
5	4	12
6	6	12
7	6	12
8	6	12
9	6	12
10	2	10
Total	**42**	**100**

3.5 AGRICULTURAL EQUIPMENT WORKSHOP PRACTICE

L T P
- - 8

LEARNING OUTCOMES

After undergoing the subject, the students will be able to understand different types of shop work and fundamental principles of different machines.

(Atleast 9 jobs are to be made)

I.   Machine Shop:

1. Lathe Machine:

(a) Step turning, Taper turning and knurling.   1 job

(b) Drilling, boring, counter boring and internal turning   1 job

(c) V thread cutting   (internal and external)   1 job

(d) Multi-thread cutting   1 job

2. Planer Shaper and Slotter   1 job

3. Group Work on Milling Machine involving down and climb milling

(i) Slab milling   1 job

(ii) Gear cutting   1 job

II.**Fitting Shop:**

(i) To make different keys   2 jobs

(ii) To make Limit gauge   2 jobs

(iii)To make cup and cut tool   1 job

(iv) To grind a drill   1 job

III.**Welding Shop:**

(a) Welding practice on mild steel & Cast Iron   2 jobs

(b) Practice of gas cutting   1 job

(c) Practice on spor welding machine   1 job

3.6   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

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

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

SUGGESTED DISTRIBUTION OF MARKS

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

4.2 MECHANICS OF SOLIDS
(Common with Mechanical Engineering)

L T P
4 1 2

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

LEARNING OUTCOMES

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

- interpret various concepts and terms related to strength of materials
- calculate stresses in bars of various cross-section.
- calculate energy stored by materials subjected to axial loads.
- calculate moment of inertia of different sections.
- interpret the concept of bending and torsion and calculate stresses on different section of materials.
- draw and calculate shear force and bending moment diagrams of beam under given loading
- calculate stresses in thin cylindrical shells.
- determine the diameter of a shaft under combined bending and torsion.
- calculate critical axial loads on column under different end constraints.

DETAILED CONTENTS

1.   Stresses and Strains   (08 Periods)
    1.1.   Basic assumptions; Concept of load, stress and strain
    1.2.   Tensile compressive and shear stresses and strains
    1.3.   Concept of Elasticity, Elastic limit and limit of proportionality.
        1.3.1.   Nominal and true stress-strain diagrams.
        1.3.2   Hook's Law
        1.3.3.   Young Modulus of elasticity
        1.3.4.   Nominal stress
        1.3.5.   Yield point, plastic stage
        1.3.6   Ultimate strength and breaking stress

        1.3.7.   Percentage elongation
        1.3.8.   Proof stress and working stress
        1.3.9.   Factor of safety
        1.3.10   Poisson's Ratio

1.3.11   Shear modulus
1.3.12   Deflection and stiffness
1.4.   Concepts of fatigue, creep and stress concentration
1.5.   Thermal stresses

2.   Resilience   (04 Periods)

2.1   Resilience, proof resilience and modulus of resilience
2.2   Strain energy due to direct stresses
2.3   Stresses due to gradual, sudden and falling load.

3.   Moment of Inertia   (05 Periods)

3.1.   Concept of moment of inertia and second moment of area
3.2   Radius of gyration
3.3   Theorem of perpendicular axis and parallel axis (without derivation)
3.4   Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
3.5   Section modulus

4.   Bending Stresses   (06 Periods)

4.1   Concept of Bending stresses
4.2.   Theory of simple bending
4.3.   Use of the equation $\sigma/y = M/I = E/R$
4.4.   Concept of moment of resistance
4.5.   Bending stress diagram
4.6.   Calculation of maximum bending stress in beams of rectangular, circular, and T section.
4.7   Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

5.   Torsion   (06 Periods)

5.1.   Concept of torsion- difference between torque and torsion.
5.2.   Use of torque equation for circular shaft
5.3.   Comparison between solid and hollow shaft with regard to their strength and weight.
5.4.   Power transmitted by shaft
5.5   Concept of mean and maximum torque
5.6   Concept of Principal stresses, principal planes and max. shear stress.
5.7   Determination of shaft diameter under combined bending and torsion.

6.   Shear Force and Bending Moment   (10 Periods)

6.1   Concept of beam and form of loading
6.2   Concept of end supports-Roller, hinged and fixed
6.3   Concept of bending moment and shearing force
6.4   S.F. and B.M. Diagram for cantilever and simply supported   beams with and without overhang subjected to concentrated load and U.D.L.

7.   Columns   (05 Periods)

    7.1.   Concept of column, modes of failure
    7.2.   Types of columns
    7.3.   Buckling load, crushing load
    7.4.   Slenderness ratio
    7.5.   Factors effecting strength of a column
    7.6   End restraints
    7.7   Effective length
    7.8   Strength of column by Euler Formula without derivation
    7.9.   Rankine Gourdan formula (without derivation)

8.   Thin Cylinder and Spherical Shells   (04 Periods)

    8.1   Introduction to longitudinal stresses, circumferential or hoop stresses and radial stresses
    8.2   Longitudinal and circumferential stresses in thin cylinder
    8.3   Longitudinal and circumferential stresses in thin Spherical shells

9.   Slope and Deflections of Beams: (08 Periods)

    9.1 Definition of slope and deflection, sign convention. Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method.
        a)   Cantilever having point load at the free end
        b)   Cantilever having point load at any point of the span
        c)   Cantilever with uniformly distributed load over the entire span
        d)   Cantilever having U.D.L. over part of the span from free end
        e)   Cantilever having U.D.L. over a part of span from fixed end
        f)   Simply supported beam with point load at centre of the span.
        g)   Simply supported beam with U.D. L. over entire span.
  Note: All examples will be for constant moment of inertia without derivation of formula.

LIST OF PRACTICALS

1.   To find the sheer force at a given section of simply supported beam for different loading.
2.   To find the value of 'E' for a steel beam by method of deflection for different loads.
3.   To determine the Max-Fiber stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.
4.   To determine the ultimate tensile strength, its modulus of Elasticity, stress at yield point, Elongation and contraction in X-sectional area of the specimen by U.T.M. through necking phenomenon.
5.   To determine the ultimate crushing strength of materials like steel and copper and compare their strength.

6. To determine Rockwell Hardness No. and Brinell Hardness No. of a sample.
7. To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test.
8. To determine the bending moment at a given section of a simply supported beam for different loading.
9. Top determine the various parameters of helical coil spring.
10. To determine the angle of twist for a given torque by torsion apparatus and to plot a graph between torque and angle of twist.

MEANS OF ASSEESSMENT

– Assignments and quiz/class tests
– Mid-term and end-term written tests
– Actual Practical Performance
– Small projects
– Viva-voce

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

RECOMMENDED BOOKS

1. SOM by Birinder Singh; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.
5. Mechanics of Solids by Karmveer Saini, Krishna Publication House, Meerut.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Website for Reference:
   http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	12
2	04	08
3	05	08
4	06	12
5	06	10
6	10	16

7	05	10
8	04	08
9	08	16
Total	**56**	**100**

4.3 FARM POWER ENGINEERING & NON CONVENTIONAL SOURCES OF ENERGY

L T P
5 - 2

Rationale:

Diploma holders in agricultural Engineering should have the knowledge of different sources of power available at farms for driving the farm machinary and equipment. I.C. Engines are the primary sources of power available on farms. Some times these conventional sources are not available adequately in rural areas. Therefore it becomes necessary to harness power from non conventional energy sources such as wind, solar and biogas etc.

LEARNING OUTCOMES

After undergoing this course, the students will be able to understand the knowledge of both conventional and non-conventional sources of power.The contents of this subject have been developed to cater above mentioned needs.

DETAIL CONTENTS

1. **INTRODUCTION:**

   Sources of power on farms, comparative study and uses, limitation and brief description of animal, fossil fuel (Diesel/petrol) wind, solar, Biogas and electrical power.

2. **I.C. ENGINES :**

(A) **Principle :**

   Heat engine, principle of operation, classifcation of I.C. engines, prinicples of operation two stroke and four stroke cycle Engine. Difference between two stroke and four stroke engine. Diesel and petrol engine, stationary, reciprocating and rotary parts, their material of construction and fuctions. Concept of terms related with I.C. engine. Numerical problems related with different terms. Performance of engine.

(B) **Engine System :**

   (i) Valve system-Arrangement of valve, Functions of different parts-Valve timing. Effect of incorrect valve timing. Valve clearance and threir adjustment. Firing order. Scavenging systems. Ratio and efficiency.

   (ii) **Fuel Supply Systems :**

System of petrol and diesel engines. Properties of fuel. Fuel filter. Carburetion. Function of Carburettor. Construction and working of simple, compensating and Zenith carburettor. Adjustments in carburettor. Specific fuel consumption.

(iii) **Fuel Injection:**

Method of injection, construction and working of fuel injection pump, injector automiser, types of nozzles.

(v) Air Cleaner :

Importance of clean air in engine. Characteristics of air cleaner. Types of air cleaners,
their construction and working. Maintenance of air cleaner.

(vi) Ignition system :

Ignition methods. Electric spark ignition, Battery & Magnetic ignition system. Spark
plug, combustion in I.C. engine, combution chamber. Silencer.

(vi) **Governing system :**

Governing, hit & miss system. Throttle system. Centrifugal & pneumatic governor.
Governor hunting and governor regulations.

(vii) **Lubricating system :**

Importance. Function & quality of lubricant. Types of lubricant used in engine. Sources
of lubricant. Selection of lubricant. Splash system. Internal forced feed and splash syste, full internal forced feed system. Oil filter.

(viii) **Cooling System :**

Importance. methods of cooling - Air cooling, water cooling. Thermo siphon and forced circulating system. Thermostate valve. Antifreeze mixture. Pressure Cooling.

3. **TRACTOR :**

(a) Introduction. Classifcation of tractor and adoptability. Factors affecting selection of Tractor.General idea about different makes, models, in different H.P. ranges of tractors.

(b) Tractor Clutches-

Necessity, properties of clutch, types of clutches, construction and working of single ,dual and multi plate disc clutches, power transmission by single plate clutch, clutch troubles.

(c) **Transmission System:**

Purpose, gear ratio, types of transmission-Selective gear type and constant mesh

type. Differential gear type - construction and working. Final drives, power take-off. Belt-pulleys.

(d) Steering system of wheel tractor.

(e) Tractor brake mechanism.

(f) Hydraulic system of tractor-construction and working.

(g) Hitching system-Drawbar. Principle of hitching, vertical and horizontal hitching adjustments.

4. HOURLY COST OF OPERATION

Hourly cost of operation of small petrol engine,diesel engine and tractor.

5. NON-CONVENTIONAL ENERGY :

(a) **Bio-Gas Technology**

Introduction to Bio-gas, prodcution to Bio-gas,Bio-digestion of plants and animals waste, reaction taking place during bio-digestion, gases produced during the process, elimination of unwanted gases such as CO_2 and H_2S, factors affecting prodcution of gas, efficiency of Bio-gas plants in winter, uses of biogas, use of digested sludge.

Bio-gas Plant

Construction & working: Main parts of gas plant-digester, gas holder, pressure gauge, gas main controlling cocks and gas meter,dimensional details of plant, working of gas plant. Bio-gas application and appliances.

(b) **WIND ENERGY TECHNOLOGY:**

Types of Wind Mills-vertical axis and horizontal axis. Various uses of wind mills-lifting water for drinking and irrigation, corn grinding, sewage pumping, electrical power generation. Site selection for a wind mill. Construction of wind mill. Working and maintenance of wind mills.

(c) **SOLAR ENERGY TECHNOLOGY:**

Solar radiation and potentiality of solar radiation in India. Application of solar energy-solar cooker,solar crop dryer, solar water heater and solar Photovolatic Technology. Solar collector-flat plate collector, concentration or focussing type collector.

PRACTICALS

1. Familiarisation with different gauges and controls of tractors and pre starting checks.

2. Tractor driving practice
   (a) Without implements in limited space like L shape, T shape & circle etc.

3. Practice of power tiller operations.

4. Hitching of trailor and different implements. Practice of trailer reversing.

5. Study of components and working of engines; two & four stroke cycle engines

   (a) With the help of cut way model.

   (b) Practice of starting, running adjusting and stopping, common trouble shooting.

   (c) Operation of biogas engine.

6. Study of valve arrangment, valve tuning and firing order. Valve grinding and setting of valve timing.

7. Study of diesel fuel supply system, air bleeding.

8. Study of battery, periodic battery care, ignition system and spark plug gap adjustment.

9. Study of cooling system in tractors and stationary engines.

10. Study and servicing of Lubrication system.

11. Study of transmission system.

12. Pereodic maintenance of engines and tractors.

13. Visit to gobar gas plant and draw its sketch.

14. Study of wind mill

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	5	5
2.	10	15
3.	20	30
4	15	20
5	20	30
Total	**70**	**100**

4.4 ELECTRICAL ENGG. & RURAL ELECTRIFICATION

L T P
5 - 2

RATIONALE

The electricity plays vital role in every sphere of life. In fact without electricity, no one can think of any development. Keeping in view the importance it became essential to make it availbale in rural areas. Without the knowledge of its production, transmission and equipments/appliances it shall not be possible to make the most efficient use of available energy which is scarce. Hence this subject provides a satisfactory knowledge to the agricultural engineering diploma holders to cater to the needs of the modern age.

DETAILED CONTENTS:

A   **MACHINES**   (54 Periods)

1. **D.C. Machines:**   (9 Periods)

   Principle of operation of D.C. Motor, E.M.F. equation, types and their uses. Principle of operation of D.C. Generators, types & application.

2. **Elements of A. C.:**   (9 Periods)

   Definition, prodcution of A.C., parameters. Instantaneous values peak, value, R.M.S. Value, Average Value, difference between direct current and alternating current.

3. **A.C. machines:**   (9 Periods)

   Principle of operation and application of
   (i) Alternator
   (ii) Synchronous motor,
   (iii)Induction motor.

4. **Transformer:**   (9 Periods)

   Principle, operation, transformation ratio, application, cooling system. Types: Step down and step up transformers.

5. **Transmission and Distribution:**   (9 Periods)

   Importance, necessity of transmission, transmission losses and how to minimize it. Basic idea about power transmission and substation. Method of distribution of electrical power.

6. **Rural Electrification:**   (9 Periods)

1.   Electrical appliances: Switches, fuses, regulator boards.

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2. Types of house wiring and wiring materials: wires, battens, conduit pipe (plastic and metal), clips etc.
3. Wiring tools and equipments.
4. Calculation of energy consumption and preparation of bills.
5. Street light connection.
6. Cables - Utility, specifications and installation with respect to save energy and economy.
7. Generalidea about the rules of U.P. Electricity Board for rural electrification.

B **MEASURING INSTRUMENTS**   (16 Periods)

1. Working principles and construction of the following instruments: (8 Periods)

    (a) Ammeter and voltmeter (moving coil and moving iron type)
    (b) Dynamometer type wattmeter
    (c) Energy Meter

2. Measurement of power in single phase and three phase circuits by wattmeter
                                                              (8 Periods)

        PRACTICALS EXERCISES

1. To Connect a single phase load with single phase supply and measure current, voltage, power and power factor.

2. To study and sketch single phase energy meter and caliberate it at different loads.

3. Stair-case wiring.

4. Study of D.O.L.starter and to connect three-phase moter with it.

5. To study star Delta starter -
    (a) Manually operated.
    (b) Automatic type.

6. To measure power and power factor of single phase circuit by a 3 voltmeter method, by 3 ammeter

7. To determine turn ratio and efficiency and regulation of a single phase transformer.

8. Estimation of cost of materials of wiring for a farm house specially batten and conduct wiring.

9.a Electrical precautions to be strictly observed while working with appliances/equipments/supply lines especially for human safety.

 b) Knowledge of First-Aid to be provided to the person involved in an accident by electricity.

10. Earthing of electrical equipments.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	54	65
2.	16	35
Total	**70**	**100**

4.5 AGRICULTURAL ENGG. DRAWING

L T P
- - 8

RATIONALE

In the feild an agricultural engineering diploma holder shall come across to various civil ingineering structureas irrigation structures, farm road, earthen dams and storage bins etc. For constructing the above mentioned structures economically and effectively he must be able to enterpret civil engineering drawing correctly.

An agricultural engineering diploma holder shall also Come across different machines in different section and he may be involved in fabrication /manufacture/ repair and maintenance / floor level assembly of parts etc. For performing the above job effectively and economically he must he able to enterpret the machine drawings correctly.

Therefore the knowledge of civil engineering drawing as well as mechanical engg. drawing is vary essential for an agricultural engg. diploma holder.

DETAIL CONTENTS

A. **MACHINE DRAWING:**

1. **Introduction:**

   Concept of half sectional and full sectional views. Concept of working drawing of assemblies from given components showing models of any machine.

2. **Detail drawings of the following :**

   1. Two views of each, out of which one should be sectional view.

   2. Cotter and knuckle joints

   3. Bearings : Foot step bearing and pedestal bearing

   4. Couplings : Flanged coupling and flexible coupling

   5. I.C. Engine: piston, piston rod and connecting rods

   6. Screw Jack

   7. Free hand proportional sketches of the following agricultural implements and their components:

   a. Shovel and cultivator

   b. Simple drum type wheat thresher exploded view.

   c. Spool for the disc harrow.

d. Mould Board Plough, Dis Plough & Reaper Cutter bar

B. **CIVIL ENGINEERING DRAWING**

Plan, elevation and section of following rural structures:

1. Farm House
2. Cattle barn
3. Poultry farm
4. Doors and windows : braced and battened door, fully panelled door and window, partially glazed and partially panelled door and window.
5. Drawing of Gobar gas plant of fixed dome type showing different parts and their sizes through visit to a near by plant.
6. Rural roads and sanitation - cross section of a rural road showing drains and trees etc., plan and section of septic tank and soakpit for a moderate rural family (6 to 10 users) as per BIS specification.
7. Sectional view of India Mark-II Hand Pump.

4.6 ENVIRONMENTAL STUDIES

L T P
3 - 2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Introduction   (04 Periods)

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

2. Air Pollution   (04 Periods)

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

3. Water Pollution   (08 Periods)

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

4. Soil Pollution   (06 Periods)

    4.1   Sources of soil pollution

4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste

4.3 Effect of Solid waste

4.4 Disposal of Solid Waste- Solid Waste Management

5. Noise pollution   (06 Periods)

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

6. Environmental Legislation   (08 Periods)

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

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

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

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

4.7 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

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

6.4 Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features

7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

8. Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery

8.2 Concept and types of co-generation system

9. General Energy Saving Tips

Energy saving tips in:
9.1 Lighting
9.2 Room Air Conditioner
9.3 Refrigerator
9.4 Water Heater
9.5 Computer
9.6 Fan, Heater, Blower and Washing 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.

INDUSTRIAL TRAINING

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity   15%
b) Initiative in learning new things   15%
c) Presentation and Viva   15%
d) Industrial training report   55%

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 organisation.
- 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 organisation.
- 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 MINOR IRRIGATION AND TUBE WELL ENGINEERING

                                                                L T P
                                                                5 - 4

RATIONALE:

The knowledge of this subject will help the learner to equip them with the importance of minor irrigation net works and tubewells in increasing the agricultural production. Design of the network and tube wells with optimum efficiency will help generating extra income through cash crops etc. to farmers.

DETAILED CONTENTS

(1) **MINOR IRRIGATION**

1. **Introduction :**   (5 Periods)

   Importance, necessity and advantages of minor irrigation.

2. **Minor Irrigation & Tubewell Engineering:**   (6 Periods)

   Concept, appliaction and scope of minor irrigation & Tubewell engineering.

3. **Planning & Layout:**   (8 Periods)

   Planning and layout of minor irrigation channel,

4. **Minor Irrigation Equipments:**   (10 Periods)

   Introduction of the following traditional water lifting devices: Swing basket, mhot, rahat, charas, dhenkuli, Egyptian screw, Propeller pump, Axial flow pump.

5. **Water Pumping Equipments :**   (5 Periods)

   Wind mills, hydrams, solar water pumps, principles, constructional details & working.

6. **Sources of minor irrigation:**   (5 Periods)

   Shallow & deep wells, water tanks and ponds, Confined and unconfined aquifer, development of well.

(2) **TUBE WELL ENGINEERING:**   (31 Periods)

1. **Introduction:**   (2 Periods)

   Definition of tube well, need, adwantages & disadvantages.

2.	**Selection of Site:**	(2 Periods)

Charctristics of tube well site, factor affecting site selection.

3.	**Drilling Methods:**	(2 Periods)

Types of drilling methods, advantages of different methods. Types of rigs; Rotary & percussion rigs, their construction, installation and working.

4.	**Types of Tube well :**	(4 Periods)

Types of tube well, advatages & disadvantages of each type, selection of tubewell for a given site.

5.	**Strainers:**	(4 Periods)

Types, method of design, comparison of defferent types of strainers.

6.	**Open Wells:**	(4 Periods)

Design and construction of open wells.

7.	**Pump and Pumping equipments**	(8 Periods)

Types, main features, working principle, selection of pumps and pumping equipment, centrifugal pump, Submersible and turbine pumps, performance, installation and Aligment of centrifugal pump. Submercible pumps, installation, operation and maintenance.

8.	**State Tube wells:**	(4 Periods)

Importance in increasing agriculture prodcution,command area and government policy about tubewells.

PRACTICALS EXERCISES

(Irrigation Engg. Lab)

1. Study and sketch of spill ways and outlet.

2. Study of different types of methods of irrigation adopted for different crops at formers field.
3. Study and sketch of infiltration and actual determinations of infilteration rate of soil in field.

4. Study and sketch different weirs, notches, orfices andflumes and flow measurement us channel.

5. Determination of discharge of a channel by

(a) Float method

(b) Current meter method

6. Studty and sketch of Tenso meter and its use in determination of soil moisture.

7. To measure pressure head in saturated soil by pizometer.

8. To determine irrigation efficiencies in field:

i. Water application ii. Water conveyance iii.water distribution

9. To determine consumptive use by weighing type evapo transpiration pan.

10. Preperation of drainage plans.

11. To determine yield of a tube well.

12. Study and sketch of the following:
      (Any two)

i.   Sprinkler Irrigation
ii.   Drip Irrigation
iii.   Wind Mill

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaining practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	39	55
2.	31	45
Total	**70**	**100**

5.3 POST HARVEST TECHNOLOGY & AGRO BASED INDUSTRIES

L T P
5 - 4

RATIONALE:

In agriculture harvesting and threshing at field are very important operations. Now a days at medium & large farms, these machines are used by agro industries, corporations,agricultural engineering departments and largeand medium size holdings and private organizations. For menning operation and maintenance of post harvest equipments supervisory personnels are required.

In view of the emphasis given by the government for conservation, storage and adding value to the agricultural produce, the post harvest technology has assumed special significance. Primary operation like drying, cleaning grading as well as storage management, layout of marketing yards and trans port system are worth mentioning. All these operation are done by the farmer at farm level, through corporation or by govt. level.

The contents of this subject have been developed to cater the above needs and equip them with the knowledge of post harvest techniques and equipments, so as to economise the processes and optimise the use of equipments and available infra structure.

DETAILED CONTENTS

1. **Introduction:**

   Importance of grain and seed processing principles of agricultural processing, sequence of operations, flow diagram, services offered by processor to farmers and Under water grain storage

   DIFFERENT STEPS INVOLVED IN SEED PROCESSINGS

2. **Drying :**

   Importance of moisture in seed and grain representation. Determination of moisture, direct and indirect methods, process of drying such as constant rate period and falling rate period. Drying kinds: thin layer and deep-bed drying. Temperature and air flow requirement, natural air and heated air drying, solar drying. Direct and Indirect dryers, their efficeincy and economics.

3. **Cleaning and Grading :**

   Importance, elementry, study of related machines, their operations and maintenance such as scalper, air screen cleaner, rotary cleaner, spiral separator, indented cylinder separator, gravvity separator, Debearder.

4. **Seed Treatment:**

Seed treatment methods, elementary study of seed treating equipments such as as powder and slurry seed treater and their advantages.

5. **Bagging & Packaging:**

Manual bagging, semi-automatic bagging Machines and automatic begging machines. Packaging materials and their utilization

6. **Storage:**

Storage of seed and grain, respiration and factors affecting it, changes in stored product during storage, loss of germination and seed viability. Design of storage system and equipments. I.S.I. code practice. Storage of fresh fruits, vegetables and dairy products.

7. **Material Handling Equipment:**

Belt conveyor, screw conveyor, pneumatic conveyor, bucket elevator, their operation and maintenance

8. **Pretreatment/Conditioning of Agricultural Produce For Milling:**

Parboiling of paddy, Methods and machinery used for parboiling, pretreatment of pulses and oil seeds for milling.

9. **Milling of Cereals, Pulses and Oil Seeds & Indian Masalas (Spices):**

Methods and machinery used for milling for cereals pulses and oil seeds such as paddy, wheat, arhar and mustared. Elementary knowledge of solvent extraction plant.

10. **Canning of Fruits and Vegetables :**

Methods and machinary used for canning, advantage of canning.

11. **Dehydration of Fruits and Vegetables :**

Methods and machinery used for dehydration of fruits and vegetables such frey drier, solam drier, Advantage of dehydration.

12. **Processing of Fruits & vegetables For Preparation of Jam, Jelley Squash, Betchup, Etc.:**

Methods and machinery used for preparation of Jam, Jelly, Squash, Betchup, Catney, Morabba, etc.

13. **Utilization of By-Products :**

Utilization of paddy husk, rice bran, paddy straw, corn cob; Bio-methanation of fruits and vegetable waste, Crasification of agricultural based celulosie materials.

14.   **Agro-Based Industires:**

Sugarcane crushing, khandsari and Gur making process and equipment; Preparation of Soybean and Potato based products such as Soyamilk, Soypaneer, Soybiscuits Papad, chips Waffers, etc.; Briquetting of agricultural waste to use as fuel, Card Board preparation from paddy straw.

PRACTICAL EXERCISES

Study and operation of the following:

1. Air screen cleaner and other cleaning equipments.

2. Heated air dryer.

3. Screw conveyor, bucket elevator & belt coveyer

4. Slurry seed treater and mixer

5. Case Study of the following available in through visits:

a. Modern Rice Mill

b. Cold Storage/Appropriate technology for short   duration storage at village level.

c. Specific gravity separator

d. Processing and storage plant

e. Gur making unit

f. Soybeean processing unit

g. Canning and packaging of fruits and vegitables.

h. Khandsari sugar making unit

i. Vegetable dehydrating unit

j. Seed germinating unit

6. Preparation of Mango, Guava, Karaunda and Apple jelly.

7. Preparation of Orange squash and Lamon squash.

8. Preparation of ketchup of different fruits.

9. Agro waste composite materials

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaining practical application of construction of

related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	5	7
2.	5	7
3.	5	7
4	5	7
5	5	7
6	5	7
7	5	7
8	5	8
9	5	8
10	5	7
11	5	7
12	5	7
13	5	7
14	5	7
Total	**70**	**100**

5.4 ESTIMATING & COSTING

L T P
5 - -

RATIONALE:

This is one of the core subject of Agricultural Engineering as it enables the students to estimate the cost of Civil Engg. Agricultural structures and cost of producing a mechanical machine or equipment used in maintenance work or expenditure on spares. They will know the working of contractors, estimators, supervisors & valuers. The study of this subject makes them efficient supervisors & good executives in Agricultural Engineering field.

DETAILED CONTENTS
(A)   **CIVIL ENGINEERING ESTIMATING:**

1.   **Introduction:**   (4 Periods)

Definition of estimating, purpose, types of estimate, preliminary estimate, cubical content estimate, plinth area estimate, approximate quantity method estimate, detailed or item rate estimate, rewised supplementary estimate, annual repair cost and special repair estimate. Bill of quantities, abstract of cost, prerequisites of estimating that is drawing, specification, rates, general and detailed specifications.

2.   **Measurement of work:**   (4 Periods)

Units of measurement, general rules of taking measurement, units of payment, method of measuring quantities- centre line method, long and short wall or out and in to in methods.

3.   **Analysis of Rates:**   (4 Periods)

Shedule of rate, need of analysis of rates, requirement of labour for different works as per NBO, requirement of material for different works, preparation of analysis of rate of 10 important works.

4.   **Estimate of different work of a building & roads & farm structures:** (6 Periods)

(a)   Earth work in foundation, steps, dwarf wall, boundary wall
(b)   Concrete in foundation
(c)   Brick masonary in footings
(d)   Brick masonary upto plinth
(e)   Brick masonary in super structure
(f)   D.P.C.
(g)   R.B. and R.C. works
(h)   Flooring

(i)   Sand/earth filling
(j)   Plastering and pointing
(k)   White washing and colour washing
(l)   Site development
(m)   Antitermite treatment
(n)   Arches and roofs
(o)   Water supply and sanitary works:
(i)   Bath room and W.C. including fittings
(ii)   Septic tank and soakpit
(iii)   P.R.A. type latrine
(p)   Doors and windows
(q)   Misc. other works

5.   **Estimate of a complete Village House**   (4 Periods)

6.   **Calculation of materials:**   (6 Periods)

        Calculation of quantities of different materials from estimated quanties of items like brick work, cement concrete R.B. and R.C. work.

7.   **Estimate of earth work of road:**   (6 Periods)

        Calculation of   land   areas   and   volumes-Prismoidal formula, mass diagram, methods of taking out and scheduling quantities for various items such as culverts and bunds. Earth work volumes by spot levels and contours.

8.   **Estimates of irrigation and drainage channels:**   (6 Periods)

        Specifications and estimating quantity and cost of irrigation and drainage channels.

(B)   **MECHANICAL ENGINEERING ESTIMATING:**

1.   **Estimation of materials:**   (6 Periods)

        Estimation of weight of a simple machine part.,

2.   **Estimation of Welding:**   (8 Periods)

        Material cost, fabrication cost,welding cost & finishing cost,overhead cost, labour accomplishment   factor   and cummulative   effects of poor practices on cost. Calculation
        of cost of welding, gas consumption and welding electrodes.

3.   **Estimation of Forging:**   (8 Periods)

        Concept of losses in forging operation. Estimation for the tock required for hard forging considering scale and shear losses.

4.   **Estimation of cost:**   (8 Periods)

Concept of costing, brief discription of direct materials, indirect materials, direct labour, indirect labour and overhead expences

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	40	55
2.	30	45
Total	**70**	**100**

5.5 AGRICULTRUAL, INDUSTRIAL FINANCE AND RURAL ENTREPENURSHIP

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RATIONALE

A diploma holder in Agricultural Engineering very often has to work with village folk. For this perpose he must have a goodn rapport with the villagers. So a diploma holder in Agricultural Engg. should be able to apply the principles of rural socialogy and social behaviour for rural people in his job and provide leadership in the development of rural areas.

Therefore, the knowledge of development of rural area is very much needed to an agricultural engineering technician. The curriculum of diploma course in Agricultural Engineering is being developed keeping in view the job opportunities in the field. It has been experienced that students who opt for diploma course are fairly intelligent and enterprising. It has also been experienced that all students who pass out diploma do not go for jobs. Persons who posses entreprenurial traits and attributes prefer setting up their own small scale industries/ business venture instead of seeking jobs.

The percentage of students who like to set up their own industrial/   business venture could be increased by way of introducing entrepreneurship development in agricultural engineering curriculum . The contents of this subject have been development   to cater the above needs. The contents of this subject have developed to cater to above needs.

DETAILED CONTENTS

(A)   **RURAL DEVELOPMENT :**   (35 Periods)

1.   Introduction: (4 Periods)

   Importance of rural development , need of development.

2.   Spheres of rural development :   (5 Periods)

   (a)Social (b) Education (c) Health (d) Housing (e) Sanitation and drainage (f) Industrial (g) Energy

3.   Govt Agencies envolved im rural development: (6 Periods)

   Block Development officer and its staff, Rural Engineering department.

   a.   Financing Agencies and their working:

      Development banks, regional   rural   bank, commercial   banks,   lead   bank, cooperative banks.

5.   Govt Schemes for rural development: (6 Periods)

Trysem, IRDP, IRD, ACID (Agriculture credit intensive development scheme), DRI (Differential rate of Intrest scheme of banks, Insurance schemes.

6. Community Development: (7 Periods)

Philosphy, principle and objectives,organisational set up of blocks,Panchayat samiti,
Gram vikas samiti etc.

7. Rural Extension: (7 Periods)

Rural Extension methods such Audio,Visual and Audio Visual. Use and role of information technology in rural development.

(B) **ENTREPRENEURSHIP DEVELOPMENT**   (35 Periods)

1. Introduction: (5 Periods)

Entrepreneur, entrepreneurship, its meaning & importance.Qualities of an entrepreneur. Entrepreneur Motivation Training (E M T). Ring toss, Achievement Planning, Tower Building.

2. Industries: (10 Periods)

Role and importance of small scale and other Industries. Classification of industries-village industry, tiny industry, small, medium and large scale industry. Ancillary industry. Identification of industry- resources,demand and skill based industry.

Financing Agencies for - Land, Infra Structure, Machinary, raw material, import of raw material and machinary. Marketing. Role and function of Govt. department connected with the devewlopment of industries in the State. Component of project report - Land, Building, Electricity, water, Equipment and other utilities. Materials, its availability, cost, labour availability and wage rates. Price of finished product.

3. Market Survey: (5 Periods)

Project selection based on market survey, demand and supply estimation, fast moving brands etc.

4. Industrial Management: (5 Periods)

Production planning and control, marketing management and laison, Basic concept of marketingand salesmanship, marketing mix, working capital management, cash flow. Personnel management. Limiting cost ,budget and its control, book keeping, balance sheet, Break even analysis.

5. Industrial Legislation and Taxes: (5 Periods)

Indusatrial and Labour Laws, Production Tax. local tax, sales tax, excise duty, Income tax.

6.   <u>Project Report:</u>   (5 Periods)

Prject report preparation   and   provisional registration. Preparation   of   detailed project preport (D. P. R.) for financial assistance.

(C)   **<u>INDUSTRIAL MANAGEMENT:</u>**   (30 Periods)

1.   <u>Organisation:</u>   (4 Periods)

Definition   of good organisation. Principle   of   good organisation with merit & demerits.

2.   <u>Lay out:</u>   (6 Periods)

Site selection of factory, influence of location on plant layout, factors considering for plant building. Definition of plant layout, objectives 2 principles. Types of plant layout.

3.   <u>Material Management:</u>   (6 Periods)

Importance and function of material handling. Engineering   & economics consideration devices. Relation between plant layout and material handling.

4.   <u>Replacement of Machinary:</u>   (6 Periods)

Reason   for machinary replacement. Depriciation, definition different method of calculation depriciation.

5.   <u>Purchase organisation:</u>   (5 Periods)

Importance of good purchasing policy. Function of purchasing department.   Duties of purchasing officer. Purchasing procedure.

6.   <u>Human Resoruce Management:</u>   (3 Periods)

Human resoruce management, selection, performance appraisal, motivation and leadership and controlling.

<u>PRACTICALS EXERCISES</u>

<u>RURAL DEVELOPMENT|</u>

1.   Socioeconomic Survey of a village selected in vicinity to polytechnic.

2.   To find the problems of the village and suggest the solution in the development of the village from the study of the above survey in respect of :

a)   Improvement suggested in agricultural activities.

b)   Rural sanitation problems.

c)   Rural Housing.

d)   Energy development.

e)   Promotion of traditional and other industries.

f)   Farm mechanisation

Entrepreneurship Development:

To prepare a Project report for opening agro based industry and arrange resources for the same from financing agencies.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	25	35
2.	25	35
3	20	30
Total	**70**	**100**

5.6 GREEN HOUSE TECHNOLOGY, HYDROPONIC AND AQUAPONIC ENGINEERING

L T P
5 - 5

RATIONALE:

Student will be able to understand green house technology and maximum production of crop, vegetables on land and roof.

DETAILED CONTENTS

1. **INTRODUCTION TO GREEN HOUSE :**

   Types of green Houses, Environmental requirements in green house, Methods of Environmental control and fixtures, Chemical for control of insects, pest, etc. Soil mixure

2. **INTRODUCTION TO HYDROPONIC :**

   Hydroponic history, use of hydroponic on land and on roofs, Chemical mixtures of hydroponic crops, Lighting fixtures, Infrastructure needs for supporting the hydroponic.

3. **INTRODUCTION TO AQUAPONIC :**

   Basic meaning of aquaponics, The commerical need of aquaponic, use of aquaponic on land and roof, Aquaponic use for production of vegetables and flowers, Aquaponic structures and fixtures.

PRACTICALS EXERCISES

1. Construction of green house (Low Cost).

2. Green house with Poly Film based, Glass fibre sheet based, Poly corbonet sheet based covering materials.

3. Green house with different growing mediums.

4. Green house environment maintaining fixtures- cooling,heating system, different type ventilators, etc, lower shutters with exhaust systems.

5. Hydroponics in different pots of shape and sizes and their respective materials.

6. Hydroponic crop grwoing - capsicum, tomato etc.

7. Aquaponics- Selection of fish and their behaviour, their differnt tank etc.
8. Aquaponic - Fixtures like air circulation pump, water circulation pumps, heating system etc.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	25	35
2.	25	35
3	20	30
Total	**70**	**100**

6.1 DAIRY AND FOOD ENGINEERING

L T P
5 - -

Rationale :

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

DETAILED CONTENTS

DAIRY ENGINEERING :   (50 Periods)

1. **INTRODUCTION:**   (5 Periods)

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.

2. **MILK RECEIVING EQUIPMENT/ SOYABEAN MILK:**   (6 Periods)

Weigh can and receiving tank, chilling equipment, weighing and measuring milk standards. Canwashers-principles of operation. Rotary and straight through can washer.

3. **STORAGE EQUIPMENT:**   (6 Periods)

Insulated storage tank. refrigarated storage tanks specification for the storage tanks. Milk transport tank. Milk processing equipments, separators-warm, milk seprators- cold milk spearators, Centrifugals cream sepraters.

4. **HEAT EXCHANGING EQUIPMENT:**   (7 Periods)

Heat exchangers, Pasteurization - Batch type and contineous type 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.

5. **INSTALLATION OF INFLOOR AND ONFLOOR CONVEYOR:**   (7 Periods)

Different types of conveyors used in dairy industry, their drives, take up units. conveyor components, Case stackers and unstackers, platising milk cases, handling of dispenser milk containers, handling of ice cream.

6. **ICE CREAM EQUIPMENTS:** (5 Periods)

Ice cream freezer batch freezer, Continuous freezers, type of designs, air incorporation, over run, control systems, freezing cylinder, dasher, scrapping blades, controls of refrigeration.

7. **HOMOGENISERS, SOYABEAN PULP GRINDER:** (4 Periods)

Theory of homogenization, design, material, single stage and two stage homogenizers, efficiency of homogenization.

8. **CREAM, BUTTER AND GHEE EQUIPMENT, PANEER AND TOFFU MAKING:**
(5 Periods)

Cream ripening tanks, design, material, automatic control, operation, cleaning, maintenance of Continious Butter making equipment. Wooden churn, metal churn. Ghee pan and Ghee making equipments

9. **EVAPORATORS & DRYING EQUIPMENTS :** (5 Periods)

Introduction of evaporators, single and multiple operation, Introduction of drum dryer and spray dryer.

B. **FOOD ENGINEERING :** (20 Periods)

Physical properties of food materials, Unit operation in food engineering : Grinding, Crushing, Mixing, Blending, Thermal processing, Dehydration. Packaging materials and methods of packing of different food products. Preservation of food product, site selection and plant layout and their cost economics.

NOTE :
For Practical knowledge of above subject one week summer in plant training must be provided in Dairy Plant and report should also be submitted in the department by each student.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	50	65
2.	20	35
Total	**70**	**100**

6.2 IRRIGATION AND DRAINAGE ENGINEERING, RAIN WATER HARVESTING

L T P
4 - 4

RATIONALE:

This subject is essential to equip the learner with the knowledge of Irrigation and drainage of agricultural lands and conservation of water for optimizing the agricultural production in the most efficient and economical way. Probleam of alkalinity and salinity can be aslo minimized to provide the efficient drainage systems on farms.

DETAILED CONTENTS

(A) **IRRIGATION ENGINEERING:**   (36 Periods)

1. **Introduction:**   (2 Periods)

   Definition of Irrigation, History of Irrigation, Necessity and scope of Irrigation, Types of Irrigation.

2. **Sources of Irrigation Water :**   (3 Periods)

   Wells, rivers, ponds, canals, tube wells. Investigation and survey, selection of site and determination of capacity of storage reservoirs and tanks.

3. **Ground Water:**   (4 Periods)

   Water bearing formation, confined and unconfined aguifers, static water level, piezometric surface, pumping water level,drawdown, area of influence, prediction of yeild in confined and unconfined aquifer, well development.

4. **Water requirement of plants:**   (6 Periods)

   Types of soils, soil properties in relation of irrigation and drainage, classes and availability of soil water, preparation of land for irrigation and drainage, quality of irrigation water, evaporation, transporation, evapotranspiration, consumptic use, esimating crop water requirements, duty of water, delta, factors affecting duty methods of improving duty. Assessment irrigation water requirements of different crops, estimation of depth and time of irrigation, different criteria for irrigation scheduling depending upon soil-plant-atmospheric factos.

5. **Irrigation Methods & Design of Drip Irrigation System :**   (4 Periods)

   Surface and subsurface methods, sprinkler and drip system of irrigation. Design of drip irrigation system : Laterals and Submain.

6. **Storage Structures, Rain Water Harvesting Structures & Methods:**   (4 Periods)

Introduction of different types of dams e.g. earther dams, rock filled, hydraulic filled etc.. Different types of spillways and outlets, cross sections of earthen dams, causes of failures of earthen dams.

7. **Evaluation of Farm Irrigation Systems:** (3 Periods)

Measurement of irrigation efficiencies, water conveyance, storage, application, distribution and water use efficiency.

8. **Soil Moisture Movement:** (5 Periods)

Soil moisture measurements, soil moisture tension, soil moisture characteristics curve, saturation and field capacity, wilting point, moisture equivalent, percolation, seepage, infiltration, hydraulic conductivity, permieability.

10. **Design of Irrigation Channels:** (5 Periods)

Non-erodible channels, design of open channels, maximum permissible velocity, channel slopes, free board, hydraulic sections, most economical section.

(B) **DRAINAGE ENGINEERING:**

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

Definition necessity water logging salinity, its control interrelationship of irrigation drainage, drainage coefficient, water table fluctuations.

2. **Drainage Investigation & Requirements:** (5 Periods)

Estimation of drainage requirements, required water table depths, lowering of water table, ground water contours, drainage depths for different crops.

3. **Drainage Systems:** (8 Periods)

Different types of surface and subsurface drainage systems, land smoothing, levelling and grading, design of surface drainage systems, different types of subsurface drainage systems and their design, tile drainage depth and spacing of tile drains, field survey, installation and layout of drains, installation of tile outlets.

4. **Special Methods of Drainage:** (4 Periods)

Vertical drainage, mole drains, drainage of irrigated lands in arid and semi arid areas. rainage for leaching.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	36	65
2.	20	35
Total	**56**	**100**

6.3 SOIL WATER CONSERVATION AND LAND RECLAMATION ENGINEERING

L T P
4 - 8

RATIONALE

This course is aimed to equip the learner with knowledge and skill required for taking effectinve measures against soil errosion,construction and maintenance of water conservation structures and development of land   for irrigation and agricultural purposes.

The   contents of the subject have been   developed   to inculcate   capabilities for performing the above mentioned   task economically and effectively.

DETAILED CONTENTS

1. **WATER SHED MANAGEMENT :**

Concept, objectives, use of remote sensing in water shed management, Planning, Ground water recharging, Water   harvesting.

2. **RUN OFF & Hydrology :**

Definition, phenomenon and forms of run off characteristics of run off, factors affecting run off, measurement of run off by float, current meter and weirs, time of concentration and its impact on run off, estimation of peak run off rate by rational equation. Hydrology: Hydrologic cycle, importance, its components, ocurance and forms of precipitation; Characteristics of rainfall in India, rain fall intensity, measurement of rain fall by non-recording and recording type of raingauges, method of computing average rainfall, reoccurance interval.

3. **SOIL EROSION :**

Mechanics, types and causes of erosion, factors affecting erosion, damages caused by soil erosion.

4. **SOIL AND WATER CONSERVATION :**

Definition and aims of soil and water conservation in agriculture, soil conservation servey and   land   use capability classification, conservation forming.

5. **AGRONOMIC MEASURES FOR SOIL & WZATER CONSERVATION :**

Crop classification on the basis of soil conservation value, contour forming, mulching, strip cropping, cover cropping, mixed cropping, conservation bcrop rotation, ley forming,   monoculture, role of grasses in soil conservation.

6. **MECHANICAL METHODS OF EROSION CONTROL :**

Elementary idea of basin listing, sub-soiling, field bunding, contour bunding, graded bunding, ridge and channel terraces. Cost of narrow base broad base bund as earthwork and sadding cost.

7. **CONSERVATION MEARURES FOR HILL SLOPES:**

Contour trenching, specification of trenching, alignment and construction of trenches, , bench terracing- types, construction and maintenance, elementary idea of stone terracing and its specification.

8. **GULLY EROSION CONTROL & RECLAIMATION:**

Classification of gullies, principles of prevention and control of gullies by vegetative and mechanical measures, contour and peripheral bunding, ditches,gully plugging.Temporary and permanent structures: Earthen check dams, wooven wire check dams, Brush dams, loose rock dams, log and plank dams, straight drop spillway. Reclaimation of gullies for cultivation.

9. **FORESTRY MANAGEMENT IN SOIL CONSERVATION:**

Effects of forests on soil and water conservation and climate, classification of forests,elementary idea of   farm and   social forestry,Taungya system and   forest protection,   selection, development, tillage, irrigation protection and management of nurseries, Bamboo Production Methods.

10. **GRASSED WATERWAYS:**

Use, design of waterways, grasses   for waterways, construction of water ways, establishment of grasses on waterways, maintenance of waterways.

11. **DRY FARMING:**

Definition, climetic classification, elementary idea of various crop management & tillage practices. Land management practices in dry farming eg. sub-soiling and tied ridging.   Water shed based soil and water conservation.

12 **WATER CONSERVATION RESERVOIRS:**

Types and uses of water conservation reservoirs, site selection & storage capacity of farm ponds,   design principles of water harvesting bunds and structures, digging of ponds, construction and maintenance of water conservation structures.

13. **FLOOD CONTROL:**

Types of flood, damages caused by floods,elementary idea of head water flood control methods.

14. **Land Grading & Land Levelling:**

Water harvesting, Scope, need types, long term and short term water harvesting techniques, design of ponds.

15. **Wind Erosion Control:**

Principles, vegetative and mechanical practices.

16. **Land reclamation**

Classification of usar soils, salt resistant crops, reclamation of usar soils. Reclamation of waste lands forest lands and sandy soils, sanddunes stabilization.

17. **Ravine reclamation:**

Classifcation of ravines and various measures for ravine reclamation.

18. **Command Area Development :**

Advantage and disadvantages, Command area development, Component of C.A.D.A., Various C.A.D.A. prgrammes in India.

19. Vermi Compost From Cowdung & Agricultural Waste

PRACTICALS

1. Study of Rain gauges, their operation & installation.

2. Computation of average rainfall depth over an area by symous rai gauge.

3. Study and use of float & current menter to measure runoff.

4. Demonstration of various types of soil erosion.

5. Preparation of land use capability map for a given area.

6. Survey and planning of soil counservation measures in a given area.

7. Cost estimation of bunding.

8. Cost estimation of levelling of a field with slope either lengthwise or breadthwise.

9. Cost estimation of digging of farm ponds of difinite dimensions.

10. Study of layout and management of forest nurseries.

11. Visit to various areas of soil-water couservation and land reclamation activities and structures.

12. Construction of Vermi compost pit and its operation.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	3	6
2.	4	6
3.	3	6
4	4	6
5	3	6
6	3	6
7	3	6
8	3	6
9	3	6
10	3	5
11	3	5
12	3	5
13	3	5
14	2	4
15	2	4
16	2	4
17	2	4
18	2	4
19	5	6
Total	**56**	**100**

6.4 R.C.C & STEEL STRUCTURES

L T P
6 - 4

RATIONALE:

Agricultural Engineering technicians has to construct farm houses, irrigation works and cattle shades etc. so he must have the knowledge of design of elementary steel structures and reinforced concrete works.

Contents of this subject have been develop in such a ways to make them capable of supervising fabrication of steel structures and casting of R.C.works.

DETAILED CONTENTS

(A) **STEEL STRUCTURES** (44 Periods)

1. **Introduction:** (4 Periods)

Importance, types of loads, structral steel, properties of structral steel, structural steel section, permissible stresses.

2. **Structural Connections:** (7 Periods)

Types of structural connection, strength and design of revetted and welded joints for axially loaded members.

3. **Tension member :** (5 Periods)

Common section used as tension memeber, strength of tension members.

4. **Compression member :** (7 Periods)

Common section used as compression member, strength of compresion memebers (axially loaded columns & struts). Concept of lacing & battens.

5. **Beams:** (7 Periods)

Design critaria, allowable stresses.

6. **Roof Truss:** (7 Periods)

Types of trusses for different spans, roof coverings, supports, spacing, loads on trusses.

7. **Bamboo Trusses :** (7 Periods)

(B) **Reinforced Concrete** (40 Periods)

1. **Introduction:** (4 Periods)

Behaviour and principles, assumptions in R.C. design, designation of concrete mixes, types and need of reinforcement, permissible stresses in concrete and steel, modular ratio, shear & bond stresses. Provision of shear and bond reinforcement. Concept of LIMIT DESIGN.

2. **Singly Reinforced Concrete Beam & slab:**   (9 Periods)

Stress distribution, nutral axis, depth of nutral axis, tensile force, compresive force, lever arm, moment of resistance, actual & critical nutral axis. Types of singly reinforced beam, under, over and balanced sections, analysis of a given section, permissible stresses, design of a singly reinforced beam and slab.

3. **Doubly Reinforced Beam:**   (6 Periods)

Importance of doubly reinforced beam, advantages and disadvantages of use of doubly reinforced beams.

4. **T Beam :**   (6 Periods)

Concept, advantages, calculation of nutral axis, moment of resistance of T beam, reinforcment (no design).

5. **Column and Column footing:**   (9 Periods)

Types of column, effective length, different theoeys of desing, lateral & transverse reinforcement, lateral ties, spiral/helical or hoop reinforcment, effective area of column, strength of short column, strength of column wounded by spirals, reduction factor. Concept of placement of steel in column footing.

6. **Prestressing:**   (6 Periods)

Definition, basic principle, advantages and disadvantages, method of prestressing, systems of prestressing (Methods only).

PRACTICAL EXERCISES

1. To determine soundness of aggregates.

2. To determine specific gravity and water absorption of aggregates.

3. Comprative study of compressive strength of concrete for atleast 3 diffrent mix under various curing periods.

4. Setting out of a building with two rooms and a varandah.

5. To determine cube strength of concrete.

6. To find slump of a given mix of concrete.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	44	65
2.	40	35
Total	**84**	**100**

6.5 FARM & LAND DEVELOPMENT MACHINARY
(Including Agricultural Implements)

L T P
4 - 4

RATIONALE:

Supervisor of agriculture machinary at farms has to organise and supervise field operation. For doing this he needs to have understanding of the proper use of various machinary and have skill in their operation. Similarly in the workshop of Agro- industry and service centre farms he should   have knowledge of repair and maintenance of equipments and machinary for supervisory work.

DETAIL CONTENTS

1. **Farm Mechanization :**

Definition, status of farm mechanization in India, scope, limitations, advantages.

2. **Primary Tillage Equipment:**

i) Definition & Functions of tillage, tillage systems, types of tillage, Tillage implements.

ii) a.   Mould Board Plough: Types of mould board plough,   construction. Types of share, and Mould board and their   material of construction, Concept of sunction, plough size,   hitching of plough, point of bearing, Draft, side draft,   unit draft, factors affecting draft, forces acting on plough. (Introduction only) Horse power requirements, and related numerical problems.

   b.   Disc Plough: Purpose, principles, types, construction and adjustment.

   c.   Other Plough: Chisel, subsurface, Rotary plough.

   d.   Ploughing: Concept of terms related with ploughing, Methods of Ploughing.

3. **Secondary Tillage equipments:**

   a. Harrow: Types, construction and Adjustment repair and maintenance of Animal & tractor driven harrow.

   b. Land Rollers Hackers & Pulveriser: Types construction and operation.

   c.   Rotavator and Puddlers

4. **Sowing & Planting Equipment:**

a. Pregermenated paddy seeder

b.   Seed Drill/Seed cum Fertilizer Drill: Functions, Types, Construction, detail, size Metering devices, Furrow openers, seed covering devices Callibration of seed drill, and related numerical problems. Field adjustment, repair and maintenance & constructional   details. Zero fill ferti drill, Fill plant machine, Strip fill drill Raised bed Planting Machine

c.   Planters: Function, Types, Metering devices, Method of planting. Field advertisment, repair and maintenance. Potato Planter, Suger Cane Planter, Cotton, Misc. etc. Planter.

d.   Trans-Planter : Paddy transplanter (Mannual and self propelled), Vegitable trans-planter.

5. **Interculture and Weed Control Equipment:**

a. Cultivator: Types, Construction, Attachments.

b. Rotary Hoe: Construction and working.

c. Flame Weed Control: Construction and working.

6. **Fertilizing Equipments:**

a. Manure Spreaders: Construction and working.

b. Fertilizer Distributor: Construction and working.

7. **Plant Protection Equipment:**

Types,   principles of working, parts and material of constrion, fuction and adjustment of sprayer and duster, selection of plant protection equipment, field adjustment, repair and maintenance , safety precaution.

8. **Harvesting Equipments:**

a. Mower, Windrower and Reaper Principle of cutting, types, construction working, adjustments,   trouble shooting.

b. Combined Harvestar : Types, Construction, Working, Material

c.   Field Forage Harvestors: Types, working adjustment and flow path adjustment, maintenance.

d. Potato & Groundnut Digger: Construction and working.

e. Sugarcane Harvester: Construction and working.
9. **Threshing Equipments:**

Types of threshers: Olpad thresher, Power wheat and paddy thresher, working principle, material,flow path, adjustment, repair and maintenance, trouble shooting and precaution.

10. **Processing Equipments:**

Types, Construction and working of the following equipments:Chaff cutter, Sugercane crusher, Corn sheller, Potato grader and Winnower.

11. **Land development Equipments:**

Construction, operation/working and output of the following: Dozer, Scraper, Power shovel, Drag hoe and Drag Line, scoop, Land Laveller, Land Plane, Laser Land Plane.

12. **Field Capacity & Efficiency:**

Introduction, Concept about Field capacity & Efficiency.

13. **Econoomics, Management and testing of farm equipments**

a. Selection of farm machines and matching equipments of farm needs, break even point, Pay Back Period.

b. Calculation of cost of operation of farm-machines.

c. Field capacity & field efficiency.

d. Farm machinery testing in India. Details of catagory and field testing of few machines e.g. seed drill, thresher and plant protection equipments.

14. **Garden Equipment :**

Details of Garden & Halticultural equipments.

15. **Rainsed Bed Preparation Equipment :**

Use and utility of rainsed bed preparation equipment.

PRACTICALS

PRACTICAL EXERCISES

1. Identifying mould board and disc plough and their parts, assembling & dismantling, measurement of size, sections, angles, setting adjutment.

2. Hitching, field operation, adjustment and measurement of draft, line of pull etc. of a mould board plough.

3. Hitching, field operation and adjustment, measurement of depth and width of ploughing with a disc plough.

4. Identifying harrow and cultivator and their parts, assembling and dismantling, angle setting, hitching, field operation and adjustments.

5. Identifying seed drills, seed cum fertiliser drill and planters and their parts, assembling and dismantling, setting and adjustments.

6. Calibration, field operation and adjustment of seed cum fertiliser drill.

7. Setting, field operation and adjutment of planter and transplanter.

8. Study of power sprayers and dusters different types of nozzles and calicuation.

9. Field, operation, setting alignment, registration and other adjustments of a reaper and windrover.

10. Study of chaff cutter and sugarcane crusher.

11. Repair of farm equipment : Ploughs, harrows, Seed drills and weeding tools.

12. Visit of a mechanised farm for study of combine harvestor.(Visit Only

13. Operation of power thresher and safety aspects.

14. Study, sketch and operation of one of the following land development equipment through field visit:

    Dozer, Scraper, Shovel, Drag hoe and Drag line

INSTRUCTIONAL STRATEGY

Teacher may use demonstration of different materials that can make the subject interst and develop knowledge of building materials and construction methods in the student. In additions student give more emphasis on explaing practical application of construction of related structures efficiently and economically and encouraged study those processes which may find practical application in future career

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

List Attached

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1	3	5
2.	4	7
3.	3	7
4	4	7
5	3	7
6	4	7
7	4	7
8	4	7
9	4	7
10	4	7
11	4	7
12	4	5
13	3	5
14	4	7
15	4	6
Total	**56**	**100**

6.6   PROJECT WORK

L   T   P
-    -   2

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. Some of the suggested project activities are given below:

(a) Rural Development

(b) Demonstration of new techniques for the cultivation of crops, operation of agricultural machinary power tiller and tractors.

(c) Problem concernig to any one of the following:

To run his own workshop for repair and maintenance of agricultural implements.

Levelling and Irrigation-Drainage and soil-water conservation needs of farms.

To establish an agro based small scale rural industry.
Any other problem concernig agriculture.

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 200 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.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work

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 Agricutural Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Applied Mechanics
- 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
- Agricultural Science
- Material and Rural Construction Technology
- Hydraulic and Hydraulic Machines
- Soil Science and Soil Mechanics
- Surveying and Levelling
- Agricultural Equipment Workshop Practice
- Mechanics of Solids
- Frame Power Engineering and Non Conventional Energy
- Electrical Engineering and Rural Electronics
- Agricultural Engineering Drawing
- Minor Irrigation and Tubewell Engineering
- Post Harvest Technology and Agro Based Industry
- Agricultural Industrial Finance and Rural Enterprenurship
- Green House Technology and Hydroponics and Aquaponics Engineering
- Irrigation and Drainage Engineering,Rain Water Harvesting
- Soil Water Conservation and Land Reclamation Engineering
- R.C.C. and Steel Structure
- Frame and Land Development Machinery
- Environmental Engineering Lab
- Energy Conservation Lab

EQUIPMENT REQUIREMENT FOR AGRICULTURAL 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
Sr. No.	Description	Qty	Total Price (Rs)

Sr. No.	Description	Qty	Total Price (Rs)
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
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
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**

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
APPLIED MECHANICS LABORATORY			
1.	Polygon law of forces apparatus	1	2,000
2.	Jib crane	1	4,000
3.	Apparatus for reaction at supports	1	5,000
4.	Inclined plane and friction apparatus	1	2,500
5.	Screw jack	1	1,000
6.	Worm and worm wheel	1	3,500
7.	Single Purchase Winch Crab	1	4,000
8.	Miscellaneous	LS	1,000
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
Sr. No.	**Description**	**Qty**	**Total Price (Rs)**
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

Sr. No.	Description	Qty	Total Price (Rs)
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

Sr. No.	Description	Qty	Total Price (Rs)
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

FARM STRUCTURES MATERIALS AND CONSTRUCTION LAB

1.	Kit of stone specimens containing at least 10 types of commonly used stones	1	1,000
2.	Kit of specimens of timber containing at least 10 types of commonly used timbers	2	2,000
3	Vicat needle apparatus with all accessories	2 Set	2,000
4.	Apparatus for determining Specific gravity of cement	1 Set	2,600
5.	Air Permeability Apparatus Blains type for finness of cement	1 Set	1,600
6	Compression Testing Machine 200 Tones Capacity with pumping unit Electically and manually operated	1 Set	70,000
7.	Model of bricks made of timber(8cm*4cm*4cm) containing queen closer,King closer, half and ¾ brick bats set of 1000 bricks packed in a wooden box	2 Set	3,000 each
8	Electric Oven with thermostat arrangement	1	5,000
9	Single Pan Balance 10 Kg capacity with set of weight 1kg to 10 Kg & weight box for fractional weights	1Set	2,000
10	Picnometer 900ml capcity	2	5,00
11	Slump Cone Apparatus complete with all accessories and base plate	2 Set	1,000 Each
12	Bar bending table with all accessories	1Set	1,000
13	Steel tape 30 meter	5	2,00 Each
14	Mettalic tape 30m,20m,and 10m 2 nos of each size	6	1,00 Each
15	Misc. for scales, jars, weights, beakers, measuring cylinders, enamel plates, sample containers etc.	L.S.	5,000

AGRICULTURAL SCIENCE LAB

1.	Specimen of crop and vegitable seed placed in a wooden box and properly levelled. (10 types of each)	2 Set	5,00 Each
2.	Specimen of different types of fertilizers kept in a wooden box and properly levelled. (10 types)	2 Set	5,00 Each
3.	Specimens bof various types of Insecticides, fungycides and weedicides kept in a wooden box properly levelled (4 types of each)	2 Set	5,00 Each

4.	Seed Treatment Machine with all acessories	1	10,000
5	Plastic Containers(Tranparent) 250 ml.	50	5 Each
6.	Plastic Containers(Tranparent) 500 ml.	30	10 Each
7.	Plastic Containers(Tranparent) 1000 ml.	20	15 Each
8.	Packer	1	1,500
9.	Roller wooden	1	1,000
10.	Hoe (Different types)	2 Set	5,00 Each
11.	Patela wooden	2	5,00 Each
12.	Prunning Knife	10	1,50 Each
13.	Secateurs	10	2,00 Each
14.	Budding & grafting knife	10	2,00 Each
15.	Footapenated ayor and duster hand operasted	10	2,500 Each
16.	Mislaneous (Kudal, Khurpi,spade, garden cissors,hazara and gamla, patri dishes, pvc pipe etc)	L.S.	10,000
M.O.S. & HYDRAULICS LAB			
1.	Universal Testing Machine of 40 T Capacity with changeble load scale to 4t,20t & 40 T.	1	4,00,000
2.	Simply supported beam apparatus for determination of shear force	1	1,000
3.	Simply supported beam apparatus for determing bending moment	1	1,000
4.	Steal beam apparatus to determine E by method of deflection for different loading condition	1 Set	1,000
5	Brinel Rockwell Hardness Tester with all accessories complete	1 Set	15,000
6.	Tortion Testing Apparatus complete with all accessories	1	2,000
7.	Bernaulli's Theorem Apparatus with ball accessories and collecting tank	1 Set	4,500
8.	Venturimeter Apparatus with all accessories, pipe, fittings and storage tank	1Set	12,000
9.	Apparatus for determining coef. ofelocity, Coef. of contraction and coef. of discharge of an orfice	1Set	12,000
10.	Reynold's apparatus for determining critical velocity and Reynold's number.	1Set	8,000
11.	Apparatus for determining Darcy's Coef. of friction in pipes	1Set	8,000

12.	Apparatus for determining losse due to sudden enlargement and sudden contraction	1Set	8,000
13.	Current meter	1	5,000
14.	Notch Apparatus with discharge tank,set of notches and other supporting structure	1Set	9,000
15.	Sectional model of the Reciprocating pump	1	2,000
16.	Sectional model of the Centrifugal pump	1	2,000
17.	Sectional model of the Impulse Turbine	1	2,000
18.	Sectional model of the Reaction Turbine	1	2,000

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

Sr. No.	Description	Qty	Total Price (Rs)
8.	Venturimeter 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

SURVEY LAB

1.	Vernier Theodolite	2	10,000 Each
2.	Dumpy Level	4	1,500 Each
3.	I.O.P. Level	4	2,000 Each

4.	Surveyer's Compass	2	6,00 Each
5.	Box Sextant	1	1,200
6.	Abney's Level	10	2,00 Each
7.	Clinometer	2	6,00 Each
8.	Optical Square	2	2,00 Each
9.	Folding Staff	2	9,00 Each
10.	Telescopic Staff	10	1,000 Each
11.	Plane Table with all accessories	4	1,200 Each
12.	Meteric Chain 20m & 30m	10	2,40 Each
13.	Steel Tap 30m	2	1,50 Each
14.	Mettalic Tap 20m	10	1,00 Each
15.	Steel Band	1	5,00
16.	Cross Staff	2	50 Each
17.	Penta Graph	2	1,000 Each
18.	Planimeter	1	7,50
19.	Telescopic Alidade	1	1,500
20.	Ranging Rod steel conduit 2m	50	60 Each
21.	Line Ranger	1	2,50
22.	Quick set Level	1	2,500
23.	Cylone Ghat Tracer	1	1,000
24.	Prismatic Compass	5	5,00 Each
25.	Boning rod set	1Set	4,00
26.	Invar Tap	1	7,50
27.	Engineers , Revenue and Gunter's Chain one each	3	1,50 Each
28.	Scientific Calculator	2	7,50 Each
29.	Miscellaneous	L.S.	10,000
SOIL MECHENICS AND SOIL SCIENCES LAB			
1.	Direct Shear Box Apparatus Complete with all accessories	1	10,000
2.	Permometer (Constant and Variable head)	1 Set	8,000
3.	Standard Procter Compaction Test Apparatus with all accessories	1 Set	1,000
4.	Split Spoon Sampler	1	8,00
5.	Thin Walled Sampler	1	5,00

6.	Hydrometer with 1000ml. jar	1	1,00
7.	Liquid Limit Apparatus With revolution counter and other accessories complete	2 Set	5,00
8	Set of BIS standard Sieve	1Set	4,000
9	Sieve Shaker Electrically operated	1	4,000
10.	Oven electrically operated medium	1	5,000
11.	Sample Extracter	1	5,00
12.	Core Cutter apparatus for determining field density of soil	1 Set	2,000
13.	Sand Replacement Apparatus for determining field density of soil	1	2,500
14.	Triple Beam Balance 3 Kg. Cap.& .1 Kg Accuracy	1	8,00
15.	Triple Beam Balance 1 Kg, Cap, & 0.1 Kg Accuracy	2	5,00 Each
16	Single Pan Balance 5Kg Cap. 1 Kg. Cap	1	6,00
17	Physical Balance with weight box	1	1,000
18	Dial Gauge .01 least count	1	1,000
19	Plateform Weighing Machine 100 Kg.	1	6,000
20	Capillary Test Apparatus	1	5,00
21	pH meter	1	5,000
22.	Tenso meter	1	2,000
23	Post hole and helical auger hand operated three sets of each	6	1,000 Each
24	Alluminum Sample Container with lid	20	5 Each
25	Cell Tester	LS	10,000
26	Misc. for minor equipment , tools, glass ware, heating and storing vessels etc.	1	2,000
ELECTRICAL ENGINEERING AND RURAL ELECTRIFICATION LAB			
1.	Three point starter	8	3,000 Each
2.	Ammeter A.C. and D.C. 4no each	8	6,00 Each
3.	Voltmeter A.C. and D.C. 4 no. each	8	6,00 Each
4.	Single phase transformer	2	3,000 Each
5.	Rheostat of different values	10	2,00 Each
6.	Wattmeter	5	5,00 Each
7.	Energy meter	5	6,00 Each
8	Earth Tester	1	4,000
9	Power Factor meter	1	6,000
10.	Star Delta Starter	4	2,000 Each
11.	Speedometer	1	4,000

12.	Moter A.C. 5 HP	5	5,000 Each
13.	Moter D.C. 5 HP	5	5,000 Each
14.	Alternator	1	10,000
15.	Connecting wires and accessories	L.S.	5,000
16	Cables and cable fittings	L.S.	10,000
17	Wooden Board and switches etc.	L.S.	5,000
18	Miscellaneous	L.S.	10,000

RURAL AND ENTREPRENEURSHIP DEVELOPMENT LAB

1.	Colour T.V.	1	20,000
2.	C.D. Player	1	5,000
3.	Portable Generater Set	1	25,000
4.	Camp furniture	L.S.	20,000
5.	Dari and bed sheets etc.	10 Set L.S.	5,000
6.	Ring Toss Game Kit	1Set	5,00
7.	Tower Building Game Kit	1 Set	4,00
8	Boat making Papers	10 Set	3,00 Each
9	Broken Squqres	1	2,50
10.	Trainer's Manual	1	2,50
11.	Tent	1	8,000
12	Miscellaneous	L.S.	5,000

FARM POWER ENGINEERING WORKSHOP

1.	Tractor with full accessories 35 BHP	1	35,0000
2.	Solar Pump	1	10,000
3.	Motercycle complete engine(second hand)	1	8,000
4.	Various Types of Carburator	1Set	8,000
5.	Diesel Pump Set complete (Slow speed)	1	10,000
6.	Diesel Pump Set complete (High speed)	1	10,000
7.	High Tention Battery	1	5,500
8	Spark Plug Tester	1	4,500
9	Old Diesel Vehicle Complete (need not in working order)	1	40,000
10.	Power Tiller with full attachments	1	2,00,000
11.	Tractor Trailer Cap. 3 Tonnes	1	35,000
12.	Air Compresor with pipe hose & 3 HP Motor with Car washer jet & Tele hoist	1	80,000
13.	High Pressure Water Pump for servicing of vehicle	1	8,000

14.	Gobar Gas Plant and Installation expences (Model)	1 Set	4,000
15.	Solar Collector flat plate	1	5,000
16	Solar Cooker,Solar crop drier & solar water heater	L.S.	75,000
17	Cut section and working Models of form power equipments	L.S.	20,000
18	Miscellaneous for meters, scales, storage and other common assorted materials	L.S.	10,000

POST HARVEST TECHNOLOGY AND AGRO BASED INDUSTY LAB

1.	Air Screen Cleaner Farm Model two sieve with motor complete	1	10,000
2.	Elevator (Conveyer belt type)	1	25,000
3.	Heated Air Drier	1	50,000
4.	Screw conveyer with motor	1	20,000
5.	Thin Walled Sampler	1	20,000
6.	Slurry seed treator with motor	1	15,000
7.	Dal Mill (mini unit) rubber role type for demonstration	1	20,000
8	Rice Mill (Mini unit) with 5 HP motor complete	1	60,000
9	Model of cold storage (Mini Plant)	1	25,000
10.	Various types of grain bins	1 Set	8,000
11.	Oil expeller 1/2 Qnt/hour capacity	1	30,000
12.	Ground nut decorticator	1	3,000
13.	Potato grader power operated	1	25,000
14.	Corn sheller hand operated	1	8,00
15.	Winower Hand operated	1	1,000
16	Juice Extractor Hand operated	2	5,00 Each
17	Juice Extractor Power operated	1	5,000
18	Gas Oven Complete	2	2,500 Each
19	Hammer Mill	1	50,000
20	Soya Bean Grinder (Net Type)	1	25,000
21	Misc. (Fruit preservation equipment and other minor tools etc.)	L.S	20,000

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

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 lit 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.

11.   EVALUATION STRATEGY

11.1   INTRODUCTION

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

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

Formative Evaluation

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

Summative Evaluation

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

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

11.2   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 application domains only.

Section-II

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

Section-III

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

12. **RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION**

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

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. 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 teacher to read them 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   towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

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

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

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

(B)   Course Level Suggestions

Teachers are educational managers at 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 within a stipulated period of time. It is essential for them to use the given time 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 process effectively:

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

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

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

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

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

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

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

8. The student centred activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with 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. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

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

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

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