NEP-2020 Aligned Curriculum for

Three Year (Six Semester) Diploma Programme in

AGRICULTURAL ENGINEERING

For the State of Uttar Pradesh

Prepared by:

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CONTENTS

THIRD SEMESTER

FOURTH SEMESTER

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 opens economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality 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.

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

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

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to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Director
Institute of Research Development & Training

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1. SALIENT FEATURE

1)	**Name of the Programme**	:	Diploma Programme in Agriculture 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)	**Pattern of the Programme**	:	Semester Pattern
5)	**NSQF Level**	:	Level - 5
6)	**Ratio between theory and Practical**	:	40 : 60 (Approx.)

7) **Industrial Training**

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

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

8) **Ecology and Environment**

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

9) **Entrepreneurship and Start-ups**

A full subject Entrepreneurship & Start-ups has been incorporated in the curriculum.

10) **Student Centered Activities**

A provision of 4-8 hrs per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise 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, library and other cultural activities.

11) **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. PROGRAM OUTCOMES (POs)

PO1: Basics and Discipline specific Knowledge

Assimilate knowledge of basic mathematics, science and engineering fundamentals.

PO2: Problem's Analysis and solution

Identify, analysis and solve problems using standard methods and established techniques.

PO3: Design and Development

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

PO4: Engineering Tools, Experimentation, and Testing

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

PO5: Socio/Economic/Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication

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

PO7: Lifelong Learning

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

3. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN AGRICULTURAL ENGINEERING

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

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

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

S.No.	Branch	Degination
1.	Agriculture • Ground water cell (Tubewell & minor irrigation) • Soil & Water Conservation • Non Conventional Energy Sources • Agricultural Engineering	Supervisor/J.E Supervisor/J.E Supervisor/J.E 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 • Work Shop • Marketing of Tractors, Implement, Seeding & Harvesting Equip.	Foreman/Supervisor
6.	Development Corporation	Supervisor/J.E
7.	National Seed Corporation	Supervisor/J.E
8.	State Formers Corporation	Supervisor/J.E
9.	Fertilizer Carporation of India • Feed plant • Fertilizer Plant	Incharge
10.	Ware Housing Corporation	J.E
11.	UP State Krishi Utpadan Mandi Parishad	J.E
12.	Rice Mills	Supervisor/J.E
13.	State Forest Department	Supervisor Machinary

		(Soil Conservate)
14.	Banks, UP State Coop Krishi Avam Gramya Bank Ltd.	Technical Supervisor/J.E.
15.	Research & Extention Deptt. of Agriculture	Research Assistant
16.	Manufactures of Tractors & Agro implements	Supervisor/Foreman/Sales Representative
17.	Teaching Institute	Assistant Lecturer /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
23	U.P. Khadi Gramodyog	Supervisor/J.E.
24	Tractor Krishi Yantra Workshop	Supervisor/Foreman
25	Auto Tractors Ltd.	Supervisor/Foreman
26	Appropriate Technology Deve. Association	J.E.
27	Zila Gram Vikas Abhikaran	A.D.O.
28.	Entrepreneurs	
	(a) Manufacturers of	
	i. Agricultural implements	
	ii. Pump sets	
	iii. Fiber Processing	
	iv. Crop Processing	
	(b) Repair & Maintenance Centre of Agriculture Implements, Pump Set etc.	

4. 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 equipment and machinery 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 implements.
21.	Survey for the feasibility of tube wells.
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 tube wells, 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 bio gas plant, 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

5. ABSTRACT OF CURRICULUM AREAS

i. HUMANITIES & SOCIAL SCIENCE COURSES (HS)

1. Communication Skills in English
2. Sports & Yoga
3. Entrepreneurship and Starts-ups

ii. BASIC SCIENCES COURSE (BS)

4. Mathematics
5. Applied Physics
6. Applied Chemistry

iii. ENGINEERING SCIENCE COURSE (ES)

7. Engineering Graphics
8. Engineering Workshop Practice
9. Introduction to Information Technology
10. Fundamental of Mechanical and Electrical Engineer
11. Engineering Mechanics

iv. PROGRAMME CORE COURSE (PC)

1. Agriculture and Soil Sciences
2. Surveying And Leveling
3. Material and Rural Construction Technology
4. Fundamental of Fluid Mechanics
5. Agriculture Equipment Workshop Practices
6. Soil Mechanics
7. Agricultural and soil Science Lab.
8. Surveying And Leveling Lab.
9. Summer Internship-I
10. Strength of Material
11. Farm Power and Machinery
12. Hydraulics
13. Hydraulics Lab.

14. Farm Mechanisation and Land Development
15. Engineering Drawing
16. Irrigation and Drainage Engineering
17. Protected Cultivation Technology
18. Strength of Material Lab.
19. Farm Mechanisation and Land Development Lab.

- **OPEN ELECTIVE COURSES [OE]**

Open Elective -1

- Internet of Things
- Energy Conservation and Audit

v. PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSE WHERE

- Summer Internship-I (4 weeks) after IInd Semester.
- Summer Internship-II (6 weeks) after IVth Semester.
- Major Project (In-House)/Internship/Industrial Training.

vi. AUDIT COURSES (AU)

- Environmental Science
- Essence of Indian Knowledge and Tradition (Q)
- Indian Constitution

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

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

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

ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 6 Marks
b) 80 - 85% 8 Marks
c) Above 85% 10Marks

iii. 25 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) 25 - State/National Level participation
b) 20 - Participation in two of above activities
c) 15 - Inter-Polytechnic level participation

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

STUDY AND EVALUATION SCHEME FOR THREE YEARS DIPLOMA PROGRAMME IN **AGRICULTURE ENGINEERING**
THIRD SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credit(C) (L+T)+P =C	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P/Drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Agriculture and Soil Sciences	PROGRAM CORE (PRACTICUM)	2	-	2	2+1=3	20	20	40	60	3	-	-	60	100
3.2	Surveying and Levelling	PROGRAM CORE (THEORY)	2	-	-	2+0=2	40	-	40	60	3	-	-	60	100
3.3	Material and Rural Construction Technology	PROGRAM CORE (PRACTICUM)	2	-	2	2+1=3	20	20	40	60	3	-	-	60	100
3.4	Farm Power and Machinery	PROGRAM CORE (PRACTICUM)	2	-	2	2+1=3	20	20	40	60	3	-	-	60	100
3.5	Hydraulics	PROGRAM CORE (THEORY)	2	-	-	2+0=2	40	-	40	60	3	-	-	60	100
3.6	Soil Mechanics	PROGRAM CORE (PRACTICUM)	2	-	2	2+1=3	20	20	40	60	3	-	-	60	100
3.7	Hydraulics Lab.	PROGRAM CORE (PRACTICAL)	-	-	4	0+2=2	-	60	60	-	-	40	3	40	100
3.8	Surveying and Levelling Lab.	PROGRAM CORE (PRACTICAL)	-	-	4	0+2=2	-	60	60	-	-	40	3	40	100
3.9	Summer Internship -1 (4Weeks after 2nd Sem.)	INTERNSHIP	-	-	-	1	-	50	50	-	-	-	-	-	50
#Student Centered Activities (SCA)			-	-	8	-	-	50	50	-	-	-	-	-	50
Total			12	-	24	21	160	300	460	360		80		440	900

NOTE:-
Each period will be of 60 minutes duration.
Each session will be of 16 weeks.
Effective teaching will be at least 14 weeks

STUDY AND EVALUATION SCHEME FOR THREE YEARS DIPLOMA PROGRAMME IN **AGRICULTURE ENGINEERING**

FOURTH SEMESTER

Sr. No.	SUBJECTS	**COURSE TYPE & CATEGORY**	STUDY SCHEME Periods/Week			Credit(C) (L+T)+P =C	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P/Drg		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.1	Strength of Material	PROGRAM CORE (THEORY)	2	-	-	2+0=2	40	-	40	60	3	-	-	60	100
4.2	Farm Mechanisation and Land Development	PROGRAM CORE (PRACTICUM)	2	-	2	2+1=3	20	20	40	60	3	-	-	60	100
4.3	Agriculture Engineering Drawing	PROGRAM CORE (PRACTICUM)	1	-	4	1+2=3	-	40	40	60	3	-	-	60	100
4.4	Irrigation and Drainage Engineering	PROGRAM CORE (THEORY)	3	-	-	3+0=3	40	-	40	60	3	-	-	60	100
4.5	Protected Cultivation Technology	PROGRAM CORE (PRACTICUM)	1	-	2	1+1=2	20	20	40	60	3	-	-	60	100
4.6	Strength of Material Lab.	PROGRAM CORE (PRACTICAL)	-	-	4	0+2=2	-	60	60	-	-	40	3	40	100
4.7	Agriculture equipment Workshop Practices	PROGRAM CORE (PRACTICAL)	-	-	4	0+2=2	-	60	60	-	-	40	3	40	100
4.8	Open Elective –01 a) Internet of Things b)Energy Conservation and Audit	OPEN ELECTIVE (THEORY)	2	-	-	2+0=2	50*	-	50*	-	-	-	-	-	-
4.9	(Q) Essence of Indian Knowledge & Tradition	AUDIT COURSE	2	-	-	0	50*	-	50*	-	-	-	-	-	-
#Student Centred Activities (SCA)			-	-	7	0	-	50	50	-	-	-	-	-	50
Total			13	-	23	19	120	250	370	300		80		380	750

NOTE:-

(Q) - It is compulsory to appear & to pass in internal assessment, But marks will not be included for division and percentage of obtained marks.

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

PRACTICUM	3.1 AGRICULTURE AND SOIL SCIENCES	L	T	P
		2	-	2

COURSE OBJECTIVE

Agricultural science is a basic subject for a diploma holder in agricultural engineering. This subject a learner has already read in high school 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 identification of the crops, common weeds, insecticide, fungicide and fertilizer as well as the skill in preparation of seed beds and seed treatment for different seeds and crops.

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 behavior in the field conditions.

COURSE 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,
- Management and production of crops and their contribution to future sustainable developments.
- work with various types of soils in the field.
- Equip the students with the capability of identifying various types of soils,
- Properties and behavior of soil in the field conditions.

DETAILED CONTENTS

UNIT-I Agriculture Science :

- Introduction to Crop production related to engineering.

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

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

UNIT-II

- 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 diseases and their control.

- 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.

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

UNIT-III

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

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

- Preparation of bio-insecticides by the use of Neem leafs, Tobacco, Dhatura and other plants

- Waste Land Development : Concept and uses.

UNIT-IV Soil Science

- 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 classification of soil, triangular classification of soil. Distinction between clay, loam & silt.

- Physical properties of soil: Texture, particle density, structure, bulk density,porosity, air & water in soil, temperature, consistency and organic matter.

UNIT-V

- 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.

- Introduction to Bio-Fertilizers, its importance.

PRACTICAL EXERCISES

Agriculture Science :

1. Identification of crops, vegetable seeds & fertilizers.

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

3. Seed treatment before sowing the crops.

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

5. Practice of pruning and some vegetative propagation like cutting, budding and air layering.

6. Raised bed farming system (Tatura System).

Soil Science :

7. Determination of moisture tension with Tensiometer.

8. Determination of wilting point.

9. pH value determination.

10. Classification of soil and field identification test.

INSTRUCTIONAL STRATEGY

Teacher may use demonstration and animation that can make the subject interest 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	20
2.	6	20
3.	6	20
4.	6	20
5.	5	20
Total	**28**	**100**

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THEORY	3.2 SURVEYING AND LEVELLING	L	T	P
		2	-	-

COURSE OBJECTIVE

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.

COURSE 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

UNIT-1 (5 Periods)

- **INTRODUCTION:**

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

- **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.

UNIT-II (6 Periods)

- **CHAIN SURVEY:**

  Definition of terms- Survey station, base line, tie line, check line, running

measurement, reference 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.

- **MEASUREMENT OF AREA:**

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

UNIT-III (6 Periods)

- **COMPASS SURVEY:**

Purpose , concept of meridians- magnetic, true and arbitrary. 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, construction, principle and working of prismatic and surveyor's compass. Traversing by compass, closed and open traverse, plotting of a traverse- included angle method and deflection angle method.

- **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, leveling 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.

UNIT-IV (6 Periods)

- **PLANE TABLE SURVEY :**

Plane table and its accessories, adjustments of a plane table, centering, levelling and orientation. Methods of plane-tabling- radiation, intersection, traversing and resection. Errors in plane table survey, advantages and disadvantages of plane table survey.

- **THEODOLITE :**

Types of theodolite, 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.

UNIT-V

(5 Periods)

- **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.

- **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 at least 3 meter up and down area.
6. Plan for land acquisition 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.

SUGGESTED LEARNING RESOURCES

1. Punmia, B.C,; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Leveling, McGraw Hill Education, New Delhi.

3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House.

INSTRUCTIONAL STRATEGY

The Strategy is tailored to align with the cognitive level diploma students, emphasizing practical skills, conceptual understanding and field application. Use of short, concept-based lectures and to demonstrate instrument like chains, compasses, theodolites and levels.

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	20
2	6	20
3	6	20
4	6	20
5	5	20
Total	28	100

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PRACTICUM	3.3 MATERIAL AND RURAL CONSTRUCTION TECHNOLOGY	L	T	P
		2	-	2

COURSE OBJECTIVE

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.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select relevant material for finishing works.

DETAILED CONTENTS

UNIT-I (5 Periods)

(1) **MATERIALS**

1. Non Metallic Materials

(a) Stone:

Formation of rocks, classification 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 artificial 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.

UNIT-II (5 Periods)

(2) **METALLIC MATERIALS**

(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) Nonferrous Metals:

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

(3) Miscellaneous:

Properties and uses of following materials: Asbestos, cork, felt, attaparcha, mica, adhesives, Bakelite, china clay and fiber glass. Leather, Canvass, Jute, rubber and other advance materials

UNIT-III (6 Periods)

(3) **CONSTRUCTION METHODS**

- 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.

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

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

- Damp Proof Course: Materials & Method used.

- Doors and windows: Types and uses of doors, windows and ventilators.
- Plastering and Pointing: Types and Methods.

UNIT-IV (6 Periods)

- Concrete :
  Lime Concrete - Ingredient, specifications, preparation and uses.

  Cement Concrete - Ingredient, preparation, laying, compaction, curing, use of local arterials as formwork, application of Ferro cement.
- Lintels: Wooden, RCC and RB lintels.

- Floors: Common types, construction methods, drainage and cleaning of floors.

- 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.

UNIT-V (6 Periods)

Rural Construction:

- Rural Buildings: Cattle shed, barns, poultry house, grain bin and go-downs, their construction details, capacity and functional requirement.
- Rural Sanitation: Constructional details of septic tank, soak pit, aqua privy and PRAI latrines.
- Farm Road: Kachcha Road, Tar Macadum and Pakka Road.
- Rural Drainage: Specification as per BIS standards.
- Rural Water Supply: Construction and working of India Mark -II pump, Over head tank and laying of pipe lines.
- 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 consistency of cement.
5. To determine setting time of cement.(a) Initial setting time (b) Final setting time.
6. To determine water absorption 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 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

- 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

Topic No.	**Time Allotted (Hrs)**	**Marks Allotted (%)**
1	5	20
2	5	20
3	6	20
4	6	20
5	6	20
Total	28	100

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PRACTICUM	3.4 FARM POWER AND MACHINERY	L	T	P
		2	-	2

COURSE OBJECTIVE:

Diploma holders in agricultural Engineering should have the knowledge of different sources of power available at farms for driving the farm machinery and equipment. I.C. Engines are the primary sources of power available on farms. Sometimes 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.

COURSE OUTCOMES:

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

- understand the knowledge of both conventional and non-conventional sources of power.
- Identify major farm machines and explain their construction and working principles.
- Perform routine maintenance and trouble shooting of engines.
- Working of tractor systems (cooling, lubrication, transmission, braking, steering).
- Compute the field capacity, efficiency, fuel consumption and power requirements of various machines.

DETAILED CONTENTS:

UNIT-I (5 Periods)

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, classification of I.C. engines, principles 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 functions. Concept of terms related with I.C. engine. Numerical problems related with different terms. Performance of engine.

UNIT-II (6 Periods)

(B) Engine System :

(i) Valve system-Arrangement of valve, Functions of different parts-Valve timing. Effect of incorrect valve timing. Valve clearance and their 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 Carburetor. Construction and working of simple, compensating and Zenith carburettor. Adjustments in carburetor. 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.

UNIT-III (6 Periods)

(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.

UNIT-IV (5 Periods)

1. **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.

UNIT-V (6 Periods)

a) Transmission System:

Purpose, gear ratio, types of transmission-Selective gear type and constant type. Differential gear type - construction and working. Final drives, power take-off. Belt-pulleys.

b) Steering system of wheel tractor.

c) Tractor brake mechanism.

d) Hydraulic system of tractor-construction and working.

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

2. **HOURLY COST OF OPERATION**

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

PRACTICALS

1. Familiarization 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 trailer 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.

6. Study of valve arrangement, 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. Periodic maintenance of engines and tractors.

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSEMENTS

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

RECOMMENDED BOOKS

1. Farm Power and Machinery By Er. Sanjay Kumar; Published by Kalyani Publications.
2. Farm Machinery & Power Engineering (Question Bank) By Basavraj Patil, H.K. Venkata Reddy, P.R.Jayon Kalyani Publication.
3. Principles of Agriculture Engineering (Vol-1 & 2) By T.P. Ojha & A.M. Michael published by Jain Brothers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	20
2	6	20
3	6	20
4	5	20
5	6	20
Total	28	100

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THEORY	3.5 HYDRAULICS (Common with Civil Engineering)	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Measure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications.

DETAILED CONTENT

Unit – I Pressure measurement and Hydrostatic pressure (6 periods)

- Technical terms used in Hydraulics–fluid, fluid mechanics, hydraulics, hydrostatics and hydrodynamics - ideal and real fluid, application of hydraulics.
- Physical properties of fluid – density-specific volume, specific gravity, surface tension, capillarity, viscosity-Newton's law of viscosity.
- Various types of pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal's law of fluid pressure andits uses.
- Measurement of differential Pressure by different methods.
- Variation of pressure with depth, Pressure diagram, hydrostatic pressure and center of pressure on immersed surfaces and on tank walls.
- Determination of total pressure and center of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical and inclined surface in contact with liquid on either side

Unit– II Fluid Flow Parameters (4 periods)

- Types of flow – Gravity and pressure flow, Laminar, Turbulent, Uniform, Non-uniform,Steady, Unsteady flow. Stream line, stream tube, streak line, path line Reynolds number.
- Discharge and its unit, continuity equation of flow.
- Energy of flowing liquid: potential, kinetic and pressure energy.
- Bernoulli's theorem : statement, assumptions, equation. (Without proof of theorem)

Unit– III Flow through pipes (8 periods)

- Major head loss in pipe: Frictional loss and its computation by Darcy's Weisbach equation,Use of Moody's Diagram and Nomograms.
- Critical velocity and velocity distribution in a pipe for laminar flow
- Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement andfittings.
- Flow through pipes in series, pipes in parallel and Dupuit's equation for equivalent pipe. Hydraulic gradient line and total energy line.
- Water hammer in pipes: Causes and Remedial measures.
- Discharge measuring device for pipe flow: Venturimeter - construction and working.
- Discharge measurement using Orifice, Hydraulic Coefficients of Orifice.

Unit– IV Flow through Open Channel (5 periods)

- Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section.
- Determination of discharge by Chezy's equation and Manning's equation.
- Conditions for most economical rectangular and trapezoidal channel section.
- Discharge measuring devices: Triangular and rectangular Notches.
- Velocity measurement devices: current meter, floats and Pitot tube.
- Specific energy diagram, Froude's' Number, Hydraulic jump.

Unit– V Hydraulic Pumps (5 periods)

- Concept of pump, Types of pump - centrifugal, reciprocating, submersible.
- Centrifugal pump: components and working
- Reciprocating pump: single acting and double acting, components and working.

- Suction head, delivery head, static head, Manometric head
- Power of centrifugal pump.
- Selection and choice of pump.
- Introduction of Impulse and Reaction turbine.

SUGGESTED LEARNING RESOURCES:

1. Modi, P. N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing, New Company Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered 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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	20
2	4	15
3	8	25
4	5	20
5	5	20
Total	28	100

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PRACTICUM	3.6 SOIL MECHANICS	L	T	P
		2	-	2

COURSE OBJECTIVES

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 behavior in the field conditions.

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

COURSE OUTCOMES

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

- Understand the nature and the properties of soil.
- Understand soil consolidation and factors affecting settlement in agricultural structures or irrigation projects.
- Understand soil shear strength and stability.
- Assess the stability of soil for foundation of structures, irrigation channels or farm roads.

DETAILED CONTENTS

UNIT-I

SOIL MECHANICS

a) 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.

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

UNIT-II

ENGINEERING PROPERTIES OF SOIL:

a. Consistency of soil: Atterburg's limit, method of determination of liquid limit and plastic limit, plasticity index, plotting of flow curve on semi log graph.

b. Permeability of soil: Darcy's law, coefficient of permeability, parameters affecting permeability, determination of permeability by constant and variable head parameters, 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,

UNIT-III

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

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

c) Subsurface investigation : Preliminary exploration, test pit, different methods of boring, augers, methods of sampling, sealing of samples, disturbed, representative and undisturbed samples, split spoon sampler.

UNIT-IV

Earth Pressure and Retaining Structures : (6 P

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

b. Relation between movement of wall and earth pressure

c. Ka and Kb by Rankin's Method.

UNIT-V

Shallow and Deep Foundations

a. Definitions of shallow and deep foundations

b. Types of shallow and deep foundations

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

b) Stabilization of Soils by Lime & Cement Concept of stabilization, materials used, advantages of lime & cement as stabilizing agents. Strength of stabilized soil.

PRACTICAL EXPERCISES

SOIL MECHANICS:

1. Determination of grain size distribution by sieve analysis.
2. Determination of liquid limit and plastic limit.
3. Determination of permeability by constant and variable head permameter.
4. Determination of shear strength by direct shear box test.
5. Determination of OMC by Procter compaction test.
6. 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 interest 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

- Dr. P. Purushothama Raj, Soil Mechanics and Foundation Engg.; Pearson Education India.
- Dr. K.R. Arora, Soil Mechanics and Foundation Engg.; Standard Publishers Distributors.
- V.N.S Murthy, Soil Mechanics and Foundation Engg.; CBS Publishers and Distributors.
- Gopal Ranjan and ASR Rao, , Basic & Applied Soil Mechanics.; New Age International Publishers

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	20
2	5	20
3	5	20
4	6	20
5	6	20
Total	28	100

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PRACTICAL	3.7 HYDRAULICS LAB. (Common with Civil Engineering)	L	T	P
		-	-	4

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Ensure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow.
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications.

LIST OF PRACTICALS TO BE PERFORMED:

1	Use piezometer to measure pressure at a given point.
2	Use U-tube differential manometer to measure pressure difference between two given points.
3	Use Reynold's apparatus to determine type of flow.
4	Use Bernoulli's apparatus to apply Bernoulli's theorem to get total energy line for a flow in a closed conduit of varying cross sections.
5	Determine minor losses in pipe fittings due to sudden contraction and sudden enlargement.
6	Calibrate Venturimeter to find out the discharge in a pipe.
7	Calibrate the Orifice to find out the discharge through a tank
8	Use Current meter to measure the velocity of flow of water in open channel.
9	Use Pitot tube to measure the velocity of flow of water in open channel.
10	Use Rectangular and triangular notch to measure the discharge through open channel.

SUGGESTED LEARNING RESOURCES:

1. Modi,P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics and Hydraulic Machines, Khanna Publishing House, Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.
4. Khurmi,R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S Chand Publishers, New Del-hi.
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

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PRACTICAL	3.8 SURVEYING AND LEVELLING LAB.	L	T	P
		-	-	4

COURSE OBJECTIVE

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

COURSE 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.

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.

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THEORY	4.1 STRENGTH OF MATERIAL (Common with Mechanical Engineering)	L	T	P
		2	-	-

COURSE OBJECTIVE

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.

COURSE 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

UNIT-I (08 Periods)

- Stresses and Strains
  - .1. Basic assumptions; Concept of load, stress and strain
  - .2. Tensile compressive and shear stresses and strains
  - .3. Concept of Elasticity, Elastic limit and limit of proportionality.
    - .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

.4. Concepts of fatigue, creep and stress concentration

.5. Thermal stresses

UNIT-II (04 Periods)

- Resilience

a) Resilience, proof resilience and modulus of resilience
b) Strain energy due to direct stresses
c) Stresses due to gradual, sudden and falling load.

- Moment of Inertia

a) Concept of moment of inertia and second moment of area
b) Radius of gyration
c) Theorem of perpendicular axis and parallel axis (without derivation)
d) Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
e) Section modulus

UNIT-III (05 Periods)

- Bending Stresses

a. Concept of Bending stresses
b. Theory of simple bending
c. Use of the equation $\sigma/y = M/I = E/R$
d. Concept of moment of resistance
e. Bending stress diagram
f. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
g. Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

- Torsion

a. Concept of torsion- difference between torque and torsion.
b. Use of torque equation for circular shaft
c. Comparison between solid and hollow shaft with regard to their

strength and weight.

d. Power transmitted by shaft
e. Concept of mean and maximum torque
f. Concept of Principal stresses, principal planes and max. shear stress.
g. Determination of shaft diameter under combined bending and torsion.

UNIT-IV (06 Periods)

- Shear Force and Bending Moment

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

- Columns

a. Concept of column, modes of failure
b. Types of columns
c. Buckling load, crushing load
d. Slenderness ratio
e. Factors effecting strength of a column
f. End restraints
g. Effective length
h. Strength of column by Euler Formula without derivation
i. Rankine Gourdan formula (without derivation)

UNIT-V (06 Periods)

- Thin Cylinder and Spherical Shells

a) Introduction to longitudinal stresses, circumferential or hoop stresses and radial stresses
b) Longitudinal and circumferential stresses in thin cylinder
c) Longitudinal and circumferential stresses in thin Spherical shells

- Slope and Deflections of Beams:

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.

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.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	04	20
3	05	20
4	06	20
5	06	20
Total	28	100

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PRACTICUM	4.2 FARM MECHANISATION AND LAND DEVELOPMENT	L	T	P
		2	-	2

COURSE OBJECTIVE

Supervisor of agriculture machinery at farms has to organize and supervise field operation. For doing this he needs to have understanding of the proper use of various machinery 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 machinery for supervisory work.

COURSE OUTCOME

- Understand the significance and scope of farm mechanization in modern agriculture, including its role in increasing productivity and reducing labor requirements.
- Identify and describe various farm machines and implements, including primary and secondary tillage tools, seed drills, planters, sprayers and harvesting equipment.
- Analyze the working principles, components and operational mechanisms of internal combustion engines used in tractors and other farm machinery.
- Operate and maintain common farm machinery safely and efficiently, ensuring proper calibration, lubrication and troubleshooting.
- Understand the principles and methods of land development including land leveling, grading, reclamation, and drainage for agricultural use.

DETAILED CONTENTS

UNIT-I (05 Periods)

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

Primary Tillage Equipment:
Definition & Functions of tillage, tillage systems, types of tillage, Tillage implements.

- 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.
- Disc Plough: Purpose, principles, types, construction and adjustment.
- Other Plough: Chisel, subsurface, Rotary plough.
- Ploughing: Concept of terms related with ploughing, Methods of Ploughing.

Secondary Tillage equipments:

- Harrow: Types, construction and Adjustment repair and maintenance of Animal & tractor driven harrow.
- Land Rollers Hackers & Pulveriser: Types construction and operation.
- Rotavator and Puddlers

UNIT-II (06 Periods)

Sowing & Planting Equipment:

- Pregermenated paddy seeder 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

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

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

Interculture and Weed Control Equipment:

- Cultivator: Types, Construction, Attachments.

- Rotary Hoe: Construction and working.

- Flame Weed Control: Construction and working.

Fertilizing Equipments:

- Manure Spreaders: Construction and working.

- Fertilizer Distributor: Construction and working.

UNIT-III (06 Periods)

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.

Harvesting Equipments:

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

- Combined Harvestar : Types, Construction, Working, Material

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

- Potato & Groundnut Digger: Construction and working.

- Sugarcane Harvester: Construction and working.

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.

UNIT-IV (05 Periods)

Processing Equipments:

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

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.

Field Capacity & Efficiency:

- Introduction, Concept about Field capacity & Efficiency.

UNIT-V (06 Periods)

Economics, Management and testing of farm equipments

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

- Calculation of cost of operation of farm-machines.

- Field capacity & field efficiency.

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

Garden Equipment :

- Details of Garden & Halticultural equipments.

Rainsed Bed Preparation Equipment :

- Use and utility of rainsed bed preparation equipment.

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 fertilizer drill and planters and their parts, assembling and dismantling, setting and adjustments.

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

7. Setting, field operation and adjustment of planter and trans planter.

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

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

10. Study of chaff cutter and sugarcane crusher.

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

12. Visit of a mechanized farm for study of combine harvester.(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 interest 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

- Sri SM Mathur, Elements of Agricultural Engineering; By Jain Brothers.
- Er. Gurcharan Singh

SUGGESTED DISTRIBUTION OF MARKS

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

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PRACTICUM	4.3 AGRICULTURE ENGINEERING DRAWING	L	T	P
		1	-	4

COURSE OBJECTIVE

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

COURSE OUTCOMES

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 interpret the machine drawings correctly.

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

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THEORY	4.4 IRRIGATION AND DRAINAGE ENGINEERING	L	T	P
		3	-	-

COURSE OBJECTIVE

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.

COURSE OUTCOMES

- Understand the basic concepts and objectives of irrigation and drainage in agriculture.
- Identify different types and sources of irrigation water and assess their quality for agriculture use.
- Calculate irrigation requirements of crops using appropriate methods (e.g. crop water requirements duty, delta etc.
- Classify and design different types of irrigation systems (surface, sprinkler and drip) for various crop and soil conditions.
- Explain the causes, effects and methods of controlling waterlogging and salinity in agricultural fields.

DETAILED CONTENTS

UNIT-I (08 Periods)

IRRIGATION ENGINEERING:

- **Introduction:**

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

Sources of Irrigation Water :

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

Ground Water:

- 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.

UNIT-II (09 Periods)

Water requirement of plants:

- 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.

Irrigation Methods & Design of Drip Irrigation System :

- Surface and subsurface methods, sprinkler and drip system of irrigation. Design of drip irrigation system : Laterals and Sub main.

Storage Structures, Rain Water Harvesting Structures & Methods:

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

UNIT-III (09 Periods)

Evaluation of Farm Irrigation Systems:

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

Soil Moisture Movement:

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

Design of Irrigation Channels:

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

UNIT-IV (09 Periods)

DRAINAGE ENGINEERING:

Introduction:
Definition necessity water logging salinity, its control inter relationship of irrigation drainage, drainage coefficient, water table fluctuations.

Drainage Investigation & Requirements:

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

Drainage Systems:

- 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.

UNIT-V (07 Periods)

Special Methods of Drainage:

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

Rain Water Harversting :

- Type of roofs, slop of fields, water tanks construction and filters of water and excepts water recharging to the rain water harvesting wells.

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

Principles of Agriculture Engineering (Vol-1 & 2) By T.P. Ojha & A.M. Michael published by Jain Brothers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	08	20
2	09	20
3	09	20
4	09	20
5	07	20
Total	42	100

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PRACTICUM	4.5 PROTECTED CULTIVATION TECHNOLOGY	L	T	P
		1	-	2

COURSE OBJECTIVE

The objective of this course is to equip students with fundamental knowledge and practical skills in protected cultivation techniques, including the design, construction and management of various protected structures such as greenhouses, shade nets and polyhouses. Student will be able to understand greenhouse technology and maximum production of crop, vegetables on land and roof.

COURSE OUTCOMES

- Explain the principals and importance of protected cultivation in modern agriculture.
- Identify and describe different types of protected structures.
- Demonstrate skills in designing and constructing basic protected cultivation systems.
- Operate and manage environmental control systems for temperature, humidity, ventilation and light inside protected structures.
- Select suitable crops for protected cultivation based on demand, climate and infrastructure.

DETAILED CONTENTS:

1. **INTRODUCTION TO GREEN HOUSE :** (05 Periods)

   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 :** (05 Periods)

   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 :** (04 Periods)

   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

1. Protected Cultivation & Secondary Agriculture By Dr. Chandan Singh, Dr. Ravindra Nath, Dr. Sachin Kumar Singh; Published by ELPHINSTONE, New Delhi.
2. A Textbook on Protected Cultivation in Horticulture; A Cultivating Edan By Dr. Mahesha K.N., K. Harish Reddy; Published by Akinik Publications.
3. Protected Cultivation and Smart Agriculture By Sagar Maitra, Dinkar Gaikwad, Tanmoy Shankar; Published by New Delhi (NP) Publication.
4. Precision Farming Techniques for Protected Cultivation By R. Suresh & S.K Nirala; Published by PHI New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	35
2	05	35
3	04	30
Total	14	100

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PRACTICAL	4.6 STRENGTH OF MATERIALS LAB. (Common with Mechanical Engineering)	L	T	P
		-	-	4

COURSE OBJECTIVE

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.

COURSE 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

LIST OF PRACTICALS

2. To find the sheer force at a given section of simply supported beam for different loading.
3. To find the value of 'E' for a steel beam by method of deflection for different loads.
4. 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.
5. 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.
6. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.

7. To determine Rockwell Hardness No. and Brinell Hardness No. of a sample.
8. To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test.
9. To determine the bending moment at a given section of a simply supported beam for different loading.
10. Top determine the various parameters of helical coil spring.
11. 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

Expose the students to real life problems.

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.

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PRACTICAL	4.7 AGRICULTURAL EQUIPMENT WORKSHOP PRACTICE	L	T	P
		-	-	4

COURSE OBJECTIVES

The objective of the course is to impart practical knowledge and hands-on training in the use, maintenance, servicing and repair of various agricultural tools, machinery and equipment.

COURSE OUTCOME

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

- Understand different types of shop work and fundamental principles of different machines.
- Handling and usage of common hand tools, power tools, measuring instruments and welding equipment used in agricultural workshop.
- Apply workshop safety standard and procedures.
- In perform basic fitting, turning and fabrication operations.
- Diagnose simple mechanical faults and takes appropriate corrective actions.

(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

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OPEN ELECTIVE-01	4.8 A) INTERNET OF THINGS	L	T	P
		2	-	-

COURSE CONTENT

Unit I - Introduction to Internet of Things

- Define the term "Internet of Things"
- State the technological trends which have led to IoT.
- Describe the impact of IoT on society.

Unit II - Design consideration of IoT

- Enumerate and describe the components of an embedded system.
- Describe the interactions of embedded systems with the physical world.
- Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

- Describe the interaction between software and hardware in an IoT device.
- Explain the use of networking and basic networking hardware.
- Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2	internet of Things: A Hands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Del-hi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

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OPEN ELECTIVE-01	4.8 B) ENERGY CONSERVATION AND AUDIT	L	T	P
		2	-	-

COURSE OBJECTIVES

- To Identify demand supply gaps in present scenario.
- To understand conservations approaches to an industry.
- To draw the energy flow diagram of an industry.
- To identify energy wastage and suggest alternative methods.
- To understand the concepts energy audit.

COURSE CONTENT

UNIT-I: Introduction: General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits; Energy Efficiency Principle – Maximum energy efficiency, Maximum cost effectiveness; Mandatory provisions of EC act; Features of EC act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC);

Unit-II: Energy Conservation Approaches In Industries: Methods and techniques of energy conservation in ventilation and air conditioners- compressors pumps, fans and blowers - Area Sealing, Insulating the Heating / cooling fluid pipes, automatic door closing- Air curtain, Thermostat / Control; Energy conservation in electric furnaces, ovens and boilers.

Unit-III: Energy Conservation Option: New equipment, technology, staffing, training; Calculation and costing of energy conservation project; Depreciation cost, sinking fund method. Cost evaluationby Return On Investment(ROI) and pay back method etc.

Unit-IV: Performance improvement of existing power plant: cogeneration, small hydro, DG Set; Demand side management; Load response programmes; Types of tariff and restructuring of electrictariff Technical measures to optimize T and D losses.

Unit-V: Energy Audit: Energy audit and its benefits; Energy flow diagram; Preliminary, Detailed energy audit; Methodology of -preliminary energy audit and Detailed energy audit – Phase I, Pre au- dit, Phase II- Audit and Phase III- Post audit; Energy audit report; Electrical Measuring Instruments
- Power Analyzer.

REFERENCE BOOKS:

1. Electric Energy Generation, Utilisation and Conservation Sivaganaraju, S Pearson, New Delhi,2012
2. Project Management, Prasanna Chandra, Tata Mcgraw Hill, New Delhi
3. O.P. Jakhar, Energy Conservations in Buildings, Khanna Publishing House, New Delhi
4. Financial Management, Prasanna Chandra Tata Mcgraw Hill, New Delhi.
5. Energy management Handbook, Prasanna Chandra, Tata Mcgraw Hill, New Delhi.
6. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi (ed. 2018)

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AUDIT COURSE	4.9 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVE:

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

COURSE OUTCOMES:

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

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

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (07Periods)

Overview of Indian Knowledge System

- Importance and relevance
- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

Unit 2: Modern Science and Indian Knowledge System (07 Periods)

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India

Unit 3: Yoga and Holistic Healthcare (07 Periods)

- Basic principles of Yoga
- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: Case Studies / Assignment (07 Periods)

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	07	30
2	07	25
3	07	25
4	07	20
Total	28	100

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9. **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)
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 fineness of cement	1 Set	1,600
6	Compression Testing Machine 200 Tones Capacity with pumping unit Eclectically 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	1Set	2,000

	weights		
10	Picnometer 900ml capacity	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	Metallic 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 of 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 accessories	1	10,000
5	Plastic Containers (Transparent) 250 ml.	50	5 Each
6.	Plastic Containers (Transparent) 500 ml.	30	10 Each
7.	Plastic Containers (Transparent) 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 operated	10	2,500 Each
16.	Mislaneous (Kudal, Khurpi,spade, garden scissors, 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 changeable 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.	Steel 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.	Torsion Testing Apparatus complete with all accessories	1	2,000
7.	Bernoulli'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 Coefficient 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.	Surveyor'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.	Metric Chain 20m & 30m	10	2,40 Each
13.	Steel Tap 30m	2	1,50 Each
14.	Metallic 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 Extractor	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	Platform Weighing Machine 100 Kg.	1	6,000
20	Capillary Test Apparatus	1	5,00
21	pH meter	1	5,000
22.	Tensiometer	1	2,000

23	Post hole and helical auger hand operated three sets of each	6	1,000 Each
24	Aluminum 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.	Motor A.C. 5 HP	5	5,000 Each
13.	Motor 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 Generator 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 Squares	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.	Motorcycle complete engine(second hand)	1	8,000
4.	Various Types of Carbonator	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 Tension 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 Tones	1	35,000
12.	Air Compressor 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 expenses (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 creator 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.	Winnower 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 up to 1/10 of milligram (capacity)	01	1000
ENERGY CONSERVATION LABORATORY			
1	Clamp meter	02	5000
2	Multi meter	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 lux meter)	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.

(A) Furniture Requirement

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

10.1 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 MPLEMENTATION

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 feedback 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.

13 - List of Participants / Experts

The following experts have participated/ contributed in workshop for Developing Curriculum Scheme /Competency Profile according to AICTE and NEP-2020, of Three Year Diploma course in Agriculture Engineering at IRDT Kanpur.

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