

**CURRICULUM**  
FOR  
**DIPLOMA PROGRAMME**  
IN  
AGRICULTURE ENGINEERING  
(N-2022 SCHEME)  
**2<sup>nd</sup> Year (3<sup>rd</sup> & 4<sup>th</sup> Semester)**  
FOR THE STATE OF HIMACHAL PRADESH



**Implemented w.e.f. Session 2022-23**

Prepared by: -  
**Composite Curriculum Development Centre**  
Directorate of Technical Education,  
Vocational & Industrial Training, Sundernagar (H.P.)

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## **THREE YEAR DIPLOMA IN AGRICULTURE ENGINEERING**

### **SALIENT FEATURES**

Programme	Diploma in Agriculture Engineering
Duration	Three years (Six Semesters)
Entry Qualification	As prescribed by H.P. Takniki Shiksha Board /AICTE
Intake	As approved by H.P. Takniki Shiksha Board
Pattern	Semester System
Curriculum for	Second Year Diploma Programme (Technical Stream)

**Course code and definition:**

<b>Course code</b>	<b>Definitions</b>
AGE	Agriculture Engineering
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Internship
PR	Project
SE	Seminar
DCS	Doubt Clearing Session

## **DIPLOMA PROGRAMME OUTCOMES**

- PO1: Basic and Discipline Specific Knowledge:** Apply knowledge of basic Mathematics, Science and engineering fundamentals and engineering specialisation to solve the engineering problems.
- PO2: Problem Analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
- PO3: Design/Development of Solutions:** Design solutions for well defined technical problems and assist with the design of systems components or processes to meet specified needs.
- PO4: Engineering Tools, Experimentation and Testing:** Apply modern Engineering tools and appropriate technique to conduct standard tests and measurements.
- PO5: Engineering Practices for Society, Sustainability and Environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
- PO6: Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well- defined engineering activities.
- PO7: Life-Long Learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

**PSO 1:** Utilize adequate knowledge and skill acquired from different courses of Diploma in Agriculture Engineering to gain better employment in various industries of agriculture engineering.

**PSO 2:** Use their expertise in planning judicious utilization of natural resources and their management through soil and water conservation techniques and various irrigation and drainage methods.

## STUDY AND EVALUATION SCHEME

### THIRD SEMESTER

Sr. No.	Sub. Cat.	Subject Code	Course Title	Hours per week			Total Hrs/ Week	Credits	Evaluation Scheme						Total Marks
				L	P	DCS*			Internal Assessment		External Assessment				
									Th	Pr	Th	Hrs	Pr	Hrs	
1	PC	AGEPC201	Basics of Agricultural Engineering	3	0	1	4	3	40		60	3			<b>100</b>
2	PC	AGEPC203	Crop Production	4	0	1	5	4	40		60	3			<b>100</b>
3	PC	AGEPC205	Farm Irrigation Engineering	3	0	1	4	3	40		60	3			<b>100</b>
4	PC	AGEPC207	Soil and Water Conservation	3	0	1	4	3	40		60	3			<b>100</b>
5	PC	AGEPC209	Manufacturing Technology-I	3	0	1	4	3	40		60	3			<b>100</b>
6	PC	AGEPC211	Basics of Agricultural Engineering Lab	0	2	0	2	1		40			60	3	<b>100</b>
7	PC	AGEPC213	Crop Production Lab	0	2	2	4	1		40			60	3	<b>100</b>
8	PC	AGEPC215	Farm irrigation Engineering Lab	0	2	2	4	1		40			60	3	<b>100</b>
9	PC	AGEPC217	Manufacturing Technology Lab-I	0	2	0	2	1		40			60	3	<b>100</b>
10			SCA	0	0	2	2			25					<b>25</b>
<b>Total Teaching Load</b>				<b>16</b>	<b>8</b>	<b>11</b>	<b>35</b>	<b>20</b>							
<b>Total</b>									<b>200</b>	<b>185</b>	<b>300</b>		<b>240</b>		<b>925</b>
<p><b>Internship-I:</b> The students shall undergo Internship-I at the end of 3<sup>rd</sup> semester (During semester break after board examinations of duration 04 weeks) which will be evaluated and reflected in study and evaluation scheme of 4<sup>th</sup> semester.</p>															

**STUDY AND EVALUATION SCHEME  
FOURTH SEMESTER**

Sr. No.	Sub. Cat.	Subject Code	Course Title	Hours per week			Total Hrs/ Week	Credits	Evaluation Scheme						Total Marks
				L	P	DCS*			Internal Assessment		External Assessment				
									Th	Pr	Th	Hrs	Pr	Hrs	
1	PC	AGEPC202	Farm Machinery and Implements-I	3	0	1	4	3	40		60	3			<b>100</b>
2	PC	AGEPC204	Post-Harvest Technology	3	0	1	4	3	40		60	3			<b>100</b>
3	PC	AGEPC206	Manufacturing Technology-II	3	0	1	4	3	40		60	3			<b>100</b>
4	PC	AGEPC208	I.C. Engine	3	0	0	3	3	40		60	3			<b>100</b>
5	PE	AGEPE202	Elective-I (Micro Irrigation Principles and Practice OR Surveying and Leveling)	3	0	0	3	3	40		60	3			<b>100</b>
6	PE	AGEPE204	Elective-II (Green House Technology OR Engineering Properties and Processing of Seeds)	3	0	0	3	3	40		60	3			<b>100</b>
7	PC	AGEPC210	Farm machinery and Implements Lab-1	0	2	0	2	1		40			60	3	<b>100</b>
8	PC	AGEPC212	Post-Harvest Technology Lab	0	2	0	2	1		40			60	3	<b>100</b>
9	PC	AGEPC214	Manufacturing Technology Lab-II	0	2	0	2	1		40			60	3	<b>100</b>
10	PC	AGEPC216	I.C. Engine Lab	0	2	0	2	1		40			60	3	<b>100</b>
11	PR	PR202	Minor Project	0	4	0	4	2		40			60	3	<b>100</b>
12	AU	AU202	Essence of Indian Knowledge and Tradition	2	0	0	2	0	40		60			3	<b>100</b>
13	SI	SI-I	Internship-I (4-weeks) after 3rd Semester	0	0	0	0	2		40			60	3	<b>100</b>
14			SCA	0	0	1	1	0		25					<b>25</b>
<b>Total Teaching Load</b>				<b>20</b>	<b>12</b>	<b>4</b>	<b>36</b>	<b>26</b>							
<b>Total</b>									<b>280</b>	<b>265</b>	<b>420</b>		<b>360</b>		<b>1325</b>
<p><b>Internship-II:</b> The students shall undergo Internship-II at the end of 4th semester (During semester break after board examinations of duration 06 weeks) which will be evaluated and reflected in study and evaluation scheme of 5<sup>th</sup> semester.</p>															



## **DETAILED CONTENTS OF SECOND YEAR**

## Basics of Agricultural Engineering (AGEPC201)

Course Code	AGEPC201
Course Title	Basics of Agricultural Engineering
Number of Credit	03(L:3, P:0, DCS:1)
Course Category	PC

### RATIONALE

This subject has been introduced with the objective of making the students conversant with the field of Agriculture & Agricultural Engg. and learning the basic concepts of engineering which will be required in the subjects to be studied in the subsequent semesters.

### DETAILED CONTENTS

#### 1. Agriculture

- 1.1 Introduction to Agriculture and its types.
- 1.2 Introduction to allied branches of Agriculture.
- 1.3 Introduction to various types of agro based business.
- 1.4 Resource requirement in Agriculture

#### 2. Agricultural Engg.

- 2.1 Introduction, need, importance and scope of Agriculture Engineering.
- 2.2 Work areas of Agricultural engineers.
- 2.3 Specialized areas covered under Agriculture Engineering
  - 2.3.1 Farm Power & Machinery  
Introduction to various sources of power used at Farm and their adaptability. Introduction to Machinery/ Implements required for different field operations like Tillage, Sowing, Planting, Weeding, Spraying, Dusting, Harvesting, Threshing etc. (their names & functions only).
  - 2.3.2 Soil and Water Engg.  
Definition of weather, climate, agricultural meteorology, elements of weather (temperature, atmospheric pressure, wind, solar energy, humidity, atmospheric humidity, relative humidity, precipitation, topography) Hydrology, Hydrologic cycle, precipitation, runoff, evaporation, evapotranspiration, condensation etc.

Introduction to Irrigation, sources of irrigation water & irrigation equipment. Concepts of water management, Rain water harvesting, Soil & water conservation, Water logging, Drainage.

2.3.3 Post-Harvest Technology & Agro Process Engg.

Introduction to Post Harvest Technology and its objectives. Familiarization with various Post Harvest operations and different unit operations in Agro processing (Names & functions only).

2.3.4 Renewable Energy

Introduction and importance of Renewable sources of energy.

**3. Engineering Quantities and Units**

3.1 Introduction to Fundamental units (Mass, Length, Time, Temperature, Current, Luminous Intensity, Angle).

3.2 Introduction to Derived units (Area, Volume, Density, Speed, Acceleration, Velocity, Linear Momentum, Force, Weight, Impulse, Work, Energy, Pressure or Stress, Power, Modulus of Elasticity, Surface Tension, Surface Energy, Angular Velocity, Frequency, Angular Acceleration, Moment of Inertia, Angular Momentum, Torque.

3.3 Coefficient of Viscosity, Heat Energy, Latent Heat, Specific Heat, Thermal Conductivity).

**4. Surveying and Leveling**

4.1 Measuring Survey:

Ranging a Line, measuring length with Chain, Measuring length with Tape, Calculation of areas (Rectangular & Square) with the help of Chain and tape.

4.2 Leveling

Introduction to Leveling & Uses of Leveling, Leveling Staff (Introduction and types), Dumpy level, its uses and settings, Taking Levels of different stations with the help of Dumpy Level.

4.3 Theodolite survey

Introduction and its uses, Calculating Horizontal Angles with Theodolite, Setting up Straight Line and Lines at Right Angle with

theodolite, Using Theodolite as Dumpy Level, Taking levels with dumpy level.

#### 4.4 Contouring

Introduction to contours, Use of contours, Contour Intervals and factors affecting contour intervals, Methods of contouring.

### 5. **Stresses and Strains**

5.1 Introduction to different terms like Load, Stress, Strain. Different types of Stresses i.e. Direct and Shear Stress, Different types of strains i.e. Tensile, Compressive, Shear and Volumetric Hooke's Law, Modulus of Elasticity, or Young's Modulus, Modulus of Rigidity or Shear Modulus, Bulk Modulus, Longitudinal Strain and Lateral Strain, Poisson's Ratio.

### 6. **Engineering Materials and their Properties**

6.1 Introduction to Engineering Materials, Importance, Classification of materials Metals and their alloys and nonmetals used in industry.

6.2 Properties of metals and alloys Physical properties- Appearance, Luster, Colour, Density, Melting point, Dimensions, Porosity, Structure, Mechanical properties- Strength, Tensile Strength, Yield Strength, Impact Strength, Stiffness, Elasticity, Plasticity, Toughness, Ductility, Malleability, Brittleness, Hardness, Fatigue, Creep, Wear resistance.

6.3 Factors affecting Mechanical properties.

6.4 Corrosion, its Causes and Effects, Control and prevention of corrosion.

### 7. **Heat Energy, Refrigeration & Air Conditioning**

7.1 Definition and units of heat energy, Modes of Heat transfer- conduction, convection and radiation, Factors affecting heat energy. Thermal Conductivity.

7.2 Definitions of Refrigeration and Air conditioning, Principles of refrigeration & air conditioning. Major components of Refrigerators, Major components of Air conditioners, Applications of Refrigerators and Air conditioners in agriculture.

### 8. **Hydraulics**

8.1 Fluids and Fluid flow:

Fluid, Classification of fluids, Hydraulics, Fluid mechanics- Hydrostatics and Hydrodynamics, Practical applications of hydraulics, concept of continuum.

## 8.2 Properties of fluids

Density or Mass density, Specific Weight, Specific volume, Specific gravity, Viscosity, Kinematic viscosity, Surface tension, Cohesion, Adhesion, Compressibility and bulk modulus, Capillarity, Vapour pressure.

## 8.3 Pressure and its measurement

Concept of pressure, units of pressure, practical utility, Pressure head, Atmospheric pressure, Gauge pressure, Vacuum Pressure, Absolute pressure, Differential pressure, Measurement of pressure or measuring devices (Names only).

## 8.4 Flow of fluids

Kinematics, practical utility, Types of fluid flow- Steady flow, unsteady flow, uniform flow, non- uniform flow, compressible flow, incompressible flow, laminar flow, turbulent flow, rotational flow, ir-rotational flow, Rate of flow or discharge, Hydraulic energy and its types- Potential, pressure or kinetic energy.

### **INSTRUCTIONAL STRATEGY**

The contents will be covered through lecture cum discussion sessions. Besides this live demonstration of the machines and familiarize with different labs of the institute be done. Also the visits to the nearby industries be arranged so that students are able to understand in a clear and better way.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the basic aspect of agriculture.
CO 2	Carry out survey and leveling.
CO 3	Comprehend properties of various types of materials.
CO 4	Comprehend the Principal of refrigeration & air conditioning.
CO 5	Know the various aspects connected with hydraulics.

### **RECOMMENDED BOOKS**

1. Elements of Agriculture Engineering by Jagdishwar Sahay; Standard Publishers distributors, Delhi.
2. Elements of Agricultural Engineering Vol I & II by Dr. O P Singhal; Saroj Prakashan, Allahabad.

3. Principles of Agriculture Engg. Vol I & II by A.M. Michael and T.P.Ojha.
4. Post-Harvest Technology of Cereals, pulses and oilseeds by A.Chakraverty.
5. Unit operations of Agricultural Processing by K.M.Sahay.
6. Hydraulics and Hydraulic Machines by Satinder Rohilla; New India Publishing House, Delhi.
7. Materials and Metallurgy by A. Kumar, H. K. Dhingra; Dhanpat Rai & Co., Delhi.
8. Strength of Materials by MK Garg & Sandeep Bajaj; North publication, Jalandhar.
9. Theory of Machines & Mechanism by Raghubir Chand Jindal; Ishan publication, Ambala.

#### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted(Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>3</b>	<b>6 %</b>
<b>2</b>	<b>8</b>	<b>15 %</b>
<b>3</b>	<b>5</b>	<b>8 %</b>
<b>4</b>	<b>8</b>	<b>15 %</b>
<b>5</b>	<b>6</b>	<b>10 %</b>
<b>6</b>	<b>14</b>	<b>18 %</b>
<b>7</b>	<b>6</b>	<b>10 %</b>
<b>8</b>	<b>14</b>	<b>18 %</b>
<b>Total</b>	<b>64</b>	<b>100 %</b>

## **Crop Production (AGEPC203)**

Course Code	AGEPC203
Course Title	Crop Production
Number of Credit	04(L:4, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

A diploma holder in Agricultural Technology needs to learn about package of practices for various seasonal crops besides becoming familiar with the preparation of cost estimates for production of these crops. After studying the subject of crop production, the diploma holders should acquire adequate knowledge and skills of crop production and cropping system, soil fertility and weed management besides plant protection and crop harvesting.

### **DETAILED CONTENTS**

#### **1. Introduction**

Agriculture, importance of agriculture, Crop production Art, Science and business, Factors affecting crop production viz. Internal and external factors. Classification of crops based on their utility and seasons of growing. Major and principal crops of the country and Himachal Pradesh. Introduction to major fruits, vegetables and flower crops of country with specific emphasis on the crops of state of H.P. Introduction to various specialization of agriculture.

#### **2. Crop Rotation and Cropping System**

Crop rotation, Principles of crop rotation, advantages of crop rotation and rotational intensity. Cropping scheme and principles of cropping scheme. Cropping intensity. Systems of cropping viz. mixed cropping and intensive cropping. Principles of mixed cropping and its advantages. Pre-requisites of intensive cropping and methods of intensive cropping viz. multiple & inter cropping. Crop diversification.

#### **3. Seed Bed Preparation**

Tillage, definition, function and importance of tillage. Types and methods of tillage. Effect of tillage on the soil characteristics and nutrient availability in soil. Selection of tillage methods.

#### **4. Sowing/Placement of Seeds**

Characteristics of good seed, types of seeds viz. Breeder's, Nucleus, and Foundation and Certified seeds. Seed treatment. Factors affecting seed germination. Different methods of seed placement in the soil and selection criteria of methods. Time of sowing.

#### **5. Irrigation and Water Application**

Importance of water for plants, necessity of water application. Critical stages (growth) of water application. Sources of irrigation water. Methods of irrigation (names only). Factors affecting selection of method viz. crop, soil, source of water.

#### **6. Inter culture and Weed Management**

Importance of intercultural operations in crop productions. Introduction with the methods, tools and equipment required for inter culture. Weed, its characteristics, classification, useful and harmful effects. Medium of weed seed dispersal. Methods of weed control viz. mechanical, biological, agronomical (crop competition and rotation), firing and chemical.

#### **7. Soil Fertility Management**

Plant nutrient elements, their classification viz. Macro, Secondary & Micro and their importance. Soil fertility, Types of Fertilizer Sand Manner used to maintain soil fertility. Methods of application, tips for safe storage and better handling of fertilizers. Amount and time/stages of fertilizer application, organic fertilizers and their advantage.

#### **8. Plant Protection**

Various factors/agents causing damage to the crop viz. Pests, Diseases etc. Introduction with the ecofriendly pest- management practices and the chemicals used for control of diseases, bio-pesticides.

#### **9. Harvesting**

Various methods of harvesting of different crops. Factors affecting harvesting viz. time of maturity, moisture contents, climates factors etc.



## 10. Practices/Cultivation Details/ Modern Techniques

Package of practices/cultivation details/important modern techniques for raising following crops: -Wheat, Paddy, Maize, blackgram, Apple, Mango, Sugarcane and Potato grown in Himachal.

## 11. Horticultural Terminology

Introductions to special operations for raising/growing horticultural crops such as grafting, pruning, shearing, pinching, girdling etc.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the factor affecting crop production
CO 2	Comprehend the various system of cropping
CO 3	Know the various method of tillage
CO 4	Comprehend about various methods of harvesting crops
CO 5	Know about soil and climate requirement, varieties, cultural practices & yields of crops

## RECOMMENDED BOOKS

1. A text book of Soil Engineering; New India Publishing House Delhi.
2. Cropping System Theory & Practice by Chatterjee; Oxford & IBH Publication Co.
3. Crop Production & Management by Y.B. Morachan; Oxford & IBH Publication Co.
4. Principles & Practices of Agronomy by S.S. Singh; Kalyani Publishers, New Delhi.
5. Manual of Irrigation Agronomy by Mishra and Ahmad Mall; Oxford & IBH Publication Co.

## SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>15</b>	<b>18 %</b>
<b>2</b>	<b>10</b>	<b>12 %</b>
<b>3</b>	<b>6</b>	<b>8 %</b>
<b>4</b>	<b>6</b>	<b>8 %</b>
<b>5</b>	<b>6</b>	<b>8 %</b>
<b>6</b>	<b>6</b>	<b>8 %</b>
<b>7</b>	<b>7</b>	<b>8 %</b>
<b>8</b>	<b>6</b>	<b>8 %</b>
<b>9</b>	<b>4</b>	<b>5 %</b>
<b>10</b>	<b>10</b>	<b>12 %</b>
<b>11</b>	<b>4</b>	<b>5 %</b>
<b>Total</b>	<b>80</b>	<b>100 %</b>

## **Farm Irrigation Engineering (AGEPC205)**

Course Code	AGEPC205
Course Title	Farm Irrigation Engineering
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

A diploma holder in agricultural technology needs to learn the principles pertaining to the optimum use of water for maximum agricultural yield besides understanding engineering principles related to surface and ground water resources. After studying this subject, the students shall acquire adequate knowledge and skills about water requirement of crops and water lifting devices.

### **DETAILED CONTENTS**

#### **1. Introduction**

Sources of surface water resources, irrigation, necessity of irrigation and advantages and disadvantages of irrigation. Types of irrigation viz. Artificial (flow, lift etc.) and natural. Sources and quality of irrigation water.

#### **2. Irrigation Water Requirement and Efficiencies**

2.1 Evaporation, pan evaporimeter. Transpiration, evapotranspiration or consumptive use, seasonal consumptive use, peak period consumptive use. Estimation of evapotranspiration from evaporation data and climatological data (introduction only).

2.2 Water infiltration and infiltration rate. Crop water requirement, net and gross irrigation requirement. Irrigation frequency, estimation and irrigation scheduling.

2.3 Duty and Delta; factors affecting duty and methods of improving duty.

2.4 Irrigation efficiencies-water conveyance, application, storage, distribution, water use, project, operational and economic efficiency.

#### **3. Water Application Methods**

3.1 Introduction to surface, sub surface, sprinkler and drip irrigation systems.

- 3.2 Surface methods of irrigation viz. border, check basin and furrow irrigation, their basic details, characteristics, types and their adaptability.
- 3.3 Sprinkler irrigation-its adaptability and limitations, types, components, operation and maintenance of sprinkler systems. Layout and various design parameters of sprinkler irrigation system.
- 3.4 Drip irrigation- its adaptability and limitations, types, components, operation and maintenance of drip irrigation systems. Layout and various design parameters of drip irrigation system.

#### **4. Water Lifting Devices**

- 4.1 Introduction to various power operated, water lifting devices.
- 4.2 Classification of pumps-positive displacement (reciprocating and rotary), variable displacement.
- 4.3 Pump sand Terminology, Centrifugal pumps (volute and diffuser type, single stage and multistage type), Types of impellers of centrifugal pump. Installation, operation and maintenance of centrifugal pumps.
- 4.4 Submersible pump and vertical turbine pumps; their common trouble sand remedies. Criteria and procedures for selection of irrigation pumps, power requirements and efficiency.

#### **5. Well Hydraulics, Open Well Sand Tube Wells**

- 5.1 Types of water bearing formations (confined, unconfined aquifer etc.) aquifer characteristics influencing yield of wells. Determination of aquifer constant, specific capacity of wells.
- 5.2 Different terms related to well hydraulic such as water tables, iso bath, isobar lines, drawdown. Recharge of ground water.
- 5.3 Types of wells, open wells, their design parameters and construction of an open well, tubewells.

#### **6. Conveyance and Measurement of irrigation water**

- 6.1 Canal sand their classification (brief description only), seepage from canal sand field channels. Canal lining-various types. Their advantages and disadvantages.
- 6.2 Introduction to various water conveyance structure sand their functions. Open channels, their types, layout and design parameters.
- 6.3 Sub surface system of water conveyance, their components.

6.4 Units of water measurement, direct and indirect method of water measurement. Measurement of water in pipes and open channels.

## 7. Environment Issues

Pollution with poor quality irrigation water and excessive use of fertilizer and agro chemicals.

## INSTRUCTIONAL STRATEGY

- Irrigation area from state Govt. departments like Agriculture, Horticulture, Jal Shakti Vibhag, etc. may be consulted.
- Water Conveyance Structure need to be studied in the agriculture farm.
- Pressurized Irrigation system installed in the farm/industry for problems and constraints.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the soil water plant relationship & appropriate method of water application in various situations
CO 2	Comprehend the various water lifting devices & their requirement
CO 3	Know the various types of water bearing formation
CO 4	Comprehend the conveyance and measurement of irrigation water
CO 5	Know various environmental issues related to irrigation water

## RECOMMENDED BOOKS

1. Ground Water and Well Drilling by Parveen Kumar; CBS Publishers and Distributors, Delhi.
2. Sprinkler Irrigation by Sivanappan; Oxford & IBH Publication Co.
3. Irrigation Engineering by M.Lal & Etal; New India Publishing House.
4. Water use Efficiency in Agriculture by Giriappa; Oxford & IBH Publication Co.
5. Irrigation Practice & Water Management by FAO; Oxford & IBH Publication Co.
6. Irrigation Engineering by Sharma & Bari; Satya Parkashan Publishers.
7. Irrigation Engineering by B.L. Gupta; Satya Parkashan Publishers.
8. Irrigation Engineering (Vol.1,2,3) by Sharma & Sharma; Oxford & IBH Publication Co.
9. Water well & Pump Engineering by A.M. Michael & S.P .Khepar; Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

10. Text Book of Irrigation Engineering (Vol.2,3) by Sharma & Sharma; Oxford& IBH Publication Co.
11. Irrigation Theory and Practice by Dr. A.M. Michael; Vikas Publishing House, New Delhi.
12. Theory and Practice by AM Michael; Vikas Publishing House, New Delhi.

#### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>3</b>	<b>5 %</b>
<b>2</b>	<b>10</b>	<b>15 %</b>
<b>3</b>	<b>18</b>	<b>30 %</b>
<b>4</b>	<b>10</b>	<b>15 %</b>
<b>5</b>	<b>10</b>	<b>15 %</b>
<b>6</b>	<b>10</b>	<b>15 %</b>
<b>7</b>	<b>3</b>	<b>5 %</b>
<b>Total</b>	<b>64</b>	<b>100 %</b>

## **Soil and Water conservation (AGEPC207)**

Course Code	AGEPC207
Course Title	Soil and Water conservation
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

A diploma holder in Agriculture Engineering needs to learn about the soil erosion, the factors affecting the erosion besides the soil erosion control practices and drainage. A course on soil conservation shall equip the students with the knowledge of the properties of soil, agents of erosion, methods of erosion control, water harvesting and drainage problems.

### **DETAILED CONTENTS**

#### **1. Soil and its properties**

Introduction to the soil as a natural body, definitions and functions of soil. Various constituents of soil and their importance. Soil as a medium of plant growth.

#### **2. Properties of Soil in relation to plant growth**

- 2.1 Soil separates and classifications (I.S.S.S. & U.S.D.A.). Soil texture and classification of soil (U. S. D. A.).
- 2.2 Soil structure; definition, types and factors affecting soil structure. Bulk density and particle density of soils. Soil consistency. Porosity & void ratio. Degree of saturation.
- 2.3 Soil moisture content (dry basis & wet basis). Method of soil moisture determination viz. gravimetric method. Retention of soil moisture; maximum retentive capacity, field capacity, permanent wilting percentage, hygroscopic coefficient. Soil moisture classifications. Available water holding capacity of soil. Soil permeability; definition and importance.
- 2.4 Darcy's law, Coefficient of permeability. Soil air and aeration.

### **3. Soil Erosion**

- 3.1 Introduction, Classification of erosion viz. Geological and accelerated.
- 3.2 Mechanics of Water Erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion and principle of gully erosion and Classification of gullies. Stream channel erosion. Effects of water erosion, Factors affecting erosion by water.
- 3.3 Mechanics of Wind Erosion: Processes of saltation, suspension, surface creep. Factors affecting erosion by wind.

### **4. Erosion Control Measures**

- 4.1 Principles of erosion control
- 4.2 Agronomical measures: Agronomic and field practices to control erosion by wind and water i.e. Contour farming, strip cropping, tillage etc.
- 4.3 Mechanical measures: Terracing to control erosion by water. Types of terraces. Terrace design parameters and planning a terrace system. Bench terraces, types and design parameters.
- 4.4 Use of bunds to control erosion and design parameters of bunds. Contour bonding. Vegetated water ways for the control of erosion.
- 4.5 Temporary structures for the control of gully erosion, their type and adaptability.
- 4.6 Permanent soil conservation structures viz. Drop spillway, Chute spillway, Drop inlet spillway for the control of erosion; their principles, adaptability, constructional features and material of construction. Introduction to the farm ponds, earthen embankments and water harvesting in relation to soil and water conservation, soil conservation through tree and grass cultivation, ground water recharge, watershed management

### **5. Water Harvesting and Storage**

Need, Importance and scope of water harvesting, Type and Methods of water harvesting. Brief description of the different systems of water harvesting and storage.

### **6. Salt affected soil and their reclamation**

- 6.1 Saline, alkaline and acid soils, Reason and factors of the information.
- 6.2 Chemical Properties: Soil reaction (pH), Electrical Conductivity



(EC), Cation Exchange Capacity (CEC), Sodium Adsorption Ratio (SAR), Exchangeable Sodium Percentage (ESP), salt concentration in the soils. Effect of salinity, alkalinity and acidity on plant growth. Reclamation of these soils and their management.

**7. Water logged soils and their drainage**

- 7.1 Water logging, causes of water logging and its effects. Drainage Types of drainage systems viz. surface and subsurface drainage. Introduction to drainage investigation. Benefits of drainage. Drainage properties of soil. Drainage coefficient.
- 7.2 Surface drainage-functional components, types (random drain, parallel field drain, parallel open ditch and bedding system used in flat areas and cross slope ditch system used in sloping areas).
- 7.3 Benefits of subsurface drainage. Introduction to investigations for subsurface drainage, different method of subsurface drainage viz. tile drains, mole drains, drainage wells, deep open drains and combination of tile and opened drains.

**8. Environment Issues:**

Water logged soil are health hazard, salt affected soils create impermeability and long-term effects

**INSTRUCTIONAL STRATEGY**

- 1. Water harvesting ponds/structures in the field/university for field exposure.

**Course Outcome:** At the completion of this course the students will be able to:

CO 1	Understand the various types of soil, water & wind erosion along with its mitigation measures
CO 2	Comprehend the agronomic & engineering method of conservation & the design of bunds & terraces being implemented on the field
CO 3	Know the method of minimising the erosion loss & conservation of soil
CO 4	Comprehend the importance and scope of water harvesting
CO 5	Know the salt affected soils and their reclamation

**RECOMMENDED BOOKS**

- 1. Soil & Water Conservation Engineering by Glenni O.Schwab, RichardK. Frevert, Talcott W. Edminster, Kenneth K.Barnes; John Wiley & Sons New York.

2. Manual of Soil & Water Conservation Practice by Gurmail Singh; Oxford & IBH Publication co.
3. Soil & Water Conservation Engineering by Suresh R.; Standard Publication.
4. Principle of Agricultural Engineering Volume-II by A.M. Michael & T.P. Ojha; Jainbrothers.

#### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>2</b>	<b>04 %</b>
<b>2</b>	<b>8</b>	<b>12 %</b>
<b>3</b>	<b>6</b>	<b>10 %</b>
<b>4</b>	<b>16</b>	<b>25 %</b>
<b>5</b>	<b>6</b>	<b>10 %</b>
<b>6</b>	<b>6</b>	<b>10 %</b>
<b>7</b>	<b>18</b>	<b>25 %</b>
<b>8</b>	<b>2</b>	<b>04 %</b>
<b>Total</b>	<b>64</b>	<b>100 %</b>

## **Manufacturing Technology -1 (AGEPC209)**

Course Code	AGEPC209
Course Title	Manufacturing Technology -1
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

The knowledge of manufacturing techniques in the area of foundry, machine shop (fitting shop, lathe machines and shaping), inspection and gauging and coating both on metallic and non-metallic is essential at the first stage for understanding technology. Hence the following topics are included.

### **NOTE:**

- a) Teachers will introduce various tools with their specific function to be used in various manufacturing processes
- b) Teachers will acquaint the students with safety measures to be taken while using manufacturing processes and tools.

### **1. Fitting**

Fits, limits and tolerances and their applications, unilateral and bilateral tolerances, gauges, gauge tolerances, micrometer, Vernier, height gauges, dial comparator, straight edge, surface plate. Metal cutting, metal shear, metal sawing, metal bending. Types of pipes, their materials and pipe standards. Types of pipe fittings and applications, pipe threads and thread cuttings.

### **2. Metallic and Non-metallic Coatings**

Necessity of metallic and non-metallic coatings, principles and processes of electroplating, galvanizing, vacuumizing, metal spraying, painting and their applications, preparation of base materials. Uses of primers, paint sand finish coatings, powder coating and its advantages.

### **3. Foundry**

Introduction, types of patterns, pattern materials, cores and core boxes, core materials, preservation and storage of patterns, Introduction to moulding, types

of moulding sands, types of moulds, preparation of cores, defects in moulds and their remedies, types of melting furnaces (pit furnace, tilting furnace, cupola, oil fired and induction furnaces), casting defects and their remedies.

**4. Lathes**

Introduction, types of lathes, specifications, description and functions of lathe parts, feed mechanism, drives and transmission, work holding devices, turning tools

Lathe operations – plain turning, facing, centring, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knurling, speeds and feeds of cut.

Introduction to capstan and turret lathes, copying lathe and their attachments, difference between capstan and turret lathes and heads, tool holders and tool layout, tool geometry and use of throwaway tips, brazed tools and HSS tools.

**5. Shapers—their functions Operation and mechanism**

**6. Inspection Instruments and Gauges**

Height gauge, depth gauge, bore gauge, slip gauge, sine bar, measurement of taper by use of slip gauges, limits, fits and tolerances, interchangeability, Go and Not-Go gauges, screw thread micrometer, thread gauge, radius gauge, dial gauge, and gear tooth Vernier, hardness checking instruments, coating thickness checking instruments, surface finish checking instruments, Tally and with computerized display of readings.

**INSTRUCTIONAL STRATEGY**

The teacher must show the models, tools and gauges as instructional materials for the effective teaching-learning process.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Know the operational and control of different machine tool and equipment
CO 2	Understand the different types of coating and their applications
CO 3	Know the function of shapers and mechanism
CO 4	Comprehend the different operation and tools in lathe

### **RECOMMENDED BOOKS**

1. Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi.
2. Manufacturing Technology by MA dithan and Gupta, New Age International (P)Ltd. Delhi.
3. Elements of Workshop Technology by SK Choudhary & Hazara, Asia Publishing House.
4. Principles of Foundry Technology by Jain, Tata Mc Graw Hill, New Delhi.
5. Workshop Technology, Vol-I,II & III by Chapman, Standard Publishers Distributors, New Delhi.

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>10</b>	<b>15 %</b>
<b>2</b>	<b>10</b>	<b>15 %</b>
<b>3</b>	<b>12</b>	<b>20 %</b>
<b>4</b>	<b>12</b>	<b>20 %</b>
<b>5</b>	<b>8</b>	<b>10 %</b>
<b>6</b>	<b>12</b>	<b>20 %</b>
<b>Total</b>	<b>64</b>	<b>100 %</b>

### **Basics of Agricultural Engineering Lab (AGEPC 211)**

Course Code	AGEPC211
Course Title	Basics of Agricultural Engineering Lab
Number of Credit	01(L:0, P:2, DCS:0)
Course Category	PC

#### **RATIONALE**

Enable the students to understand and acquire knowledge about basic machine components and different engineering materials also make them familiarize & acquaintance with farm and soil machinery.

#### **LIST OF PRACTICALS**

1. Visit to nearby Agro Based Industries / Agro Based Business units.
2. Identification of Basic machine components.
3. Identification of different Engineering materials.
4. Familiarization & Acquaintance with the Machinery & Equipment's in Farm Machinery & Implements Lab (Identification & Functions).
5. Familiarization & Acquaintance with the Machinery & Equipment in Soil & Water Engg. Lab (Identification & Functions).
6. Familiarization & Acquaintance with the Machinery & Equipment in Agro Process Engg./Post Harvest Technology Lab (Identification & Functions).
7. Familiarization with different hydraulic equipment's of hydraulic lab of the institute.
8. Visit to Krishi Vigyan Kendra.
9. Visit to Renewable Energy Parks/ solar power plants.
10. Ranging a line and its measurements.
11. Taking out the levels of different stations with dumpy level.
12. Taking Horizontal angles with theodolite.
13. Taking levels with theodolite.

14. Drawing contours (Indirect methods).

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the actual working environment and enhance their knowledge and skill
CO 2	Understand the various processes carried out in agro industries
CO 3	Draw contours and can make topographical map of the area
CO 4	Work on various methods of levelling

### Crop Production Lab (AGEPC213)

Course Code	AGEPC213
Course Title	Crop Production Lab
Number of Credit	01(L:0, P:2, DCS:2)
Course Category	PC

#### RATIONALE

Enable the students to understand the identification of crops sand their seeds and different fertilizers used. Also, the identification of different diseases and insect-pests of major field crops.

#### LIST OF PRACTICALS

1. Identification of crop sand their seeds.
2. Identification of different types of fertilizers.
3. Identification of different crop weeds and method of weed control.
4. Practices of fertilizer application.
5. Methods of seed bed preparation.
6. Methods of sowing/planting.
7. Visit to the mechanized/modernized farm of agricultural universities/center-state farms for the study of growth phases in various crops and to get the exposure of modern techniques being used for raising different crops.
8. Study of Vermi composting and visit to agriculture farms.
9. Estimation of different entities required for crop production and estimation of yield of crops.
10. Identification of different diseases and insect-pests of major field crops.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Comprehend the growth phases in various crops also know the modern techniques used for raising different crops
CO 2	Identify different entities for crop production and estimate of yield of crops
CO 3	Know the different methods of sowing / planting
CO 4	Identify different types of crops sand their seeds and fertilizers.



### Farm Irrigation Engineering Lab (AGEPC215)

Course Code	AGEPC215
Course Title	Farm Irrigation Engineering Lab
Number of Credits	01(L:0, P:2, DCS:2)
Course Category	PC

#### RATIONALE

A diploma holder in agricultural technology need to learn the installation, operation and maintenance of irrigation system, centrifugal pump submersible pumps. Tour of irrigation industries will enhance their knowledge.

#### LIST OF PRACTICALS

1. Installation, operation and maintenance of sprinkler irrigation system.
2. Installation and operation of centrifugal pump.
3. Dismantling of centrifugal pump, study of constructional feature of its component and its assembly.
4. Installation, operation & maintenance of submersible pump. Identifying/locating the faults/troubles and remedies.
5. Measurement of water flow in the open field channels.
6. To survey market and field for the availability, adaptability and selection of various types of pumps and irrigation systems in the region.
7. Study tours to irrigation equipment industries: pumps, sprinkler and drip etc.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Use of water management on irrigation system.
CO 2	Understand the operation and maintenance of sprinkler irrigation system
CO 3	Know the working of installation of different pumps
CO 4	Adaptability and selection of various types of pump available in market

## Manufacturing Technology Lab-I (AGEPC217)

Course Code	AGEPC217
Course Title	Manufacturing Technology Lab-I
Number of Credits	01(L:0, P:2, DCS:0)
Course Category	PC

### RATIONALE

Enable the students to understand and acquire knowledge of operation & adjustment of fitting shop lathes, pattern making and foundry shop.

### LIST OF PRACTICALS

#### 1. Fitting shop

Bench work and fittings; simple male-female fitting (fitting of pulley, bearings, gears on shafts), scraping, pipe fittings with leak proof joints, checking alignment and centre distance.

#### 2. Pattern making and foundry shop

- To prepare pattern of rectangular block, 'V' block, step pulley with core box, split pattern.
- Preparation of open flour mould of solid pattern, cope drag mould using split pattern.
- Visit to foundry to see castings of cast iron, steel, non-ferrous materials, hand moulding, machine moulding and melting furnaces. Induction heating and gas fixed furnaces.

#### 3. Lathes

- Introduction to turning machine and allied services like cutting tool grinding, general shop layout including maintenance, oils, tools and gauge stores.
- Different exercises in turning like plain turning, step-turning, facing, chamfering, knurling, parting off and thread cutting, use of compound slide and tail stock, tool grinding, selection of cool ant and lubricants and speed and feeds. Use of safety goggles.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Build practical knowledge about pattern making, pattern material & type of pattern casting process.
CO 2	Know various tools , equipment and machine operation required for basic manufacturing
CO 3	Work on various machines such as lathe, grinding etc.

## **Farm Machinery and Implements-I (AGEPC202)**

Course Code	AGEPC202
Course Title	Farm Machinery and Implements-I
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

The topics covered in the subject will enable the students to understand the basic principles, construction and working of farm machinery for different crops. This will also enable them to select appropriate machinery, use, repair and maintain the same. This knowledge will be highly useful in running an Enterprise related with Farm Machinery and employment in Farm Mechanization sectors. In view of its importance and lengthy curriculum this course will be taught partly in two semesters Farm Machinery and Implements-I & II

### **DETAILED CONTENTS**

#### **1. Mechanical Principles**

##### **1.1 Simple Mechanisms**

Introduction to Mechanism, Machine, Structure, Element & Link, Classification of Links, Kinematic Pair, Classification of Kinematic Pair, Kinematic Chain, Types of Kinematic Chain (Introduction only), Brief description of Four Bar chain.

##### **1.2 Power Transmission in Farm Machinery**

Flat and V-Belt Drive, Length of belt, Ratio of tensions for belt drives, Chain & Sprocket Drive, Gear Drive, Effect of Centrifugal Tension, Horse Power transmitted, Conditions for maximum power transmission. Introduction to Belt dynamometer (No derivation).

##### **1.3 Balancing & Vibration**

Concept of Balancing, Static & Dynamic Balancing, Concept of Vibration, Types of vibrations: Longitudinal, Transverse & Torsional, Causes of vibration in machines, their harmful effects & remedies.

#### 1.4 Shaft Couplings, Bearings & Pipe Joints

Couplings, their functions and use (Oldham and Universal Coupling), Bearings their functions and use (Bush Bearing & Plummer Block), Pipe Joints & their use in Agricultural machinery (Flanged, Socket & Union joint).

#### 1.5 Hydraulic Control System

Working Principle of hydraulic system, Basic components of hydraulic system. Types of Hydraulic system- Position Control, Draft control & Mixed Control, Repair & Maintenance of hydraulic system, Precautions for hydraulic system.

### 2. Introduction of tools

Introduction and brief history of the traditional tools and equipment used in farming operations. Farm Mechanization-Scope & Limitation, Classification of Farm Machinery according to operation (seed bed preparation, sowing, harvesting, threshing etc.). Classification of Farm Machinery/Implements according to hitching (Trailed, Semi mounted & mounted type Drawbar, 2-point & 3-point linkage)

### 3. Tillage Implements

#### 3.1 Tillage & its objectives. Types of Tillage.

Introduction to different types of tillage implements and their classification.

#### 3.2 Primary Tillage Implements

Mould Board Plough- Constructional details & Components & its different types, Adjustments of M. B. Plough (Horizontal suction, Vertical suction etc.) Plough accessories (Jointer, Coulter etc.).

#### 3.3 Mechanics of Ploughs, Size, capacity and power requirements of plough.

Disc Plough-Constructional details & Components, different types of disc plough- Standard disc plough hand Vertical disc plough, Adjustments of Disc Plough (Disc angle, Tilt angle).

#### 3.4 Adaptability of Mould Board Plough & Disc Plough & their Comparison.

#### 3.5 Methods of Ploughing-Continuous & Round and Round Ploughing.

- 3.6 Constructional details, functions, uses and working of Indigenous Plough, Chisel Plough, Subsoiler and Rotary Plough
- 3.7 Secondary Tillage Implements  
Introduction to various types of Harrow- Constructional details & components and Working of Disc Harrow, Spike tooth harrow, Spring tooth harrow, Triangular harrow, Blade harrow, Zigzag Harrow, Rolling harrow, Reciprocating harrow, Cage Harrow.
- 3.8 Introduction to different types of cultivators, their function and constructional details.
- 3.9 Rotavator - Constructional details, Principle of operation & functions, Advantages over other tillage implements.
- 3.10 Routine maintenance of Ploughs and other tillage machinery.
- 3.11 No tillage /Zero tillage machinery–Zero till drill, Strip till drill etc.

#### **4. Seeding & Planting Machines & Equipment**

- 4.1 Introduction to different types of Seeding/ Planting Methods & machines used for sowing/planting different crops.
- 4.2 Seed drills and Seed cum fertilizers drills, their functions, Constructional details, Components & working. Different types of seed metering mechanisms and furrow openers used in seed drills.
- 4.3 Planter-Introduction to planters for different crops. Main Components and functions of a planter. Different types of seed metering mechanisms used in planters.
- 4.4 Study of Potato Planter, Sugarcane planter, Corn Planter
- 4.5 Adjustments of seed drills and planters for depth of sowing and sowing rate and Calibration of seed drills and planters.
- 4.6 Transplanter-Functions, working, components & constructional details of Paddy transplanter. Routine/ Preventive maintenance of Seed Drills and Planters.

#### **INSTRUCTIONAL STRATEGY**

Drawing of various machines may be used to illustrate the constructional details of Machinery & Equipment's. Besides this live demonstration of the machines & visits to

the local units manufacturing these implements/ machines be arranged so that students are able to understand in a clear and better way.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the working principle of different machinery for different crops
CO 2	Comprehend a technical knowledge and skill for operation of various machine used in agricultural farms.
CO 3	Know the different methods of seeding/ planting method and adjustment of seed drills and planter for depth of showing
CO 4	Comprehend the working Principle of hydraulic system
CO 5	Know the adaptability of different plough

### LIST OF BOOKS

1. Elements of Agricultural Engineering by Dr. Jagdishwar Sahay; Standard Publisher Distributors, Nai Sarak, Delhi-110006.
2. Principle of Farm Machinery by R.A. Kepner, Roy Bainer and E.H. Barger, CBS Publishers and Distributors, Delhi.
3. Farm Power Machinery & Surveying by Irshad Ali; KitabMahal, Allahabad, Surjit Book Depot P.B.No. 1425, 4074-75, Nai Sarak, Delhi.
4. Principle of Agricultural Engineering Volume-I by A.M. Michael & T. P. Ojha; Jain brothers.
5. Farm Machines & Equipments by C.P. Nakra; Dhanpat Rai & Sons, Nai Sarak New Delhi.
6. Elements Of Agricultural Engineering Part 1 & 2 by Dr. O.P. Singhal and Naresh Chandra Aggarwal; Mumfordganj, Allahabad.
7. Basic Farm Machinery by Shiphen & Ellen; Jain brothers.
8. Farm Machinery and Equipment by Smith, Tata McGraw Hill Publishing Company Ltd., New Delhi.

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	25	40 %
2	7	10 %
3	16	25 %
4	16	25 %
<b>Total</b>	<b>64</b>	<b>100 %</b>

## Post-Harvest Technology (AGEPC204)

Course Code	AGEPC204
Course Title	Post-Harvest Technology
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### RATIONALE

Agricultural produce e.g. cereal, pulses and oil seeds are not consumed as such. They are processed before consumption. Knowledge of unit operation such as drying, storage and processing of fruits and vegetables is of great importance for value addition of these food products.

### DETAILED CONTENTS

#### 1. Introduction

- 1.1 Introduction to post harvest technology of agricultural produce, its need, scope and importance.
- 1.2 Brief description and introduction to various post-harvest operation such as cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating), washing; their functions and use in the post-harvest processing

#### 2. Engineering Properties of Agricultural Materials

Introduction to the engineering properties of agricultural materials affecting post-harvest operations. Physical properties such as shape, size, density and specific gravity. Aero and hydro dynamic properties such as drag coefficient and terminal velocity. Frictional properties e.g. static friction, kinetic friction, rolling resistance, elasticity and angle of repose. Mechanical properties such as hardness, compressive strength, impact and shear resistance and thermal properties like specific heat, thermal conductivity and thermal diffusivity etc.

#### 3. Drying of Cereals and Pulses

- 3.1 Introduction, importance of drying, principles of drying and factors affecting drying, types of drying methods i.e. sun drying & artificial drying by mechanical means. Moisture content representation, equilibrium moisture content, determination of moisture content by direct and indirect methods.
- 3.2 Introduction to various grain drying systems - solar drying system, batch drying system, continuous flow drying system. Safe temperatures during drying.

3.3 Principles of operation of different types of dryers viz. Deep bed dryers, thin layer dryers, continuous flow dryers, L.S.U. dryers, fluidized bed dryers, rotary dryer, tray and tunnel dryers.

#### **4. Storage of Cereals and Pulses**

4.1 Introduction, need and importance, general principles of storage, temperature and moisture changes during storage i.e. influence of moisture content, relative humidity and temperature etc. on stored product.

4.2 Insect and other organism associated with stored grains.

4.3 Familiarization with the various types of storage structures. Deep and shallow bins. Traditional and modern storage structures. Management of storage structures. Comparison of bag and bulk storage. Losses during storage and their control, space requirement of bag storage structure.

#### **5. Post-Harvest Technology of Fruits and Vegetables**

5.1 Post-harvest losses and introduction to factors affecting storage of fruits and vegetables. Need and importance of storage. Principle of storage of fruits and vegetables i.e. cold storage controlled and modified atmosphere storage. Recommended storage conditions for important fruits and vegetables Introduction to packaging of fruits and vegetable sand types of packaging. Concept of modified atmosphere packaging.

5.2 Post-harvest treatment to increase shelf life i.e. freezing, chilling and canning. Introduction to cool-chain for handling, storage and marketing of fresh fruits and vegetables.

### **INSTRUCTIONAL STRATEGY**

Arrange visits to storage and drying facility. Invited guest lecture may be arranged from technical persons of FCI/State Warehousing Corporation.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the various post-harvest operations such as cleaning, grading drying etc.
CO 2	Understand the engineering properties of agricultural material affecting post-harvest operations.
CO 3	Analyse various aspects of quality control and evaluation
CO 4	Knows the post-harvest losses and factors affecting storage of fruits and vegetables
CO 5	Know how to keep fruits and vegetables or commodities free from insect and pests



## RECOMMENDED BOOKS

1. Post-Harvest Technology of Cereal, Pulses, Oil seeds by A.Chakraverty; Oxford & IBH Publication Co.
2. Unit operation of Agro Processing Engineering by Dr.K.M. Sahay & K.K Singh; Vikas Publications.
3. Post-Harvest Technology of fruits& Vegetables by Thompson; CBS Publishers and Distributors, 485 Jain Bhavan, Shandara Delhi-110032.
4. Post-Harvest (Introduction Physiology Handling fruits & Vegetables by Wills R.B.H. Etal ;Oxford & IBH Publication Co.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
<b>1</b>	<b>04</b>	<b>08 %</b>
<b>2</b>	<b>08</b>	<b>14 %</b>
<b>3</b>	<b>16</b>	<b>24 %</b>
<b>4</b>	<b>16</b>	<b>24 %</b>
<b>5</b>	<b>20</b>	<b>30 %</b>
<b>Total</b>	<b>64</b>	<b>100 %</b>

## **Manufacturing Technology-II (AGEPC206)**

Course Code	AGEPC206
Course Title	Manufacturing Technology-II
Number of Credits	03(L:3, P:0, DCS:1)
Course Category	PC

### **RATIONALE**

Knowledge in various machining operations viz. drilling, boring, milling, planning and grinding processes, finishing operations, gear production, CNC machines, bending forming and welding processes is very essential for the diploma holders. Hence this subject.

### **DETAILED CONTENTS**

#### **1. Drilling and Boring**

Introduction, Types of drills, types of drilling machines i.e. portable, bench type, pillar and radial, drilling speeds and feeds, drill chucks and other accessories (jigs etc.) used in drilling machines, reaming, introduction to boring, types of boring machines – horizontal and vertical, specifications, boring bar and boring heads

#### **2. Machining Processes**

- 2.1 Milling – Types of milling machines and their operations, speeds and feeds, indexing (simple and compound), types of milling cutters.
- 2.2 Planning machines and their operation.
- 2.3 Grinding – cylindrical, center less and surface grinding machines, types of grinding wheels, specifications, grade sand their selection, balancing of grinding wheels and their storage.

#### **3. Finishing Operations**

Lapping, honing, super finishing operations and their applications, types of abrasives used and their selection.

#### **4. Gear Production**

Gear cutting and gears having machines, gear cutter sand coolants.

#### **5. CNC Machines**

Introduction to CNC control systems, advantages, productivity, accuracy and cost.

## 6. Bending and Forming

Bending and Forming description of press brakes, bending dies, forming machines.

## 7. Welding

Introduction, types of welding (gauge welding, arc welding, resistance welding), butt welding, flash, projection, seam and spot welding. Selection of electrodes, filler metals, types of welding defects and their remedies, soldering and brazing – processes and applications.

## 8. Coolants and Lubricants

Types of coolants and Lubricants for various machining processes.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Apply the knowledge of various manufacturing process
CO 2	Design and analyze various manufacturing process and tooling
CO 3	Understand the various machining operations e.g. drilling, boring milling gear production etc.
CO 4	Get the knowledge of jigs and fixtures so as to utilize machine capability for variety of operations.
CO 5	Know the finishing operation and their application.

## RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi.
2. Workshop Technology Vol. – I, II & III by Chapman, Standard Publishers Distributors, New Delhi.
3. Workshop Practice by RK Singhal, SK Kataria & Sons, New Delhi.
4. Production Technology by HMT, Tata McGraw Hill, New Delhi.
5. Elements of Workshop Technology by SK Chaudhary & Hazra, Asia Publishing House.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	10	15 %
2	16	25%
3	6	10 %
4	6	10 %
5	6	10 %
6	6	10 %
7	10	15 %
8	4	05 %
<b>Total</b>	<b>64</b>	<b>100 %</b>

## I.C. ENGINE (AGEPC208)

Course Code	AGEPC208
Course Title	I.C. ENGINE
Number of Credits	03(L:3, P:0, DCS:0)
Course Category	PC

### RATIONALE

The IC engines are the primary source of mechanical power for tractors and all other allied purposes. This course will enable the students to understand the principle of working and construction of I.C. engines.

### DETAILED CONTENTS

#### 1. Principles of I.C. Engines

Introduction and classification of I.C. engines. Working principle of four stroke and two stroke cycle. Petrol and Diesel engines, their comparison location and function of various parts of I.C. engines and material used for them. Concept of I.C. engine terms, bore, stroke, dead Centre, crank throw, compression ratio, clearance volume, piston displacement and piston speed. Working principle of rotary (wankle) engine.

#### 2. Thermodynamics Cycles

Concepts of reversibility cycle, perpetual motion machine, thermal efficiency and air standard efficiency, Carnot cycle efficiency and its implications, Otto, Diesel and dual combustion cycles - ideal and actual effect of compression ratio, relative efficiency. Simple problems of their cycles.

#### 3. Air Intake System

Components of air intake system viz. pre-air cleaner, inlet manifold exhaust manifold, types of air cleaners: wet, dry

#### 4. Fuel System in Diesel Engine

Components of fuel system, description and working of fuel feed pump, types working of fuel injection pump, injector, fuel filters, complete detail and working of micro fuel injection system for a multi cylinder engine, use of alternate fuels in I.C. engines i.e. biogas, gasoline, biomass fuel (wood)

## 5. Cooling and Lubrication

Necessity of engine cooling, cooling system, their main features, thermostat, defects in cooling system and their rectification, functions of lubrication, types and properties of engine lubricants, additives for improving the properties, lubrication system of I.C. engine, oil pumps, oil filters, pressure relief valve, positive crank case ventilation.

## 6. IC Engine Testing

Engine power, indicated and brake power, efficiency – mechanical, thermal, relative and volumetric efficiencies, methods of finding indicated and brake horse power, Morse test and heat balance sheet performance and endurance tests of I.C. engine specification (according to ISI). Exhaust smoke analysis and pollution control. Introduction to latest Standards for emission instituted by Govt. of India from time to time.

## 7. Repair and Maintenance of Engines

Preventive Maintenance, repair and overhaul of engines.

### INSTRUCTIONAL STRATEGY

Cut section/models may be used for explaining different components of engine. Visits may be arranged to nearest tractor/engine repair workshop.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Know the working principle of four strokes and two strokes
CO 2	Demonstrate the operating characteristics of common IC Engine
CO 3	Demonstrate an understand the air and fuel induction process
CO 4	Understand the fluid flow in the combustion chamber and exhaust system
CO 5	Understand repair and overhaul of engine

### RECOMMENDED BOOKS

1. Farm Tractors by S.C. Jainand Rai; Tata Oxford Company.
2. IC Engine by S.S. Thethi.
3. IC Engine by A.S. Sarao.

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs.)</b>	<b>Marks Allotted (%)</b>
<b>1</b>	<b>08</b>	<b>18 %</b>
<b>2</b>	<b>06</b>	<b>14 %</b>
<b>3</b>	<b>05</b>	<b>10 %</b>
<b>4</b>	<b>08</b>	<b>16 %</b>
<b>5</b>	<b>08</b>	<b>16 %</b>
<b>6</b>	<b>08</b>	<b>16 %</b>
<b>7</b>	<b>05</b>	<b>10 %</b>
<b>Total</b>	<b>48</b>	<b>100 %</b>

## Micro Irrigation Principles and Practice (AGEPE202-I Elective-I)

Course Code	AGEPE202-I Elective-I
Course Title	Micro Irrigation Principles and Practice
Number of Credits	03 (L: 3, P:0, DCS:0)
Course Category	PE

### RATIONALE

To impart knowledge and skills to students to design sprinkler and drip irrigation systems in order to improve water productivity of different crops and to perform economic analysis and cost estimates of micro-irrigation systems.

#### 1. **Sprinkler irrigation**

Historical developments, Scenario in the World, Country and State, Adoptability and Limitations. Different components and functions of the sprinkler system. Types of sprinkler irrigation systems - Based on sprinkling mechanism, Based on portability. Moisture distribution patterns under sprinkler, Effect of wind speed on working of the systems, distribution uniformity, Christiansen Uniformity coefficient. Design of sprinkler system layout, laterals and mains. Operation and maintenance of system, field evaluation of the system, Cost analysis.

#### 2. **Drip irrigation**

Historical development, Scenario in the World, Country and State - Advantages and limitations. Components of drip irrigation - Head control unit, Water carrier system, and Water distribution system. Drip Hydraulics - Water flow in pipes, Friction and pressure losses, Coefficient of friction.

#### 3. **Types of Emitters**

Based on Flow regime (Reynolds number), Based on Lateral connection Different types of fertigation equipment. Emitter flow Equation, Pressure variations (%) for different emitter flow variations, Emission uniformity, Distribution Uniformity and irrigation Efficiency.

#### 4. **Planning and design of drip system**

Collection of preliminary data, Layout, crop water requirements, hydraulic design, Selection of components, Economic pipe size selection. Installation, Operation and Maintenance of drip irrigation systems, Testing and field

evaluation of the system. Cost estimation of drip irrigation system for row and orchards.

5. Pressure variation along pipe lines and design criteria of lateral, sub-main and main lines.
6. Troubles and remedies in the sprinkler and drip irrigation systems.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Design different irrigation system depends upon requirement of crops
CO 2	Perform economic analysis and cost estimates of micro irrigation system
CO 3	Understand the different troubles and remedies in micro irrigation system
CO 4	Understand the working of different emitters
CO 5	Evaluates the field evaluation and cost analysis of system

### Reference

1. Micro-Irrigation for Crop Production Design, Operation and Management.
2. Freddie R. Lamm, James E. Ayars and Francis S Nakayama, 2006. Elsevier Publication, Singapore.
3. Drip irrigation by Sivanappan RK, Padma Kumari O and Kumar V 1987. Keerthi Publishing House Pvt. Ltd, Coimbatore

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	11	24 %
2	11	24 %
3	8	16 %
4	8	16 %
5	5	10 %
6	5	10 %
<b>Total</b>	<b>48</b>	<b>100 %</b>



## **Surveying and Leveling (AGEPE202-II Elective-I)**

Course Code	AGEPE202-II (Elective-I)
Course Title	Surveying and Leveling
Number of Credits	03(L:3, P:0, DCS:0)
Course Category	PE

### **RATIONALE**

To enable student to acquire skills in the measurement of land, preparation of plans and find out their areas (regular or irregular) either for civil engineering or Agriculture Engineering related works, in general, and Land and water management works in particular by Various methods and instruments (chain, tapes, compasses plane table etc.) available commercially. Further to enable the student to take and calculate the reduced levels with the help of various leveling instruments and prepare contour maps and further estimate the cuts and fill quantities while Land leveling or grading work is take up in any agricultural field.

#### **1. Introduction**

- 1.1 Concept of Surveying-purpose of Surveying, Linear and angular measurements, Fundamental principles of surveying.
- 1.2 Classification of Survey based on instruments and purpose of field work – Engineering Surveys Instruments used for taking Linear and angular measurements.

#### **2. Chain Surveying**

- 2.1 Purpose and Principle of Chain Survey - equipment used and their functions, Chains and arrows. Metallic tapes and Steel tapes, ranging rods, offset rods, pegs, plumb bob, Optical square, Line ranger.
- 2.2 Errors in ordinary chaining -Correction due to incorrect length of Chain or tape-problems.
- 2.3 Different operations in Chain Surveying- Direct ranging and Indirect Ranging Chaining on sloping ground –Setting out right angles with open cross staff and tape – Guidelines for Chain triangulation.

- 2.4 Recording field notes – field Book-Conventional signs, Obstacles in chaining-methods to overcome obstacles. Calculations of area – different methods – Average ordinate, Trapezoidal and Simpson’s rules.

### **3. Compass Surveying**

- 3.1 Compass Surveying- Purpose and principle of compass Survey-description, working and uses of prismatic compass, Concept of true meridian, magnetic meridian, designation of bearings - whole Circle bearing, Quadrantal bearing - conversion of whole circle bearing to Quadrantal bearing.
- 3.2 Compass Survey –field notes - Traversing using prismatic compass. Local attraction-detection and correction.
- 3.3 Declination- conversion of magnetic bearings to true bearings- problems - calculation of included angles.
- 3.4 Plotting of Closed traverse-closing error and adjustments by Bowditch method. Errors in Compass Surveying-Personal, Instrumental and Natural.

### **4. Leveling**

- 4.1 Definitions of important terms in leveling. Component parts, operations involved in leveling- Temporary adjustments of a dumpy level. Types of leveling staves.
- 4.2 Determination of reduced levels by Height of Instrument and Rise and fall methods –Comparison – Problems.
- 4.3 Errors in Leveling-Personal, instrumental and natural – Precautions.
- 4.4 Classification of Leveling- Profile leveling, Reciprocal leveling-detailed description of each method – problems on reciprocal leveling.

### **5. Contouring**

- 5.1 Uses and Characteristics, Methods of contouring - Block contouring, Radial contouring. Interpolation of contours-tracing contour gradient- use of Contour maps. Uses and working principles of minor instruments- Abney level, Electronic Planimeter, Pentagraph.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the land and can prepare maps/ plan for simple irrigation work like laying of pipe lines, drainage channels
CO 2	Carryout field levelling and make contour maps of the farm
CO 3	Estimate the cuts and fill quantities while levelling or grading
CO 4	Find out the reduced level with the help of various levelling instruments.
CO 5	Understand the principle and working of prismatic compass

## REFERENCES

1. Surveying and levelling Vol –1 Kulkarni & Kanetkar,Pune Vidyarthi Griha Prakashan,1786, Sadasivpeth, Pune.
2. Surveying and Levelling Vol –1 B.C. PUNMIA, Laxmi Publications (p) Ltd, 113, Golden house, Daryaganj, New Delhi-110002.
3. Surveying – 1 A. KAMALA, Radiant – Book house, # 4-5-62, Women’s CollegeRoad, Beside Andhra Bank, Kothi, Hyderabad-95.
4. Surveying (McGraw-Hill) N. N. BASAK, Tata McGraw – Hill Publishing Company Ltd, 7 West Patel Nagar, New Delhi – 110008.
5. Text Book of Surveying C. Venkatramaiah, Universities Press (India) Limited 3-5-820, Hyderguda, Hyderabad-500 029.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	6	15 %
2	10	20 %
3	10	20 %
4	12	25 %
5	10	20 %
<b>Total</b>	<b>48</b>	<b>100 %</b>

## **Green House Technology (AGEPE204-I Elective-II)**

Course Code	AGEPE204-I (Elective-II)
Course Title	Green House Technology
Number of Credits	03 (L:3, P:0, DCS:0)
Course Category	PE

### **RATIONALE**

Constructional and operational details of greenhouses will lead the students to grow crops with profits and also to use the greenhouses for offseason usage and also to manage them commercially.

#### **1. Green houses**

Introduction, history, definition, greenhouse effect, advantages of greenhouses. Classification of greenhouses Greenhouse types based on shape, utility, construction and covering material. Plant response to greenhouse environment – light, temperature, relative humidity, ventilation and carbon dioxide.

#### **2. Environmental requirement for crops**

Temperature requirement of horticultural crops, light requirement of crops and lighting control methods, Greenhouse shading methods, Greenhouse supplemental lighting systems.

#### **3. Environmental control inside greenhouse**

Manual controlling, thermostats, microprocessors and computerized control systems. Natural and forced ventilation summer and winter cooling systems, carbon dioxide enrichment method.

#### **4. Planning of greenhouse facility and Materials used for construction**

Site selection and orientation, structural design, covering materials. Wood, Galvanised iron pipe and glass. Greenhouse covering materials – Polyethylene film, PVC, Polyester, Tefzel T<sup>2</sup> film, Polyvinyl chloride rigid panel, fiber glass reinforced plastic rigid panel, Acrylic and polycarbonate rigid panel. Design criteria and construction details of glass and pipe framed greenhouses – Material requirement and procedure for erection.

#### **5. Greenhouse heating and energy storage**

Type of heat loss, heating systems, heat distribution systems, water and rock storage, heat conservation practice.

## 6. Greenhouse irrigation systems

Rules of watering, Hand Watering, perimeter watering, overhead sprinklers, Boom watering, Drip irrigation.

## 7. Greenhouse utilization in off season

Drying of agricultural produce. Economics of greenhouse production – Capital requirements. Economics of production and conditions influencing returns. Protected Agriculture Techniques – row covers.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand different planning criteria for green house
CO 2	Understand different material used for construction of green house and their requirement and erection
CO 3	Understand different environment requirement for crops
CO 4	Identify various greenhouse irrigation system
CO 5	Understand various types of heating system and heat losses in green house

## References

1. Green house Technology and Management by Radha Manohar K and Igathinathane C 2000, B.S.Publication, Hyderabad.
2. Greenhouse Technology Tiwari G.N and Goyal R.K. 1998, Narosa Publishing House, New Delhi.
3. The complete Book of Greenhouse Gardening Cavendish M 1991, Marshal Cavendish Books Ltd, London.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	8	18 %
2	6	12 %
3	6	12 %
4	10	22 %
5	6	12 %
6	6	12 %
7	6	12 %
<b>Total</b>	<b>48</b>	<b>100 %</b>

## Engineering Properties and Processing of Seeds (AGEPE204-II Elective-II)

Course Code	AGEPE204-II (Elective-II)
Course Title	Engineering Properties and Processing of Seeds
Number of Credits	03 (L:3, P:0, DCS:0)
Course Category	PE

### RATIONALE

To enable the students to understand the principles and concepts of various properties of biological materials to design various processing equipment to ensure food quality and safety. They are the basis for measuring instruments and sensors.

- 1. Physical characteristics of different food grains** – Shape, size, roundness, sphericity, porosity and surface area.
- 2. Rheology** – Basic concepts, ASTM standard definition of terms, and rheological Properties-Force deformation behaviour, stress and strain behaviour.
- 3. Friction** – Concept, effect of load sliding velocity, friction in agricultural materials – measurement – rolling resistance, angle of internal friction and angle of repose.
- 4. Flow of bulk granular materials** – Gravity flow in bins and hoppers, Aerodynamics of agricultural products – drag coefficient frictional drag and profile drag or pressure drag and terminal velocity. Application of engineering properties in handling and processing machines and in storage structures.
- 5. Seed processing and blending** – Introduction, Basic flow pattern in seed processing – Preparing seed for processing, Scalper- two screen single air blast scalper, Reel screen scalper and Debearder, services of seed processor, contaminants of seed, physical characteristics used to separate seed. Seed blending Types and Numerical.
- 6. Air screen cleaner** – Installation, separating action, adjustments, Innovations to improving efficiency screen dams, screen brushes, oil cloth cover, Blanking the lower end of the top screen, combination screens, clay crushing rolls, hopper feed.
- 7. Length separations** – Disc separator, operation and adjustments, indented cylinder separator – Variables effect the separation, cylinder speed, size of indent, trough setting, tilt of the cylinder, Adjustable retarder.
- 8. Gravity or weight separations** – Specific gravity separator, the separating action, preparation of seed for processing, parts of the machine, Adjustment of feed rate, air control, end slope, side slope and deck oscillation speed- Destoner.

9. **Aspirators and pneumatic separators** – Fractionating aspirator, scalping aspirator, pneumatic separator.
10. **Surface texture separations** – Roll mill, separating action, finite for liquids separation, magnetic separator, buck horn separator, width and thickness separations (precision grader).
11. **Shape and roundness separations** – spiral separator, inclined draper belt, horizontal disc separator, colour separations – electronic colour sorter.
12. **Importance of material handling devices** –types of conveying equipment's.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the principles of various properties of biological material
CO 2	Understand different unit operations used in seed processing
CO 3	Understand the working of air screen cleaner and different separators
CO 4	Know the different processes in seed processing and blending
CO 5	Comprehend the importance of material handling devices

### References

1. Physical properties of plant and animal materials Mohsenin NN 1986. Gordon and Breach Science publishers, New York.
2. Seed processing B.R. Greeg A.G.Law, S.S.Virdi and B.S.Balls. National Seed Corporations, US aid Publications.
3. Unit operations of Agricultural Produce KM Sahay and KK Singh

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	3	6 %
2	3	6 %
3	3	6 %
4	6	14 %
5	6	14 %
6	5	10 %
7	5	10 %
8	5	10 %
9	3	6 %
10	3	6 %
11	3	6 %
12	3	6 %
<b>Total</b>	<b>48</b>	<b>100 %</b>

### Farm Machinery and Implements Lab-1 (AGEPC210)

Course Code	AGEPC210
Course Title	Farm Machinery and Implements Lab-1
Number of Credits	01(L:0, P:2, DCS:0)
Course Category	PC

#### RATIONALE

To enable the students to have knowledge of different farm machinery constructional features, working and different adjustments used in them.

#### LIST OF PRACTICALS

1. Study of constructional features, working and adjustments of Mould Board Plough.
2. Study of constructional features, working and adjustments of Disc Plough.
3. Study of constructional features and working of Disc Harrow.
4. Study of constructional features and working of Subsoiler.
5. Study of constructional features, working and adjustments of Seed cum fertilizer Drill.
6. Study of constructional features, working and adjustments of Zero till Drill.
7. Study of constructional features, working and adjustments of Potato planter.
8. Study of constructional features, working and adjustments of Sugarcane Planter.
9. Study of constructional features, working and adjustments of Paddy Transplanter.
10. Tractor driving practice.
11. Hitching and de hitching of different implements with the tractor.
12. Preventive/ Routine maintenance of tillage & sowing machines.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand different farm machinery used in farm
CO 2	Understand the construction features and working of different farm machinery
CO 3	Learn the different adjustment used in farm machinery
CO 4	Learn tractor driving
CO 5	Understand the Hitching and de hitching different impalements with tractor



### Post-Harvest Technology Lab (AGEPC212)

Course Code	AGEPC212
Course Title	Post-Harvest Technology Lab
Number of Credits	01(L:0, P:2, DCS:0)
Course Category	PC

#### RATIONALE

To strengthen the students technically in the different post harvesting processes and machinery equipment.

#### LIST OF PRACTICALS

1. Determination of physical properties of agricultural materials e.g. size, shape, density and angle of repose.
2. Determination of moisture content of grains by direct/oven method and by moisture meter.
3. Study of different types of dryers.
4. Study of domestic grain storage structures.
5. Visit to warehouses (bag storage and bulk storage structures).
6. Visit to cold-storage.
7. Study of different packaging materials.
8. Study of material conveying equipment.
9. Visit to canning industry (Milk Plant etc.).

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Find out the moisture contents in the field.
CO 2	Store different material in storage structure.
CO 3	Understand the different packing materials used in industries.
CO 4	Get practical knowledge of different agro industries.
CO 5	Understand the different physical properties of agricultural materials.

## **Manufacturing Technology Lab –II (AGEPC214)**

Course Code	AGEPC214
Course Title	Manufacturing Technology Lab -II
Number of Credits	01(L:0, P:2, DCS:0)
Course Category	PC

### **RATIONALE**

To enable the students to become technically sound by performing practical on different machinery such as CNC, Honing, and Milling etc.

### **LIST OF PRACTICALS**

1. Introduction to drilling and boring machines, an exercise of simple drilling and boring operation, selection of speeds and feeds, use of jigs and fixtures and coolant.
2. Simple exercises on shaper.
3. Practice on horizontal and vertical milling machines, work holding device and types of milling cutters.
4. Practice on cylindrical and centre less grinding machine, selection, dressing and storage of grinding machines. Use of lubricants.
5. Practice on honing machines with selection of honing sticks, honing and finish pattern in the bore. Bore geometry measurement.
6. Observe working of CNC machine including setting of cutting parameters and dimensions and loading of tools, repeatability of operation and adjustment for wear allowances Visit to industry (sheet metal shops) to observe bending and forming operation and use of dies.
7. Visit to industry (Sheet metal shops) to observe bending and forming operation and use of dies.
8. Use of appropriate coolant and lubricants for all machining operation in the workshop and during Industrial visits.

## **INSTRUCTIONAL STRATEGY**

Teacher should take the help of models, chart and non-print instructional resources e.g. CDs etc. so that the students are able to understand the topics effectively.

**Course Outcome:** At the completion of this course the students will be able to:

CO 1	Handle different machine such as milling machine, drilling boring machine etc.
CO 2	Work on CNC machines
CO 3	Understand the use of coolant and lubricants in machines

## I.C. ENGINE LAB (AGEPC216)

Course Code	AGEPC216
Course Title	I.C. ENGINE LAB
Number of Credits	01(L:0, P:2, DCS:0)
Course Category	PC

### RATIONALE

To enable the students to have knowledge of assembling and dismantling of I.C. Engines.

### LIST OF PRACTICALS

1. Identification of various types of diesel engines.
2. Identification of various tools used for dismantling and assembling IC engines.
3. Performing pre-starting checks on engine.
4. Engine dismantling and inspection of various parts, measurements of clearances.
5. Engine assembly and trouble shooting.
6. Study of fuel injection equipment's of multi cylinder engine, dismantling and reassembling.
7. Study of cooling system, water pump, thermostat.
8. Study of lubrication system, oil pump, oil filter.
9. Visits to I.C. Engine repair shops.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Understand the working of various types of diesel engines
CO 2	Perform pre starting checks on engine
CO 3	Understand the lubricating systems
CO 4	Repair and dismantling of various parts of engine
CO 5	Understand the function of fuel injection equipment of multi cylinder engine

### Minor Project (PR202)

Course Code	PR202
Course Title	Minor Project
Number of Credits	02 (L:0, P:04, DCS:0)
Course Category	PR

#### **RATIONALE**

Minor project work aims at exposing the students to field practices, size and scale of operations and work culture at works sites. For this purpose, students during middle of course, are required to be sent at different industries/fields where some activities related to agriculture are in progress or some operations are going on.

#### **GENERAL GUIDELINES**

Depending on the interests of the students, they may be sent to following (or any other field project related to Agricultural Engineering):

- a. Visit to Dairy Industries.
- b. Visit Hatchery.
- c. Fruit processing Plants.
- d. Fruit juice making & packaging in plastic container.
- e. Canning of mango pulp & mango slices.
- f. Automatic bottle washing machine.
- g. Automatic water level sensing crane.

As a minor project activity, each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes seen by him/her and give seminar using computer aided presentation slides using photographs. These students should be guided by respective subject teachers. Each teacher may guide a group of 10 – 15 students. The teachers along with field supervisors will conduct performance assessment of students. Some of the projects are suggested below:

1. Study and preparation of Model of water purifying bicycle.
2. Study and preparation of Model of solar irrigation system.
3. Study and preparation of Model of vegetable slicing machine.
4. Study and preparation of Model of Water pumping system using wind power.
5. Study and preparation of Models of hydraulic pumps.
6. Study and preparation of Models of solar agro sprayer.

**This Industry oriented minor project work will carry 40 marks for internal assessment.**

A group of students (4 to 5 No's) may work on any one project. Each student will prepare the project report of the activities observed by him. They will study the whole process of the plant, and explain the same in their project report. Further they are required to present the Project Report of work done by them through seminar in the class for internal assessment. External examiner will ask the questions on the construction, working, processes observed by the students during their project work: Shortcomings in the works (site) and their remedial measures may be suggested by the students.

**NOTE:** This is only a suggestive list. The students may take any other problem as per their interest. The students of the class may be divided into groups and work may be assigned to each group as per their interest.

**Course Outcome:** At the completion of this course the students will be able to

CO 1	Enhance their knowledge to implement to Major project.
CO 2	Learn new technology used in industries in the field of Agriculture.
CO 3	Learn different processing methods used in industry.

## Essence of Indian Knowledge & Tradition (AU202)

Course Code	AU202
Course Title	Essence of Indian Knowledge and Tradition
Number of Credits	0 (L:2, P:0, DCS:0)
Prerequisite	-
Course Category	AU

### Course Learning Objectives

The objective of this course is to expose the students with the concepts of Indian traditional knowledge and to make them appreciate the importance of the roots of indigenous knowledge system.

### Course Content

#### Unit 1: Indian Knowledge System (IKS)

- Introduction and Function of Indian Knowledge System (IKS).
- The Basic Structure of Indian Knowledge System (IKS) (only Introduction)
  1. The 4 Vedas, Namely ऋग्वेद (Rigveda), यजुर्वेद (Yajurveda), सामवेद (Samaveda), अथर्ववेद (Atharvaveda).
  2. The 4 UpVedas, Namely आयुर्वेद (Ayurveda (health-care)), धनुर्वेद (Dhanurveda (archery)), गंधर्ववेद (Gandharva-veda (dance, music etc.)) and स्थापत्यवेद (Sthapatyaveda (architecture)).
  3. The 6 Vedagangs, namely Shiksha (शिक्षा), Kalpa (कल्प), Vykarana (व्याकरण), Chhandas (छंदस), Nirukta (निरुक्त), and Jyotisha (ज्योतिष).
  4. Itihasa (इतिहास) (Ramayana (रामायण) and Mahabharata महाभारत) and Purana पुराण (Vishnupurana विष्णुपुराण, Bhagavata Purana (भागवत पुराण) etc.)
  5. Dharmashatra धर्मशास्त्र (Manusmriti मनुस्मृति, Yajnavalkya-smriti याज्ञवल्क्य स्मृति, etc.).
  6. Darshan दर्शन (आस्तिक तथा नास्तिक).
  7. Nyaya न्याय (Logic तर्कशास्त्र and Epistemology ज्ञानमीमांसा).

#### Unit 2: Modern Science

- Modern Science: Introduction, Characteristics, Importance and Example.
- Difference between Modern Science and Indian knowledge system.
- Role of IKS in Modern Science.

### **Unit 3: Traditional knowledge**

- Traditional knowledge: Definition, nature, characteristics, scope and importance.
- Indigenous Knowledge (IK): characteristics.
- Traditional knowledge vis-a-vis Indigenous knowledge,
- Traditional knowledge Vs western knowledge.
- The need for protecting traditional knowledge.

### **Unit 4: Yoga and Holistic Health Care**

- Yoga: Meaning and Importance of Yoga.
- Yoga and physical health, Yoga and psychological health, Yoga and intellectual health, Yoga and spiritual health, Yoga and social approach.
- Introduction to Ashtanga Yoga, Yogic Kriyas (Shat Karma).
- Pranayama and its types; Active lifestyle and stress management through Yoga.
- Physical Fitness, Health and wellness: Meaning and Importance of Wellness.
- Components of Wellness, Health and physical Fitness.
- Traditional sports & Regional Games for promoting wellness.
- Leadership through Physical Activity and Sports; Introduction to First Aid.

### **Unit 5: Himachal Pradesh: A Basic Information**

- History, Culture, Heritage/Tradition, Custom & Manners.
- Regional knowledge, Geographical features, Constitutional History.
- Tourism place & Scope.
- Festivals and Fairs.

### **Suggested Text/ Reference Books**

1. Cultural Heritage of India-Course Material by V. Sivaramakrishna Bharatiya, Vidya Bhavan, Mumbai, 5th Edition, 2014 Modern Physics and Vedant by Swami Jitmanand Bharatiya, Vidya Bhavan
2. The wave of Life by Fritz of Capra
3. Tao of Physics Fritz of Capra



4. Tarkasangraha of Annam Bhatta, International by V N Jha, Chinmay Foundation, Velliarnad, Ernakulam
5. Science of Consciousness Psychotherapy and Yoga Practices by RN Jha, Vidyanidhi Prakasham, Delhi, 2016
6. Himachal Pradesh History, Culture & Economy by Mian Goverdhan Singh & Prof. Dr. C.L. Gupta.

### Course Outcomes

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

CO 1	Identify the concept of Indian Knowledge System (IKS).
CO 2	Understand the need and importance of protecting traditional knowledge.
CO 3	Compare the Indian traditional knowledge and modern science.
CO 4	Understand the use of Yoga in stress management, mental health, mindfulness, healthy eating, weight loss and quality sleep.
CO 5	Aware of the general knowledge of Himachal Pradesh.

<b>SUGGESTED DISTRIBUTION OF MARKS (Internal Assessment)</b>		
<b>Project Component</b>	<b>Time Allotted(Hrs.)</b>	<b>Marks Allotted (%)</b>
Unit 1: Indian Knowledge System (IKS)	<b>8</b>	<b>25%</b>
Unit 2: Modern Science	<b>6</b>	<b>20%</b>
Unit 3: Traditional knowledge	<b>5</b>	<b>15%</b>
Unit 4: Yoga and Holistic Health Care	<b>8</b>	<b>25%</b>
Unit 5: Himachal Pradesh: A Basic Information	<b>5</b>	<b>15%</b>
<b>Total</b>	<b>32</b>	<b>100%</b>

### Internship-I (SI-I)

Course Code	SI-I
Course Title	Internship-I
Number of Credits	02(L:0, P:0, DCS:0)
Prerequisite	-
Course Category	SI

#### RATIONALE

Enable the students to acquire the knowledge by direct exposure to industry.

#### GUIDELINES

An internship of four weeks after 3rd semester during vacations should be undertaken in an industry/ Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres / Institutes/ Schemes. The assessment of internship will be carried out in 4th semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

#### EVALUATION CRITERIA

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 4th semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor : 40%

(b) The assessment criteria (External Assessment) by the institute is as follows:

- Presentation : 60%
- Report : 20%
- Viva : 20%

**Course Outcomes**

After completion of this course students will be able to:

CO 1.	Work in peer group.
CO 2.	Develop leadership quality.
CO 3.	Develop communication skills oral / written and acquire practical knowledge.

## Internship-II (SI-II)

Course Code	SI-II
Course Title	Internship-II
Number of Credits	03(L:0,P:0, DCS:0)
Prerequisite	-
Course Category	SI

### RATIONALE

Enable the students to acquire the knowledge by direct exposure to industry.

### GUIDELINES

An internship of Six weeks after 4<sup>th</sup> semester during vacations should be undertaken by the students in relevant industry. The objective of this mandatory internship is to expose the students to the real world of work and get experience with the latest tools, best practices, work & culture, etiquettes and ethics followed in modern industries. The assessment of internship will be carried out in 5<sup>th</sup> semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

### EVALUATION CRITERIA

The internal assessment of internship is to be carried out by the Industry/Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 5<sup>th</sup> semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%

- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor : 40%

(b) The assessment criteria (External Assessment) by the institute is as follows:

- Presentation : 60%
- Report : 20%
- Viva : 20%

**Course Outcomes**

After completion of this course students will be able to:

CO 1.	Work in peer group.
CO 2.	Develop leadership quality.
CO 3.	Develop communication skills oral / written and acquire practical knowledge.