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PBTE/RES/Res/O/260810/0014

GOVERNMENT OF THE PUNJAB
PUNJAB BOARD OF TECHNICAL EDUCATION
21-A Kashmir Block, Allama Iqbal Town, Lahore.

Dated the 10th August, 2026

NOTIFICATION

In pursuance of the NAVTTC Notification No. F.D.G(SS&C)/2021/QD-1(PT-II) dated 22-06-2026, it is notified that the newly developed curriculum of the **Diploma in Agricultural Sciences** has been approved by National Vocational & Technical Training Commission (NAVTTC) for its implementation in all institutes affiliated with PBTE.

2. The implementation of said technology shall apply on the students who shall be registered for academic session 2026-27 and onward. Punjab Board of Technical Education shall conduct the examination of the said technology w.e.f. 1st Annual Examination 2027.Soft copy of the curriculum of the said technology may be downloaded from the website of PBTE i.e. **https://www.pbte.edu.pk/ptextbooks.aspx**

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(MUHAMMAD HAFEEZ)
SECRETARY
PUNJAB BOARD OF TECHNICAL EDUCATION

C.C.

A copy is forwarded for information and necessary action to the:-

1) ***PS to Chairperson, PBTE. Lahore***
2) ***PS to Director General (PSDA), Punjab, Lahore***
3) ***PS to Director General (Academics), TEVTA, Lahore.***
4) ***PS to Director General (Ops-I), TEVTA Lahore.***
5) ***PS to Director General (Ops-II), TEVTA Lahore.***
6) ***PA to Secretary, PBTE, Lahore***
7) ***PA to COE, PBTE, Lahore***
8) ***All Principals, affiliated institutes for DAS program.***
9) ***System Analyst, PBTE, Lahore.***
10) ***Database Administrator, PBTE Lahore.***
11) ***Data Processing Officer, PBTE, Lahore.***
12) ***Computer Programmer, PBTE Lahore***
13) ***AS (Recognition) Section, PBTE, Lahore.***
14) ***AS (Registration) Section, PBTE, Lahore.***
15) ***ACE (P&P-I) Section, PBTE, Lahore.***

16) ***ACE (P&P-II) Section, PBTE, Lahore.***
17) ***ACE (C&V) Section, PBTE, Lahore.***
18) ***ACE NSU, PBTE, Lahore.***
19) ***AS (Certificate) Section, PBTE, Lahore***
20) ***Web Administrator PBTE, to upload at Board's website***

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Curriculum
For
3-Years Diploma
In Agricultural Sciences

(Developed April, 2026)

TRAINING OBJECTIVES

The three-year Diploma in Agricultural Sciences is designed to provide students with a strong foundation in both theoretical knowledge and practical skills related to agriculture and allied sectors. The program aims to develop a clear understanding of crop production, soil science, plant protection, agricultural economics, and farm management etc. It equips students with the scientific principles underlying agricultural practices and helps them understand the functioning of agricultural ecosystems and sustainable farming systems.

A key objective of the diploma is to build practical and technical competencies through hands-on training. Students are trained in land preparation, sowing, irrigation management, nutrient application, weed control, and harvesting techniques. They also gain experience in soil testing, pest and disease management, nursery raising, greenhouse operations, and the use and maintenance of farm machinery and tools. This practical exposure ensures that students are capable of handling real-life agricultural operations efficiently.

The diploma also emphasizes sustainable and environmentally responsible agriculture. Students are introduced to organic farming, integrated nutrient management, integrated pest management, water conservation techniques, and climate-smart agricultural practices. The objective is to promote resource-efficient farming methods that protect the environment while maintaining productivity.

Another important objective is to develop entrepreneurial and agribusiness skills. The program prepares students to manage farms effectively and understand agricultural marketing systems. It encourages self-employment and enterprise development in areas such as horticulture, dairy farming, poultry farming, and agro-processing. The diploma holders will be competent to work as agricultural technicians, farm managers, or entrepreneurs.

CURRICULUM SALIENTS:

Entry level	:	Matric (Science)
Duration	:	3-Years
Total Credit Hours:		69 hours
	:	Approx. 40 hours per week
	:	7 hours/day (Friday 5 Hours)
Training Methodology	:	Practical
	:	Theory
Medium of Instruction	:	English/ Urdu

SCHEME OF STUDIES FOR 3-Years' DIPLOMA IN AGRICULTURAL SCIENCES (DAS)

1st YEAR

Sr. No.	COURSE CODE	COURSE TITLE	CREDIT HOURS	Periods per Week		Marks		
				Theory	Practical	Theory	Practical	Total
1	DAS-113	Agriculture Extension-I	3(3-0)	03	00	150	00	150
2	DAS-123	Agronomy-I	3(2-1)	02	03	100	50	150
3	DAS-133	Applied Biology in Agriculture	3(2-1)	02	03	100	50	150
4	DAS-143	Applied Physics in Farm Mechanization	3(2-1)	02	03	100	50	150
5	DAS-153	Horticulture-I	3(2-1)	02	03	100	50	150
6	DAS-163	Environmental Sciences & Forestry	3(2-1)	02	03	100	50	150
7	ENG-142	English-I	2(2-0)	06	00	100	00	100
8	GEN-172	Urdu-I	2(2-0)	06	00	100	00	100
9	RE111/ISLl11	Religious Education / Islamiat	1(1-0)	03	00	50	00	50
10	ETH111 / CIV111/TT111	Ethics-I / Civics-I / Tarjumat-ul-Quran-I	1(1-0)	01	00	50	00	50
Total			24(19-5)	29	15	950	250	1200
				44				

2nd YEAR

Sr. No.	COURSE CODE	COURSE TITLE	CREDIT HOURS	Periods per Week		Marks		
				Theory	Practical	Theory	Practical	Total
1	DAS-213	Agriculture Extension-II	3(3-0)	03	00	150	00	150
2	DAS-223	Agronomy-II	3(2-1)	02	03	100	50	150
3	DAS-233	Plant Protection	3(2-1)	02	03	100	50	150
4	DAS-243	Agriculture Machinery	3(2-1)	02	03	100	50	150
5	DAS-253	Horticulture-II	3(2-1)	02	03	100	50	150
6	DAS-263	Agri. Business Management.	3(3-0)	03	00	150	00	150
7	ENG-242	English-II	2(2-0)	06	00	100	00	100
8	GEN-272	Urdu-II	2(2-0)	06	00	100	00	100
9	GEN-291	Pakistan Study	1(1-0)	03	00	50	00	50
10	ETH211 / CIV211/TT211	Ethics-II/ Civics-II / Tarjumat-ul-Quran-II	1(1-0)	01	00	50	00	50
Total			24(20-4)	30	12	1000	200	1200
				42				

3rd YEAR

Sr. No.	COURSE CODE	COURSE TITLE	CREDIT HOURS	Periods per Week		Marks		
				Theory	Practical	Theory	Practical	Total
1	DAS-313	Soil Fertility and Plant Nutrition	3(2-1)	02	03	100	50	150
2	DAS-323	On- Farm Water Management	3(2-1)	02	03	100	50	150
3	DAS-333	Introductory Plant Breeding	3(2-1)	02	03	100	50	150
4	COMP-383	Computer Science	3(2-1)	02	03	100	50	150
5	DAS- 343	Post-Harvest Horticulture	3(2-1)	02	03	100	50	150
6	DAS-353	Applied Chemistry in Food Science	3(2-1)	02	03	100	50	150
7	*DAS*-363	Project	3(0-3)	00	09	00	150	150
Total			21(12-9)	12	27	600	450	1050
				39				

Diploma in Agriculture Sciences (DAS)

1st Year

AGRICULTURE EXTENSION-I

DAS-113

Paper A&B

Total Contact Hours

Theory	**96**	**T**	**P**	**C**
Practical	**00**	**3**	**0**	**3**

Learning Outcomes

By the end of this course, students will be able to understand, explain, apply, and demonstrate agricultural extension principles, methods, communication techniques, and adult learning strategies in rural development work.

Course Contents:

Paper A (48 Hours)

1. INTRODUCTION TO AGRICULTURE EXTENSION 10 Hours

1.1 Introduction

1.2 Concept of Education
- 1.2.1 Formal education
- 1.2.2 Non-formal education
- 1.2.3 Informal education

1.3 Concept of Agricultural Extension

1.4 Principles of Agricultural Extension

1.5 Objectives of extension

1.6 Extension worker/agent
- 1.6.1 Role of extension worker/agent
- 1.6.2 Qualification of extension worker/agent
- 1.6.3 Duties of extension worker/agent

2. EXTENSION METHODS AND APPROACHES 16 Hours

2.1 Extension methods

2.2 Types of extension methods
- 2.2.1 Individual
- 2.2.2 Group
- 2.2.3 Mass Media

2.3 Agricultural extension approaches
- 2.3.1 On-farm demonstrations
- 2.3.2 Agricultural information services
- 2.3.3 Crop maximization programs
- 2.3.4 Extension through fellow farmers
- 2.3.5 Credit-based extension

2.3.6 Women's extension services
2.3.7 Training and visits systems (T&V)

2.4 Weaknesses of traditional agriculture extension
2.4.1 Organizational
2.4.2 Coverage and Mobility
2.4.3 Training of extension agents
2.4.4 Insufficient coordination with research

3. ADULT LEARNING IN AGRICULTURE EXTENSION 15 Hours

3.1 Adult education
3.1.1 Adult education in extension
3.2 Adult Learner
3.3 Needs of adults
3.4 Characteristics of an adult farmer
3.5 Adoption process
3.6 Principles of adult learning
3.7 Techniques for extension workers
3.8 Motivation

4. COMMUNICATION 07 Hours

4.1 Definition
4.2 The process of Communication
4.3 Elements of communication
4.3.1 Sender
4.3.2 Message
4.3.3 Channel
4.3.4 Receiver
4.3.5 Feedback
4.3.6 Noise
4.4 Goals of Communication
4.5 Forms of communication
4.5.1 Intra-personal communication
4.5.2 Interpersonal communication
4.5.3 Group communication
4.5.4 Mass communication
4.5.5 Non-verbal communication
4.6 Barriers to communication
4.6.1 Physical
4.6.2 Language
4.6.3 Cultural
4.6.4 Psychological
4.6.5 Emotional
4.6.6 Time
4.6.7 Information
4.7 Techniques for effective communication
4.8 Public Speaking (Brief coverage)

Paper B (48 Hours)

5. Applied Extension Methods of communication **03Hours**

5.1 Practical communication skills
5.2 Public speaking practice
5.3 Communication evaluation

6. MASS CONTACT METHODS **17Hours**

6.1 Mass Contacts
6.1.1 Mass Media
6.2 Electronic Media
6.2.1 Radio
6.2.2 Television
6.2.3 Internet
6.3 Printed media
6.3.1 Newspaper
6.3.2 Magazines

7. INDIVIDUAL CONTACT METHODS **10 Hours**

7.1 Farm Visits
7.2 Home visits
7.3 Official calls
7.4 Personal letters
7.5 Telephone calls

8. GROUP CONTACT TECHNIQUES **18 Hours**

8.1 Group contact methods
8.2 Demonstration
8.2.1 Method Demonstration
8.2.2 Result Demonstration
8.3 Group meetings/discussions
8.4 Seminar/Workshop
8.5 Tours and field trips/exposure visits
8.6 Field days
8.7 Farmers' training centers

Recommended Books:-

1. Extension Methods, by Rajab Ali Memon, National Book Foundation.

2. Khan, M.H.2009.Participatory Rural Development in Pakistan, Oxford University, USA

3. Muhammad, S.2005 Agriculture Extension: strategies and skills. Unitech Communication, Faisalabad.

Instructional Objectives

1: Introduction to Agriculture Extension

1. Define agriculture extension and explain its importance.
2. Differentiate between formal, non-formal, and informal education.
3. Explain the concept and scope of agricultural extension.
4. State and describe the principles of agricultural extension.
5. Identify and explain the objectives of extension services.
6. Describe the roles, qualifications, and duties of an extension worker.
7. Analyze the importance of extension agents in rural development

2 Extension Methods and Approaches

1. Define extension methods and explain their importance.
2. Classify extension methods into individual, group, and mass methods.
3. Compare different agricultural extension approaches.
4. Explain the Training and Visit (T&V) system.
5. Describe on-farm demonstrations and farmer-to-farmer approaches.
6. Identify the weaknesses of traditional agricultural extension systems.
7. Evaluate appropriate extension approaches for different rural situations.

3 Adult Learning in Agriculture Extension

1. Define adult education and explain its relevance to extension.
2. Describe the characteristics and needs of adult learners.
3. Explain the adoption process of innovations.
4. Apply principles of adult learning in extension programs.
5. Identify suitable techniques for teaching adult farmers.
6. Explain motivational strategies for encouraging the adoption of innovations.
7. Design simple extension activities based on adult learning principles.

4: Communication

1. Define communication and describe its process.
2. Identify and explain the elements of communication.
3. Distinguish between different forms of communication.
4. Identify barriers to effective communication.
5. Apply techniques for effective communication in extension work.
6. Demonstrate basic public speaking skills.

7. Evaluate communication effectiveness in extension settings.

5: Applied Extension Methods of communication

1. **Explain** the importance of practical communication skills in agricultural extension work.
2. **Demonstrate** effective verbal and non-verbal communication techniques in real-life extension situations.
3. **Apply** appropriate communication strategies while interacting with farmers and rural communities.
4. **Develop and deliver** a short public speech on an agricultural topic with clarity and confidence.
5. **Use** proper voice modulation, body language, and audience engagement techniques during public speaking.
6. **Evaluate** the effectiveness of communication based on feedback and predefined criteria.
7. **Identify and improve** weaknesses in personal communication and presentation skills.

6: Mass Contact Methods

1. Define mass contact methods in extension.
2. Identify different types of mass media used in agriculture.
3. Explain the role of electronic media in agricultural communication.
4. Describe the use of printed media in disseminating agricultural information.
5. Select appropriate mass media tools for different target audiences.
6. Assess the advantages and limitations of mass contact methods.

7: Individual Contact Methods

1. Define individual contact methods.
2. Describe different types of individual extension contacts.
3. Explain the importance of farm and home visits.
4. Demonstrate effective techniques for personal communication.
5. Evaluate the advantages and limitations of individual contact methods.

8: Group Contact Techniques

1. Define group contact methods in extension.
2. Differentiate between method and result demonstrations.
3. Organize and conduct group meetings and discussions.
4. Plan seminars, workshops, and field days.
5. Describe the importance of tours and exposure visits.
6. Evaluate the effectiveness of group training techniques.
7. Develop a simple group extension plan.

Agronomy-I

DAS-123

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

This course aims to equip students with the knowledge and skills related to the improvement of agricultural products. Students will develop the basic concepts of Agriculture and its related disciplines. It also aims to develop sustainable and environmentally friendly agriculture practices. The Goal of this course is also to develop an understanding of the sustainable use of agricultural resources to improve the well-being of rural and urban communities. In a nutshell, by the end of this course, students will understand the basic principles of agriculture, agronomy, crop classification, crop physiology, crop production technology, and farm management, and apply this knowledge to practical agricultural situations.

Course Contents:

1. **Agriculture** **10 Hours**
   1.1 Importance of Agriculture
   1.2 Branches of Agriculture
   1.2.1Crop Husbandry (Arable Farming)

i. Agronomy

i.i. General Agronomy

i.ii. Crop Physiology

i.iii Seed Technology

ii. Plant Breeding and Genetics

iii. Soil Science

iv. Horticulture

iv.i. Pomology

iv.ii. Olericulture

iv.iii. Floriculture

iv.iv. Landscaping

v. Plant Protection Science

v.*i. Entomology*

v.ii. Plant Pathology

v.iii. Weed Science

vi. Agriculture Mechanization

vii. Agricultural Water Management

viii. Major Agricultural Products

viii.i Food

viii.ii Feed

viii.iii Fiber

viii.iv Fuel

viii.v Medicinal Products

viii.vi Ornamental Plants

2. AGRONOMY **10 Hours**

2.1 Introduction to Agronomy

2.1.1 Etymology ("Agros" and "Nomos")

2.2 Definition and Scope of Agronomy

2.2.1 Principles of Crop Production and Soil Management

2.3 Importance of Agronomy in Agriculture

2.3.1 Enhancing Productivity and Sustainability

2.4 Brief History of Agronomy

2.4.1Ancient Civilizations to Modern Innovations

2.5 Career Opportunities in Agronomy

2.5.1 Roles in Research, Consulting, Industry, and Policy

3. CLASSIFICATION OF CROPS **12Hours**

3.1 Significance of Crop Classification

3.2 Agronomic Classification

3.2.1 Cereals, Pulses, Oilseeds, Fiber Crops, etc.

3.3 Special Purpose Classification

3.3.1 Catch Crops, Cover Crops, Trap Crops, etc.

3.4 Classification Based on Life Cycle

3.4.1 Annual, Biennial, Perennial Crops

3.5 **Classification Based on Growing Season**

3.5.1Kharif, Rabi, Zaid Crops

3.6 Classification Based on Photoperiod

3.6.1 Short-Day, Long-Day, Day-Neutral Crops

3.7 Classification Based on Growth Habitat

3.7.1 *Herbs, Shrubs, Trees, Climbers, Creepers*

3.8 Classification Based on Mode of Propagation

3.8.1 Seed, Vegetative, and Micropropagation

3.9 Classification Based on Mode of Photosynthesis

3.9.*1 C3, C4, CAM Plants*

3.10 Classification Based on Nutrient Requirement

3.10.1 Exhaustive, Light-Feeder, Restorative Crops

3.11 Classification Based on Water Requirement

3.11.1 *Water-Intensive, Moderate-Water, Low-Water Crops*

3.12 Classification Based on Root System

3.12.1 Taproot vs. Fibrous Root Crops

3.13 Classification Based on Growth of Stem

3.13.1 *Erect, Creeping, Climbing Stems*

4. CROP PHYSIOLOGY 10 Hours

4.1 Concept of Crop Physiology

4.1.1. Importance in Growth, Adaptation, and Yield Optimization

4.2 Carbon Metabolism

4.2.1. Photosynthesis, Respiration, Transpiration and Evapotranspiration

4.3 Factors Affecting Photosynthesis, Respiration, Transpiration and Evapotranspiration

4.3.1 Light, CO_2, Temperature and Water

4.4 Photosynthetic Efficiency of Crop Plants

4.4.1 C3 vs. C4 vs. CAM Plants

4.5 Physiology of Key Growth Stages

4.5.1Germination, Dormancy, Seedling Establishment

4.5.2 Tillering, Root/Stem/Leaf/Flower/Seed Development

4.6 Maturity, Senescence, and Abscission

4.6.1 Aging and Shedding in Plants

4.7 Biological Nitrogen Fixation

4.7.1 Process, Symbiotic Bacteria

4.8 Plant Growth Regulators

4.8.1 Synthesis, Translocation, and Mode of Action

4.8.2 Auxins, Cytokinins, Gibberellins, Ethylene, Abscisic Acid

5. CROP PRODUCTION TECHNOLOGY 14 Hours

5.1 Matching Crops to Environment & Land Preparation

5.1.1 Soil and Seasonal Suitability

5.1.2 Tillage, Conservation Practices, Soil Amendment

5.2 Planting the Seeds

5.2.1 Seed Selection, Timing, Methods (Drill vs. Broadcasting)

5.2.2 Seed Treatment and Depth/Spacing

5.3 Feeding the Plants (Fertilizers)

5.3.1 Soil Testing, Fertilizer Application (NPK Ratios)

5.3.2 Integrated Nutrient Management

5.4 Watering the Crops (Irrigation)

5.4.1 Crop-Specific Water Needs

5.4.2 Precision Irrigation Methods

5.4.3 Water Conservation

5.5 **Protecting from Pests & Weeds**

5.5.1 IPM Strategies: Resistant Varieties, Biological Controls

5.5.2 Herbicide Application and Manual Weeding

5.6 Harvesting the Crop

5.6.1 Indicators of Maturity

5.6.2 Manual vs. Mechanical Harvesting

5.6.3 *Post-Harvest Drying*

5.7 **Storing the Grain**

5.7.1 Conditions for Safe Storage

5.7.2 Technologies: Airtight Bags, Silos

5.7.3 Pest Prevention and Monitoring

6. FARM MANAGEMENT 08 Hours

6.1 Concept of Farm Management and Record Maintenance

6.2 Definition and Principles of Farming Systems

6.2.1 Collective vs. Cultivation Farming Systems

6.3 Objectives and Advantages of Farm Records

6.3.1 Types of Farm Records

6.3.2 Financial Monitoring, Legal Compliance, and Decision-Making

Recommended Books:-

1. Balasubrananiyan, P. 2007, Principles and Practices of Agronomy (2nd Ed), Agri Bios Publishers India.
2. Ready, S.R. 2007, Principles of Agronomy, 3rd edition, Kalyani Publishers, New Delhi, India.
3. Panda, S.C. 2006. Soil Management and Organic Farming, Agro Bios Publishers, India.
4. Akhtar, A. M. 2004. General Agricultural, 3rd edition, Publishers Emporium, Urdu Bazar, Lahore.
5. Agriculture the Basic by Dr. Inam Ullah and Dr. Asad Ali Khan
6. Muhammad Naveed Arshad, Basics of Agricultural Sciences (2025). Publisher: LAP Lambert Academic Publishing ISBN: 978-3659764844

Instructional Objectives

1. Agriculture

1. Define agriculture and explain its importance to food security, economy, and livelihoods.
2. Identify and describe the major branches of agriculture.
3. Differentiate between agronomy, horticulture, soil science, plant protection, and agricultural engineering.
4. Classify the subdivisions of horticulture (pomology, olericulture, floriculture, landscaping).
5. Explain the role of plant protection sciences (entomology, plant pathology, weed science).
6. Describe the importance of agricultural mechanization and water management.
7. List and explain major agricultural products (food, feed, fiber, fuel, medicinal, ornamental).
8. Relate agricultural branches to real-world farming practices.

2. Agronomy

1. Explain the etymology of agronomy ("Agros" and "Nomos").
2. Define agronomy and describe its scope in crop production and soil management.
3. Explain the importance of agronomy in increasing productivity and sustainability.
4. Summarize the historical development of agronomy from ancient to modern times.
5. Identify career opportunities in agronomy (research, extension, consulting, industry, policy).
6. Apply basic agronomic principles to crop production systems.

3. Classification Of Crops

1. Explain the significance of crop classification in agriculture.
2. Classify crops based on agronomic groups (cereals, pulses, oilseeds, fiber crops, etc.).
3. Differentiate crops based on special purposes (catch crops, cover crops, trap crops).
4. Classify crops according to life cycle (annual, biennial, perennial).
5. Distinguish crops by growing season (Kharif, Rabi, Zaid).
6. Differentiate crops based on photoperiod requirements.
7. Classify crops based on habitat, propagation method, and photosynthetic pathway (C3, C4, CAM).
8. Categorize crops according to nutrient and water requirements.
9. Differentiate crops based on root systems and stem growth patterns.
10. Apply classification systems to identify crops in practical situations.

4. Crop Physiology

1. Define crop physiology and explain its importance in yield optimization.
2. Describe the processes of photosynthesis and respiration.
3. Explain factors affecting photosynthesis and respiration.
4. Compare C3, C4, and CAM plants in terms of photosynthetic efficiency.
5. Describe physiological processes during germination, vegetative growth, flowering, and seed development.
6. Explain maturity, senescence, and abscission in crops.
7. Describe biological nitrogen fixation and the role of symbiotic bacteria.
8. Brief introduction of major plant growth regulators and their functions.
9. Apply physiological knowledge to solve crop production problems.

5. Crop Production Technology

1. Match crops with suitable environmental and soil conditions.
2. Explain different land preparation and tillage methods.
3. Demonstrate proper seed selection, treatment, and planting methods.
4. Calculate and apply appropriate fertilizer recommendations (NPK ratios).
5. Explain integrated nutrient management practices.
6. Describe irrigation methods.
7. Apply integrated pest management (IPM) strategies.
8. Identify indicators of crop maturity and proper harvesting methods.
9. Explain post-harvest handling and drying techniques.
10. Describe safe grain storage practices and pest prevention methods.
11. Evaluate appropriate crop production technologies for different farming systems.

6. Farm Management

1. Define farm management and explain its importance.
2. Describe principles of farming systems.
3. Differentiate between collective and cultivation farming systems.
4. Explain the importance of farm record keeping.
5. Identify different types of farm records.
6. Analyze farm records for financial monitoring and decision-making.
7. Apply farm management principles to improve farm efficiency and profitability.

List of Practical (96 Hours)

1. Collect and identify different types of weeds found in agricultural fields.
2. Demonstrate and apply various weed control methods (manual, mechanical, chemical, and cultural).
3. Identify and classify basic agricultural implements and hand tools used in farming operations.
4. Measure and calculate land area using field measurement techniques.
5. Prepare and interpret weather maps by identifying different ecological zones of Pakistan.
6. Identify and label different parts of a plant specimen.
7. Identify and classify different crop seeds based on physical characteristics.
8. Conduct and evaluate a seed germination test under controlled conditions.
9. Perform planting operations and determine appropriate crop spacing in field conditions.
10. Observe, record, and analyze crop growth parameters during different growth stages.
11. Crop appraisal of different crops for the determination of yield
12. Moisture determination of different grains for safe storage
13. Calculate germination percentage of different field crops.

Applied Biology in Agriculture

DAS-133

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

By the end of this course, students will be able to identify major pests and diseases of crops and fruits, explain their economic importance, and apply appropriate plant protection and integrated pest management strategies safely and effectively.

Course Contents:

1. Applied Biology **04 Hours**

1.1 Importance of Applied Biology in Agriculture
1.2 History
1.3 Branches

2. PEST **06 Hours**

2.1 Introduction to Pest.
2.2 Types of Pest
2.2.1 Insect
2.2.2 Weeds
2.2.3 Microorganisms
a. Bacteria b. Fungi c. Virus d. Nematodes
2.2.4. Mites
2.2.5. Snail & Slugs
2.2.6 Plant Parasites
2.2.7 Rodents
2.2.8 Birds
2.2.9 Wild Animals

3. INSECT **06 Hours**

3.1 Insect Body Parts
3.1.1 Insect Head
a. Antennae b. Mouth Parts
3.1.2 Insect Thorax
a. Legs b. Wings
3.1.3 Insect Abdomen
3.2 Insect Metamorphosis
3.2.1 Types of Metamorphosis
3.2.2 Significance & Importance of Metamorphosis.
3.3 Damage Caused by Insect Pest
3.3.1 Direct Losses
3.3.2 Indirect Losses
3.3.3 Economic Losses.

4. MAJOR INSECT PESTS OF RABI AND KHARIF CROPS **10 Hours**

4.1 Wheat and Barley

4.2 Rabi Pulses
4.3 Rabi Vegetables and Oilseed Crops
4.4 Kharif Crops
4.4.1 Sugarcane
4.4.2 Maize and sorghum
4.4.3 Rice
4.4.4 Kharif Vegetables and Oilseed Crops
4.4.5 Cotton
4.5 Insect pests of stored Grains
4.6 Vertebrate Pests

5. MAJOR DISEASES OF RABI AND KHARIF CROPS 10 Hours

5.1 Wheat
5.2 Rabi Pulses
5.3 Rabi Vegetables
5.4 Ground Nut
5.5 Barseem
5.6 Kharif Crops
5.6.1 Sugarcane
5.6.2 Maize
5.6.3 Rice
5.6.4 Kharif Vegetables

6. INSECT PEST OF MAJOR FRUITS 10 Hours

6.1 Pome Fruit
6.2 Citrus Fruit
6.3 Stone Fruit
6.4 Berries
6.5 Date Palm
6.6 Mango
6.7 Apple

7. DISEASES OF MAJOR FRUITS 10 Hours

7.1 Pome Fruit
7.2 Citrus Fruit
7.3 Stone Fruit
7.4 Berries
7.5 Date Palm
7.6 Mango
7.7 Apple
7.8 Guava
7.9 Peach
7.10 Grapes

8. INTEGRATED PEST MANAGEMENT (IPM) 04 Hours

8.1 Factors Affecting Insect Population
8.1.1 Physical Factors/Weather Conditions
a. Light b. Temperature c. Humidity/Rainfall d. Wind

8.1.2 Biological Factors
a. Competitors b. Member of the same Family c. Food Source d. Farmer Friends (Beneficial)
8.2 IPM Measures
8.2.1 Preventive Measures
8.2.2 Curative Measures

9. SAFE USE OF PESTICIDES 04 Hours

9.1 Pre-Application
9.2 During Application
9.3 Post Application
9.4 Precautionary Measures
9.5 Storage

Recommended Books:-

1. Ahmed I.2010,Hasharat(insects) National Book Foundation Lahore
2. Shah, H.A. & Saleem M.A., 2002 Applied Entomology(3rd Ed.), Izhar Sons Publisher, Lahore
3. Khan, M.A. and Sahi, S.T. 2007. Laboratory Manual of Plant Pathology, Department of Plant Pathology, University of Agriculture, Faisalabad
4. Manisegaran, S. 2008. Pest Management in Field Crops: Principles and Practices, Agrobios Publisher, Jodhpur, India.
5. Gupta, G.P. 2004. Plant Diseases, 1st Ed., Discovery Publishing House, New Delhi, India.

Instructional Objectives

1. Applied Biology

1. Define applied biology and explain its importance in biology in agriculture.
2. Describe the historical development of biological practices.
3. Identify and explain the major branches of applied biology with reference to agriculture (Entomology, Plant Pathology, Weed Science, Nematology, etc.).
4. Explain the role of the applied side of biology in improving crop yield and quality.

2. Pest

1. Define pest and explain its significance in agriculture.
2. Classify pests into major categories (insects, weeds, microorganisms, mites, rodents, birds, wild animals, etc.).
3. Differentiate between bacteria, fungi, viruses, and nematodes as plant pathogens.
4. Identify various types of vertebrate and invertebrate pests.
5. Explain the impact of different pests on crop production.

3. Insect

1. Describe and label the main body parts of an insect (head, thorax, abdomen).
2. Identify insect mouthparts, antennae, legs, and wings.
3. Differentiate between types of insect metamorphosis (complete and incomplete).
4. Explain the significance of metamorphosis in insect development and control.
5. Identify different types of damage caused by insect pests.
6. Distinguish between direct, indirect, and economic losses caused by insects.

4. Major Insect Pests of Rabi and Kharif Crops

1. Identify major insect pests of wheat, barley, pulses, vegetables, and oilseed crops (Rabi crops).
2. Identify major insect pests of sugarcane, maize, sorghum, rice, cotton, and Kharif vegetables.
3. Recognize insect pests of stored grains.
4. Identify vertebrate pests affecting field crops.
5. Describe the nature of damage caused by major insect pests.
6. Recommend appropriate control measures for major crop pests.

5. Major Diseases of Rabi and Kharif Crops

1. Identify major diseases of wheat, pulses, vegetables, groundnut, and barseem.
2. Identify important diseases of sugarcane, maize, rice, and Kharif vegetables.
3. Differentiate between fungal, bacterial, viral, and nematode diseases.
4. Describe symptoms and modes of transmission of major crop diseases.
5. Recommend suitable disease management practices.

6. Insect Pests of Major Fruits

1. Identify major insect pests of pome fruits, citrus, stone fruits, berries, and date palm.
2. Identify insect pests affecting mango and apple.
3. Describe symptoms and damage caused by fruit pests.
4. Recommend appropriate pest control measures for fruit crops.

7. Diseases of Major Fruits

1. Identify major diseases of pome fruits, citrus, stone fruits, berries, and date palm.
2. Identify important diseases of mango, apple, guava, peach, and grapes.
3. Describe disease symptoms and causal organisms.
4. Recommend suitable preventive and curative disease control measures.

8. Integrated Pest Management (IPM)

1. Define Integrated Pest Management (IPM).
2. Explain physical and biological factors affecting insect populations.
3. Differentiate between preventive and curative IPM measures.
4. Identify beneficial organisms and explain their role in pest control.
5. Design a basic IPM strategy for a selected crop.

9. Safe Use of Pesticides

1. Explain the importance of safe pesticide use.
2. Describe precautions before, during, and after pesticide application.
3. Demonstrate proper handling, mixing, and application procedures.
4. Explain correct pesticide storage methods.
5. Apply safety measures to minimize environmental and health hazards.

List of Practical (96 Hours)

1. Identify and label the body parts of an insect (head, thorax, abdomen and appendages).
2. Observe and differentiate types of insect metamorphosis (complete and incomplete).
3. Examine and describe the digestive system of insects.
4. Demonstrate the circulatory system of insects.
5. Demonstrate the nervous system of insects.
6. Collect, preserve, and mount insect specimens from field conditions.
7. Identify and classify insects based on morphological characteristics.
8. Identify and document pests of field crops and stored grains.
9. Complete and present assigned practical tasks and written reports.
10. Conduct and report observations during a supervised field visit.
11. Demonstrate and evaluate fumigation techniques before and after grain storage.
12. Demonstrate and practice basic apiculture (beekeeping) techniques.
13. Demonstrate and describe basic sericulture (silkworm rearing) practices.
14. Identify and differentiate types of spray nozzles and their uses.
15. Identify, operate, and compare different types of spray machines used in pest control.

Applied Physics in Farm Mechanization

DAS-143

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

This course aims to equip students with comprehensive knowledge and skills of Farm Mechanization, including the theory, operation and maintenance of Agricultural Machinery, particularly Tractors and Engines. The Course also aims to introduce students to the practical application of renewable energy technologies in agriculture and its sustainable practices with efficient use of resources. At the end of the course, students will be able to apply modern agricultural techniques, select appropriate machinery and maintain equipment for enhanced productivity.

Course Contents:

01 Basic Physics Applied to Agriculture 07 Hours

1.1 Mechanics
- *1.1.1 Force*
- *1.1.2 Work*
- *1.1.3 Power*
- *1.1.4 Energy*
- *1.1.5 Friction*
- *1.1.6 Torque*

1.2 Thermodynamics
- *1.2.1 Heat*
- *1.2.2 Temperature*
- *1.2.3 Laws*
- *1.2.4 Heat engines*

1.3 Fluid Mechanics
- *1.3.1 Pressure*
- *1.3.2 Flow*
- *1.3.3 Pumps*

1.4 Electricity
- *1.4.1 Current*
- *1.4.2 Voltage*
- *1.4.3 Resistance*
- *1.4.4 Ohm's Law*

02 Introduction to Farm Mechanization 07 Hours

2.1 Farm Mechanization

2.2 Need and Importance of Farm Mechanization

2.3 Comparison between traditional and mechanized farming

2.4 Key Barriers to Mechanization and Proposing Steps for Improvement
2.5 Benefits of Renting Agricultural Equipment
2.6 Cons/Disadvantages of Renting Agricultural Equipment
2.7 Best Practices for Maintaining Farm Machinery
2.8 Best Practices for Storing Farm Machinery

03 Tractor 05 Hours

2.1 Overview of Tractors
2.2 Classification of Tractors
2.3 Performance Enhancement Techniques
2.4 Standard Tractors Used in Pakistan and Their Specifications
2.5 Guidelines for Tractor Implements and Purchase Decisions

03 Tractor Engine 05 Hours

3.1 Basic Theory of Engines
3.2 Diesel and Petrol Engines in Agriculture Specifications Comparison
3.3 Types of Engine Horsepower

04 Tractor Movement Control, Instruments, and Systems 05 Hours

4.1 Controls for Tractor Movement
4.2 Dashboard Components
4.3 Wheel Alignment
4.4 Systems within a Tractor Engine and Their Functions

05 Tractor Maintenance 05 Hours

5.1 Tractor Logbook
5.2 Repair and Maintenance Book
5.3 Tractor Maintenance Schedules
5.4 Troubleshooting Common Engine Problems

06 Hand Tools Used in Agriculture 06 Hours

6.1 Traditional Tools Used in Pakistan
6.2 Basic Information and Performance of Farm Hand Tools and Power Tools
6.3 Common Power Tools
6.4 Use and Performance of Workshop Hand and Power Tools in an Agricultural Setting

07 Introduction to Renewable Energy 08 Hours

7.1 Sources of Power and Energy in Agriculture
7.2 Non-Renewable Energy
7.3 Conventional vs. Non-Conventional Energy

08 Introduction to Biogas Technology 08 Hours

8.1 Biogas and Its Importance in Sustainable Agriculture
8.2 Basic Principles of Anaerobic Digestion and Types of Digesters
8.3 Factors Affecting Biogas Production and Applications

09 Solar Energy Applications in Agriculture 08 Hours

9.1 Solar Driers and the Importance of Solar Driers in Agriculture
9.2 Solar Powered Irrigation Systems

Recommended Books

1. Zakria, M. and M. A. Ali. 2012. Rahnmai Machini Kashtkari braai Tulba Diploma in Agricultural Sciences wa Zarai Karknan. Directorate General Agri. (Ext. & A. R.) Punjab Lahore.
2. Bell, B., 2008. Farm Machinery (5th Edition) Old Pond Publishing Company, USA.
3. Power, A.G., and Aware, V.V.2007. Farm Mechanization and Power, New India Printers, New Delhi, India.
4. Tahir, A.R. & Sabir, M.S. 2003, Fundamentals of Tractor & Agri. Machinery, Deptt. of Farm Machinery, University of Agriculture, Faisalabad.
5. Ransome, J.A. 2003, Implements of Agriculture. Old Pond Publishing Ltd. USA.
6. Jochen Bundschuh, Guangnanchen. 2014"Sustainable Energy Solution in Agriculture" CRC press.
7. Bent Sorensen 2007."Renewable Energy Conversion, Transmission and storage" Technology and Engineering Academic press.

Instructional Objectives

1. Introduction to Farm Mechanization

1. Define farm mechanization and explain its role in modern agriculture.
2. Describe the need and importance of farm mechanization in improving productivity and reducing labor.
3. Compare traditional farming methods with mechanized farming systems.
4. Identify key barriers to farm mechanization and propose practical improvement solutions.
5. Evaluate the benefits and disadvantages of renting agricultural equipment.
6. Explain best practices for maintaining farm machinery.
7. Describe proper storage methods to extend the life of farm machinery.

2. Tractor

1. Describe the basic structure and functions of a tractor.
2. Classify tractors based on type, power, and purpose.
3. Identify standard tractors used in Pakistan and describe their specifications.
4. Explain techniques used to enhance tractor performance.
5. Recommend appropriate tractor implements based on farm needs.
6. Apply guidelines for selecting and purchasing a suitable tractor.

3. Tractor Engine

1. Explain the basic working theory of internal combustion engines.
2. Differentiate between diesel and petrol engines used in agriculture.
3. Compare engine specifications and performance characteristics.
4. Identify different types of engine horsepower and explain their significance.
5. Relate engine performance to agricultural operations.

4. Tractor Movement Control, Instruments, and Systems

1. Identify and operate tractor movement controls (clutch, brake, accelerator, steering).
2. Describe the functions of dashboard instruments and gauges.
3. Explain the importance of proper wheel alignment.
4. Identify major systems within a tractor (fuel, lubrication, cooling, electrical) and describe their functions.
5. Diagnose basic operational issues using tractor instruments.

5. Tractor Maintenance

1. Maintain a tractor logbook and a repair record book accurately.
2. Develop and follow a tractor maintenance schedule.
3. Perform routine inspection and servicing procedures.
4. Identify and troubleshoot common engine problems.
5. Apply preventive maintenance techniques to improve tractor lifespan.

6. Hand Tools Used in Agriculture

1. Identify traditional agricultural tools used in Pakistan.
2. Describe the functions and performance of common farm hand tools.
3. Identify and explain the use of common power tools in agriculture.
4. Demonstrate proper use of workshop hand and power tools.
5. Evaluate tool performance and safety practices in agricultural settings.

7. Introduction to Renewable Energy

1. Identify various sources of power and energy used in agriculture.
2. Differentiate between renewable and non-renewable energy sources.
3. Compare conventional and non-conventional energy systems.
4. Explain the importance of renewable energy in sustainable agriculture.
5. Assess the potential of renewable energy technologies in farming systems.

8. Introduction to Biogas Technology

1. Define biogas and explain its importance in sustainable agriculture.
2. Describe the principles of anaerobic digestion.
3. Identify different types of biogas digesters.
4. Explain factors affecting biogas production.
5. Describe the applications of biogas in agriculture.
6. Evaluate the benefits of biogas technology for rural communities.

9. Solar Energy Applications in Agriculture

1. Explain the principles of solar energy utilization in agriculture.
2. Describe the structure and working of solar driers.
3. Explain the importance of solar drying in post-harvest management.
4. Describe the working principles of solar-powered irrigation systems.
5. Evaluate the advantages of solar energy applications in farming.

List of Practical (96 Hours)

1. Identify tractor parts and making and labelling of diagrams of all the parts.
2. Inspect tractor (engine oil, coolant, fuel level) fill check list (daily, weekly and monthly).
3. Lubricate tractor components.
4. Clean air filter and replacement procedure.
5. Check and maintain of battery and electrical system.
6. Inspect tyre (pressure measurement and maintenance).
7. Change engine oil and replace filter.
8. Maintain records (logbook).
9. Select site for a biogas plant.
10. Calculate digester size based on waste availability.
11. Estimate construction materials for the plant.
12. Design inlet and outlet structures.
13. Prepare a schematic diagram of a biogas system.
14. Calculate drying capacity for agricultural products.
15. Select materials for solar dryer construction.
16. Design and manual drawing of solar dryer structure.
17. Test airflow mechanisms and efficiency.
18. Calculate crop water requirements for irrigation.
19. Select and size of solar panels and water pumps.
20. Prepare installation layout and evaluate system performance.
21. Demonstrate tractor operation at field.
22. Test Biogas production and gas yield.
23. Fabricate and assemble a solar dryer.
24. Install solar water pumping system.
25. Troubleshoot and repair common agricultural machinery faults.

Horticulture-I

DAS-153

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

After studying this course, the students will be able to: -

a. Understand the significance and role of Horticulture in Pakistan

b. Know about the different branches of Horticulture

c. Demonstrate different parts of the plant, pollination and fertilization in Horticulture Crops

d. Gain knowledge about crops and plants classification, propagation and different growth regulators

e. Know about seed dormancy and its breaking, floriculture and ornamental Horticulture

Course Contents:

1: Introduction to Horticulture **09 Hours**

1.1 Orientation to Horticulture.

1.2 Branches of Horticulture

- 1.2.1 Pomology
- 1.2.2 Olericulture
- 1.2.3 Floriculture.
- 1.2.4 Medicinal and Aromatic plants.
- 1.2.5 Arboriculture

1.3 Importance of Horticulture

1.4 Scope of horticulture in Pakistan.

2: Horticulture Crops **03 Hours**

2.1 Fruit crops

- 2.1.1 Pome Fruits
- 2.1.2 Stone Fruits
- 2.1.3 Berries
- 2.1.4 Citrus
- 2.1.5 Nuts

2.1.6 Drupe
2.1.7 False Fruit
2.2 Vegetable Crops
2.2.1 Summer Vegetables
2.2.2 Winter Vegetables
2.3 Flower Crops (Floriculture)
2.4 Spices and Condiments
2.5 Medicinal Plants and Aromatic Plants
2.6 Ornamental plants

3: Plant Morphology 03 Hours

3.1 Stem
3.2 Root.
3.3 Leaf.
3.4 Flower
3.5 Fruit

4: Pollination & Fertilization in Fruits &Vegetable 03 Hours

4.1 Define Pollination
4.2 Types of pollination.
4.2.1 Cross-pollination
4.2.2 Self-pollination
4.3 Fertilization
4.4 Fruit formation.
4.5 Seed formation.

5: Growth Regulators 03 Hours

5.1 Define Plant Growth, Regulators
5.2 Classification of Growth Regulators
5.3 Different Types of Plant Growth Regulators
5.3.1 Natural growth regulators
5.3.2 Synthetic growth regulators
5.3.3 Role of plant growth regulators in horticultural crops

6: Classification of Horticultural Crops 04 Hours

6.1 Plant Body (Structure)
6.2 Life Cycle
6.3 Growth Habit
6.4 Leaf Maintenance
6.5 Pollination Mechanism

7: Seed Dormancy 09 Hours

7.1 Definition and Types of Seed Dormancy
7.1.1 Physical Dormancy
7.1.2 Physiological Dormancy
7.1.3 Morphological Dormancy
7.1.4 Mechanical Dormancy
7.1.5 Chemical Dormancy
7.2 Methods of Breaking Seed Dormancy

8: Propagation of Horticultural Crops 06 Hours

8.1 Define propagation and describe different types of propagation

8.2 Sexual propagation

8.3 Asexual propagation

9: KITCHEN GARDENING 06 Hours

9.1 Orientation to the concept of Kitchen Gardening and its different types.

9.2 Benefits of kitchen gardening (Economical, Aesthetic, Health Benefits)

9.3 Planning & Designing a Kitchen Garden

9.4 Soil Preparation and Composting

9.5 Seed Selection and Planting

9.6 Watering, Mulching, and Fertilizing

9.7 Pest and Disease Management

9.8 Harvesting and Maintenance

10: Tunnel Farming 04 Hours

10.1 Orientation the concept to the Tunnel Farming

10.2 Objectives & Economics of Tunnel Farming

10.3 Types of Tunnel farming

10.4 Merits and Demerits of Tunnel Farming

11: Green House 04 Hours

11.1 Concept of Greenhouse

11.2 Types of Greenhouses

11.3 Merits and Demerits of Greenhouses

12: Vegetable Production Technology 10 Hours

12.1 Direct Sowing

12.2 Nursery Raising Method

12.3 Trays

Recommended Books / Literature

1. A. Edwards — 2006, Encyclopaedia of Horticulture. Anmol Publishers Pvt. Ltd., New Delhi, India.

2. Kumar, U. — 2007, Methods in plant tissue culture (2nd ed) Agrobios Publishers, India

3. Prasad, S. — 2008, Principles of horticulture, (2nd ed) Agrobios Publishers, India

4. Dr. Munawar Ahmad Noor, Dr. Chaudhry Muhammad Ayub — 2016, **Horticultural Science** *(Vegetables, Fruits, Flowers and Ornamental Plants)*

5. Dr. Zafar Iqbal, Prof. Dr. Muhammad Akbar Anjum (University of Sargodha, Pakistan), Prof. Dr. Sezai Ercisli, Dr. Saeed Rauf. **Sustainable and Innovative Vegetable Production in Times of Climate Change: Concepts of Olericulture** (2025) **Publisher**: Springer Nature Singapore **ISBN**: 978-981-9662-83-8

6. Malik, M.N. Ed. 2015. Horticulture, National Book Foundation, Islamabad

Instructional Objectives

1. Introduction to Horticulture

1. Define horticulture and explain its orientation and scope.
2. Identify and describe the branches of horticulture (Pomology, Olericulture, Floriculture, Medicinal & Aromatic Plants, and Arboriculture).
3. Explain the importance of horticulture in food security, nutrition, and income generation.
4. Describe the scope and potential of horticulture in Pakistan.
5. Differentiate between various horticultural branches based on crop types and uses.

2. Horticulture Crops

1. Classify fruit crops into pome fruits, stone fruits, berries, citrus, nuts, drupes, and false fruits.
2. Differentiate between summer and winter vegetable crops.
3. Identify major flower crops used in floriculture.
4. Describe important spices, condiments, medicinal, aromatic, and ornamental plants.
5. Categorize horticultural crops based on their economic importance and use.

3. Plant Morphology

1. Identify and describe the structure and function of the stem, root, leaf, flower, and fruit.
2. Differentiate between vegetative and reproductive plant parts.
3. Relate plant morphology to crop growth and productivity.

4. Pollination & Fertilization in Fruits & Vegetables

1. Define pollination and explain its importance in fruit and vegetable production.
2. Differentiate between self-pollination and cross-pollination.
3. Describe the process of fertilization in flowering plants.
4. Explain the process of fruit and seed formation.
5. Analyze factors affecting pollination and fruit set.

5. Growth Regulators

1. Define plant growth regulators (PGRs).
2. Classify growth regulators into natural and synthetic types.
3. Identify major plant growth regulators and describe their functions.
4. Explain the role of growth regulators in horticultural crop production.
5. Apply knowledge of growth regulators to improve crop yield and quality.

6. Classification of Horticultural Crops

1. Classify horticultural crops based on plant body structure.
2. Categorize crops according to life cycle (annual, biennial, perennial).
3. Differentiate crops based on growth habit.
4. Classify crops according to leaf retention (deciduous vs. evergreen).

5. Distinguish crops based on pollination mechanism.

7. Seed Dormancy

1. Define seed dormancy and explain its importance.
2. Differentiate between physical, physiological, morphological, mechanical, and chemical dormancy.
3. Explain causes of seed dormancy.
4. Describe and apply methods for breaking seed dormancy.
5. Evaluate suitable dormancy-breaking techniques for different crops.

8. Propagation of Horticultural Crops

1. Define plant propagation and explain its importance.
2. Differentiate between sexual and asexual propagation.
3. Describe methods of sexual propagation (seed propagation).
4. Demonstrate knowledge of asexual propagation methods (cutting, grafting, layering, budding).
5. Select appropriate propagation methods for specific horticultural crops.

9. Kitchen Gardening

1. Define kitchen gardening and explain its concept and types.
2. Describe the economic, aesthetic, and health benefits of kitchen gardening.
3. Plan and design a kitchen garden layout.
4. Prepare soil and compost for kitchen gardening.
5. Select suitable seeds and perform proper planting.
6. Apply watering, mulching, fertilizing, and pest management practices.
7. Harvest and maintain crops effectively in a kitchen garden.

10. Tunnel Farming

1. Define tunnel farming and explain its concept.
2. Describe the objectives and economic benefits of tunnel farming.
3. Classify different types of tunnel farming.
4. Evaluate the merits and demerits of tunnel farming systems.

11. Greenhouse

1. Define greenhouse and explain its concept.
2. Identify different types of greenhouses.
3. Analyze the advantages and disadvantages of greenhouse production.

12. Vegetable Production Technology

1. Explain the method of direct sowing in vegetable production.
2. Describe nursery raising techniques for vegetables.
3. Demonstrate the use of trays for seedling production.
4. Compare different vegetable production methods.

List of Practical (96 Hours)

1. Identify and classify ornamental plants based on morphology, growth habit, and aesthetic value.
2. Prepare and raise nurseries for horticultural crops using appropriate media and cultural practices.
3. Demonstrate and perform various propagation methods, including sexual (seed) and asexual (cuttings, grafting, layering, and budding).
4. Prepare soil mixtures and fill pots correctly, ensuring proper texture, nutrients, and drainage for healthy plant growth.
5. Observe, analyze, and document different soft and hard landscaping designs during assignments and field visits to public parks.
6. Demonstrate and practice landscape design techniques, including layout planning, plant arrangement, and selection of ornamental species.
7. Identify and categorize seeds of important vegetable crops based on size, shape, and quality.
8. Perform sowing, nursery raising, hardening, and transplanting of vegetable seedlings following standard horticultural practices.
9. Demonstrate pruning, training, and staking techniques to improve plant growth, structure, and yield.
10. Eradicate and manage weeds in horticultural crops using manual, mechanical, and cultural methods.
11. Harvest, grade, and pack vegetables efficiently while maintaining quality and minimizing post-harvest losses.
12. Conduct assignments and carry out field visits to vegetable farms, tunnels, and markets to observe practical crop production, marketing, and management practices.

Environmental Sciences & Forestry

DAS-163

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

By the end of this course, students will be able to:

1. Understand the concept, scope, and importance of farm forestry in sustainable agriculture.
2. Explore its relationship with other disciplines and differentiate between farm forestry and agroforestry systems.
3. Identify suitable tree species and apply appropriate planting, propagation, and soil conservation techniques.
4. Analyze the effects of soil, climate, deforestation, and reforestation on tree growth and land productivity.
5. Evaluate the role of farm forestry in climate change mitigation, resource conservation, and as an alternative source of income.

Course Contents:

1. Introduction to Farm Forestry 5 Hours

1.1 What is Farm Forestry?
1.2 Concept of Farm Forestry
1.3 Scope of Farm Forestry
1.4 Role and importance of Farm Forestry

2. Farm Forestry and Other Disciplines 5 Hours

2.1 Correlation of Farm Forestry with Other Disciplines
2.2 Agronomy
2.3 Ecology
2.4 Sociology
2.5 Entomology
2.6 Pathology

3. Tree Species and Selection Criteria for Farm Forestry 6 Hours

3.1 Characteristics of Tree Species Suitable for Farm Forestry
3.2 Selection Criteria for Tree Species
3.3 Growth Habits
3.4 Adoptability

4. Agroforestry 9 Hours

4.1 What is Agroforestry?
4.2 Concept of Agroforestry
4.3 Difference between Agroforestry and Farm Forestry
4.4 Characteristics of Agroforestry

4.5 Agroforestry Systems and Models

5. Soil Conservation Techniques 9 Hours

5.1 Overview of Soil Erosion in Farm Landscapes
5.2 Causes and Types of Soil Erosion
5.3 Impact on Productivity and Long-term Land Health
5.4 Role of Vegetation and Land Use in Erosion Control
5.5 Mechanical Soil Conservation Techniques
5.6 Biological and Vegetative Measures
5.7 Soil Fertility Management in Farm Forestry
5.8 Monitoring and Assessment Techniques

6. Planting Techniques of Tree Species 9 Hours

6.1 Overview of Planting Techniques of Tree Species
6.2 Selection of Planting Material
6.3 Nursery Techniques
6.4 Direct Seeding Methods
6.5 Planting through Saplings
6.6 Vegetative Propagation Techniques
6.7 Pre-Planting and Post-Planting Care
6.8 Protection and Maintenance

7. Effect of Soil and Climate on Tree Growth and Management Practices 9 Hours

7.1 How Soil and Climate Work Together to Influence Tree Growth and Development
7.2 Soil Effect on Tree Growth and Development
7.3 Climate Effect on Tree Growth and Development
7.4 Management Practices for Trees in Farm Forestry
7.5 Integrated Tree Management in Farm Forestry

8. Deforestation & Reforestation and Forest Products 6 Hours

8.1 Concept of Deforestation and Reforestation
8.2 Causes of Deforestation Worldwide and Locally
8.3 Impact of Deforestation on the Environment
8.4 Global and National Efforts to Promote Reforestation
8.5 Advantages of Reforestation
8.6 Disadvantages of Deforestation
8.7 Techniques of Reforestation
8.8 Forests Products
8.9 Urban Forestry

9. Climate Change and Farm Forestry 6 Hours

9.1 Understanding Climate Change
9.2 Farm Forestry as a Climate Resilience Strategy
9.3 Carbon Sequestration and Trees
9.4 Microclimate Regulation by Trees
9.5 Climate-Resilient Tree Species
9.6 Techniques in Climate-Smart Farm Forestry

Recommended Books

1. "Agroforestry: A Sustainable Approach" by H. P. Singh (Punjab Agricultural University).
2. "Farm Forestry: Principles and Practices" by G. S. Rao (Andhra Pradesh Agricultural University)
3. "Climate-Smart Agriculture: Integrating Agriculture, Forestry, and Fisheries for Sustainable Development" by Leslie Lipper et al.
4. Agroforestry: A Pathway to Climate-Resilient Agriculture" by World Agroforestry Centre (ICRAF)
5. "Agroforestry for Climate Change Adaptation and Mitigation" by Jagdish Chandra Dagar et al.
6. "Dissemination Strategies for Agroforestry Innovations" by Jagdish Chandra Dagar et al.

Instructional Objectives

1. Introduction to Farm Forestry

1. Define Farm Forestry and explain its basic concept.
2. Describe the scope of Farm Forestry in agricultural systems.
3. Explain the role and importance of Farm Forestry in sustainable agriculture.
4. Identify the economic, environmental, and social benefits of Farm Forestry.

2. Farm Forestry and Other Disciplines

1. Explain the relationship between Farm Forestry and other academic disciplines.
2. Describe how Agronomy contributes to Farm Forestry practices.
3. Analyze the ecological principles relevant to Farm Forestry.
4. Discuss the sociological aspects influencing the adoption of Farm Forestry.
5. Identify common insect pests (Entomology) affecting farm trees and their management.
6. Explain the role of plant diseases (Pathology) in tree health management.

3. Tree Species and Selection Criteria for Farm Forestry

1. Identify characteristics of tree species suitable for Farm Forestry.
2. Apply appropriate criteria for selecting tree species for different farm conditions.
3. Describe different growth habits of trees.
4. Assess the adaptability of tree species to various environmental conditions.

4. Agroforestry

1. Define Agroforestry and explain its concept.
2. Differentiate between Agroforestry and Farm Forestry.
3. Identify the characteristics of Agroforestry systems.
4. Classify different Agroforestry systems and models.
5. Evaluate the benefits of integrating trees with crops and/or livestock.

5. Soil Conservation Techniques

1. Explain the causes and types of soil erosion in farm landscapes.
2. Analyze the impact of soil erosion on farm productivity and long-term land health.
3. Describe the role of vegetation and land use in controlling erosion.
4. Demonstrate knowledge of mechanical soil conservation techniques.
5. Apply biological and vegetative soil conservation measures.
6. Explain soil fertility management practices in Farm Forestry.
7. Describe monitoring and assessment techniques for soil conservation.

6. Planting Techniques of Tree Species

1. Explain different planting techniques of tree species.
2. Select appropriate planting materials for Farm Forestry.
3. Describe nursery management techniques.

4. Apply direct seeding methods appropriately.
5. Demonstrate proper planting through saplings.
6. Explain vegetative propagation techniques.
7. Plan pre-planting and post-planting care practices.
8. Identify protection and maintenance strategies for young trees.

7. Effect of Soil and Climate on Tree Growth and Management Practices

1. Explain how soil and climate interact to influence tree growth and development.
2. Analyze the effects of soil properties on tree performance.
3. Assess the impact of climatic factors on tree growth.
4. Recommend appropriate management practices for trees under varying conditions.
5. Develop integrated tree management strategies in Farm Forestry systems.

8. Deforestation, Reforestation and Forest Products

1. Define deforestation and reforestation.
2. Identify causes of deforestation at global and local levels.
3. Analyze the environmental impacts of deforestation.
4. Describe global and national efforts promoting reforestation.
5. Explain the advantages of reforestation and the disadvantages of deforestation.
6. Describe techniques used in reforestation.
7. Classify different types of forest products and their uses.

9. Climate Change and Farm Forestry

1. Explain the concept of climate change.
2. Describe Farm Forestry as a climate resilience strategy.
3. Explain the role of trees in carbon sequestration.
4. Analyze how trees regulate microclimates.
5. Identify climate-resilient tree species.
6. Recommend climate-smart Farm Forestry techniques.

List of Practical (96 hours)

1. Demonstrate planting of tree seedlings in a farm forestry system using recommended spacing and pit preparation techniques.
2. Measure and record tree height and diameter using appropriate forestry instruments (e.g., measuring tape, diameter tape, and clinometer).
3. Observe and analyze different agroforestry systems in the field and document their components and management practices.
4. Identify and classify tree species in a designated area based on morphological characteristics.
5. Identify and document windbreak tree species and describe their role in soil and crop protection.
6. Identify and categorize timber tree species based on wood characteristics and economic importance.
7. Identify fruit and nut tree species and their uses in farm forestry systems.
8. Identify and list non-timber forest products (NTFPs) and their economic and ecological significance.
9. Demonstrate various tree planting methods, including direct seeding and transplanting of saplings.
10. Practice different propagation techniques for farm trees, including seed propagation and vegetative methods.
11. Perform post-planting care operations, including watering, mulching, staking, pruning, and protection measures.
12. Prepare field reports based on assignments and visits to private and government forest areas, documenting observations and management practices.

English-I

ENG-142

Total Contact Hours

Theory	**192**	**T**	**P**	**C**
Practical	**00**	**6**	**0**	**2**

Course Contents:

As per BISEs /General Education Boards of the Country

Urdu - I

GEN-172

Total Contact Hours

Theory	**192**	**T**	**P**	**C**
Practical	**00**	**6**	**0**	**2**

Course Contents:

As per BISEs /General Education Boards of the Country

Religious Education / Islamiat

RE111/ISLl11

Total Contact Hours

Theory	**96**	**T**	**P**	**C**
Practical	**00**	**3**	**0**	**1**

Course Contents:

As per BISEs /General Education Boards of the Country

Ethics-I / Civics-I / Tarjumat-ul-Quran-I

ETH111 / CIV111/TT111

Total Contact Hours

Theory	**32**	**T**	**P**	**C**
Practical	**00**	**1**	**0**	**1**

Course Contents:

As per BISEs /General Education Boards of the Country

Diploma in Agriculture Sciences (DAS)

2nd Year

AGRICULTURE EXTENSION-II

DAS-213

Paper (A&B)

Total Contact Hours

Theory	**96**	**T**	**P**	**C**
Practical	**00**	**3**	**0**	**3**

Learning Outcomes

After this course, the students will be able to:

a. Gain knowledge about the principles and philosophy of agricultural extension.

b. Know about extension approaches and models.

c. Understand rural society and model farm services centers.

d. Demonstrate leadership and its Islamic concept.

e. Know about the communication pattern in rural society.

f. Gain knowledge about motivation and participatory technology development

g. Understand gender and development in extension

h. Gain knowledge about extension research and innovation

i. Know about field work and practical experience

Course Contents:

Paper A (48 Hours)

1 Principles and Philosophy of Agriculture Extension 06 Hours

1.1 Principles of Extension Education
1.2 Philosophy behind extension work
1.3 Extension education process and methodologies
1.4 Application of Agriculture extension principles and philosophy

2 Extension Approaches and Models 12 Hours

2.1 Various approaches to agriculture agricultural extension (e.g., training and visit system, participatory extension approaches)
2.2 Models of extension services

2.3 Comparative analysis of different extension systems globally

3 Communication Pattern in Rural Society **09 Hours**

3.1 Definition of communication Types of communication
3.2 Components of the communication process
3.3 Characteristics of components of the communication process
3.4 Challenges in rural communication incorporated in notes

4 Motivation **06 Hours**

4.1 Definition of motivation
4.2 Types and techniques of motivation
4.3 Principles of Motivation
5.4 Points to be avoided in the motivation process

5 Participatory Technology Development (PTD) **06 Hours**

5.1 Importance
5.2 Application in Agriculture
5.3 Steps in PTD
5.4 Challenges in PTD
5.5 Farmers' Field School (Definition, Importance, Formalities, Principles, Procedure)

6 Gender and Development in Extension **09 Hours**

6.1 Gender roles in agriculture and rural development
6.2 Gender sensitive approaches in agricultural extension
6.3 Principle of gender inclusive extension
6.4 Empowerment of women through extension activities

Paper B (48 Hours)

7 Rural Society **12 Hours**

7.1 Basic concepts of rural society in Pakistan

7.2 Major socio-economic problems in rural society

7.3 Socio-economic classes of rural society and their role in the development of agriculture

7.4 Social change and forces against social change in Pakistan

7.5 Sources of conflict between groups of people in rural society

7.6 Role of extension agent in promoting social change

8 Model Farm Services Centers (MFSC) **09 Hours**

8.1 Objectives

8.2 Establishment (Structure, general body, executive committee and Management committee, their eligibility Criteria and role)

8.3 Advantages and disadvantages of MFSC

8.4 Case Study

9 Leadership and Its Islamic Concept **09 Hours**

9.1 The qualities of a good leader

9.2 The types of leadership and how to select, develop and train leaders in rural society

9.3 Role of extension worker as professional leader

10 Extension Research and Field Work Report **18 Hours**

10.1 Importance of research in extension work

10.2 Methods of conducting extension research

10.3 Adaptation and diffusion of agricultural innovations

10.4 Field visits to rural areas

10.5 Interaction with farmers and rural communities

10.6 Preparation of field reports

10.7 mock demos and field visit report preparation

Books Recommended:

1. Extension Methods by Rajab Ali Memon and others.

2. Adult Education in Urdu by Chaudhry Ghulam Hussain.

3. Benor, D; Harrison, J.Q; Baxter, M. agriculture extension, the training and visit system, Washington, D.C. The World Bank, 1984.

4. Khan Imdad A. Changing pattern of rural leadership and their characteristics, Peshawar, Pakistan Academy of Rural Development 1988.

5. Agricultural Extension: A Reference Manual, edited by Burton E. Swanson.

6. Zarai Tausie Taleem (Urdu) by Habib-ur-Rehman Nizami and Muhammad Sarfaraz Rana, R.Y. Khan

Instructional Objectives

1: Principles and Philosophy of Agriculture Extension

1. Define and explain the principles of extension education.
2. Describe the philosophy behind extension work and its relevance to rural development.
3. Explain the extension education process and methodologies.
4. Apply the principles and philosophy of agricultural extension in practical contexts.

2: Extension Approaches and Models

1. Identify and describe various approaches to agricultural extension, including the Training and Visit system and participatory approaches.
2. Explain different models of extension services.
3. Conduct a comparative analysis of extension systems globally.
4. Evaluate the strengths and weaknesses of different extension approaches in rural settings.

3: Communication Pattern in Rural Society

1. Define communication and identify its types.
2. Explain the components of the communication process and their characteristics.
3. Analyze challenges in rural communication.
4. Describe tele-farming and its application in agricultural extension.
5. Apply effective communication techniques in rural extension work.

4: Motivation

1. Define motivation and explain its importance in extension work.
2. Identify types and techniques of motivation.
3. Apply the principles of motivation in promoting farmer engagement.
4. Recognize points to avoid in the motivation process.

5: Participatory Technology Development

1. Explain the importance of Participatory Technology Development (PTD).
2. Apply PTD concepts in agricultural settings.
3. Describe the steps in PTD.
4. Identify challenges in PTD implementation.
5. Explain the concept, importance, principles, and procedures of Farmers' Field Schools.

6: Gender and Development in Extension

1. Explain gender roles in agriculture and rural development.
2. Identify gender-sensitive approaches in agricultural extension.
3. Apply the principles of gender-inclusive extension.

4. Analyze strategies for empowerment of women through extension activities.

7: Rural Society

1. Explain the basic concepts of rural society in Pakistan.
2. Identify major socio-economic problems in rural communities.
3. Describe socio-economic classes in rural society and their role in agricultural development.
4. Analyze social change and forces against social change in rural Pakistan.
5. Identify sources of conflict between groups in rural society.
6. Explain the role of extension agents in promoting social change.

8: Model Farm Service Centers

1. State the objectives of Model Farm Service Centers (MFSC).
2. Explain the establishment of MFSCs, including structure, general body, executive committee, and management committee, along with their eligibility criteria and roles.
3. Assess the advantages and disadvantages of MFSCs.
4. Analyze real-world examples through case studies of MFSCs.

9: Leadership and Its Islamic Concept

1. Describe the qualities of a good leader.
2. Identify different types of leadership and explain how to select, develop, and train leaders in rural society.
3. Analyze the role of extension workers as professional leaders in rural communities.

10: Extension Research and Field Work Report

1. Explain the importance of research in extension work.
2. Describe methods of conducting extension research.
3. Analyze the adaptation and diffusion of agricultural innovations.
4. Conduct field visits to rural areas and interact with farmers and communities.
5. Prepare field reports and mock demonstration reports.
6. Evaluate field observations to enhance extension practices.

Agronomy-II

DAS-223

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

This course aims to equip students with a comprehensive, scientifically grounded, and practically applicable understanding of modern agricultural production systems. It synthesizes core principles and cutting-edge innovations across crop production, improvement, management, and technology to foster sustainable and resilient food systems.

1. Production Technology of Crops **30 Hours**

1.1 Cereal Crops (Wheat, Rice, Maize, Barley, Pearl Millet)

a. **Land Preparation**
   Primary Tillage
   Secondary Tillage
   Rice-Specific Preparation

b. Seed Selection & Treatment
   Certified Seeds
   Seed Treatment

c. Sowing
   (Crop-specific tables: Time, Depth, Spacing, and Method)

d. Irrigation
   Critical Stages
   Efficiency

e. Fertilization
   Soil Test-Based
   Foliar Sprays

f. Weed & Pest Control
   Weeds
   Integrated Pest Management (IPM)

g. Harvesting
Indicators
Methods
Loss Prevention

h. Storage
Drying
Hermetic Bags

1.2 Oilseed Crops (Sunflower, Canola, Rapeseed-Mustard, Sesame, Linseed, Groundnut, Safflower, Soybean)

a. Seed Selection

b. Water Management
Critical Stage
Deficit Irrigation

c. Fertilization
Sulfur Requirement
Boron Foliar

d. Pest Management
Aphids
Sclerotinia ascospores

h. Harvesting
Timing
Combine Settings

1.3 Pulses (Chickpea, Lentil, Pigeonpea, Mongbean, Cowpea, Mashbean)

a. Sowing Innovations
Zero-Till
Seed Inoculation

b. Water-Sensitive Stages
Chickpea
Waterlogging Tolerance

c. Pest Surveillance
Helicoverpa

Pod Borer

d. Harvest & Post-Harvest
Mechanical Harvesting
Solar Drying

1.4 Forage Crops (Alfalfa, Barseem, Napier Grass, Sorghum, Millet, Maize, Oat, Motgrass, Sudan Grass)

a. Sowing Specifications
b. Regulated Deficit Irrigation

c. Nutrient Optimization
d. Harvest Management
(Crop-specific tables: Optimal Stage, Frequency, Cut Height)
e. Quality Preservation

1.5 Fiber Crops (Cotton)
1.6 Sugar Crops (Sugarcane, Sugar beet)
1.7 Cash Crops (Tobacco)

2. Crop Improvement 07 Hours

2.1 What is Crop Improvement?

Genetic Enhancement
Physiological Optimization
Environmental Adaptation
Nutritional Fortification
Key Drivers

2.2 Goals of Crop Improvement

Goal, Scientific Approach, and Real-World Example

2.3 Methods to Improve Crops

1. **Introduction**
Process
Risks
2. **Selection Methods**
Type, Mechanism, Best For, Limitations
3. **Hybridization**
Steps
Impact

3. Cropping Systems 07 Hours

3.1 Defining Cropping Patterns & Intensity

Cropping Pattern
Cropping Intensity (CI)
Role of Irrigation

3.2 Factors Influencing Cropping Patterns

Climate
Soil Properties
Water Access
Economic Drivers
Policy Interventions
Socio-cultural Factors

3.3 Cropping Systems: Types, Benefits, and Challenges

1. **Monocropping**
   Definition
   Examples
   Pros & Cons

2. **Multiple Cropping**
   Sequential Cropping
   Intercropping
      Spatial Designs & Benefits/Challenges
   Crop Rotation
      Examples & Benefits

3. **Farming Systems**
   Extensive Farming
   Intensive Farming

3.4 Modern Innovations & Sustainability

Conservation Agriculture
Precision Farming
Climate-Smart Systems

4. Seed Technology 06 Hours

4.1 Why Good Seed Matters.

4.2 What is Seed Quality?

(5 Parameters: Genetic Purity, Physical Purity, Germination Capacity, Seed Health, Moisture Content)

4.3 Seed Production Levels

(Table: Level, Producer, Purity Standard, Purpose)

4.4 Seed Certification

Field Inspection
Seed Testing
Tagging & Sealing
Traceability

4.5 Seed Storage

Principles
Seed Longevity Examples

5. Modern Farming Methods 06 Hours

5.1 Vertical Farming

5.1.1 Concept
5.1.2 Core Technologies
5.1.3 Pros & Cons
5.1.4 Case Study: Aero Farms (USA)

5.2 Regenerative Agriculture

5.2.1 Principles
5.2.2 Key Practices

5.2.3 Outcome

5.3 Precision Agriculture

5.3.1 Toolkit (Table: Technology, Function, Impact)

5.3.2 AI Integration

5.4 Hydroponics & Aquaponics

5.4.1 Hydroponic Systems (Table: Type, Mechanism, Crops)

5.4.2 Aquaponics Synergy

5.4.3 Efficiency

5.5 Climate Change Impacts on Agriculture

5.5.1 Key Threats

5.5.2 Economic Toll

5.6 Climate-Smart Agriculture (CSA)

5.6.1 Three Pillars: Adaptation, Mitigation, and Productivity

6. Fodder and Forage Crops 08 Hours

6.1 **Introduction: Fodder Challenges in Pakistan**

6.1.1 Agro-Ecological Context

6.1.2 Critical Issues

6.2 Rabi Fodder Crops (Oct-March)

1. **Barseem (*Trifolium alexandrinum*)**

   Adaptation

   Cultivation

   Harvest Management

   Innovation in Pakistan

2. **Oats (*Avena sativa*)**

   Adaptation

   Cultivation

   Nutrient Profile

   Advisory

3. **Rye Grass (*Lolium multiflorum*)**

   Adaptation

   Establishment

   Harvest

   Advantage

6.3 Kharif Fodder Crops (Apr-Sep)

1. **Sorghum (*Sorghum bicolor*)**

Adaptation

Cultivation

Water-Saving Technique

Innovation

2. **Maize Fodder (*Zea mays*)**

Adaptation

Intensive Management

Silage Protocol

Economic Impact

3. **Cowpea (*Vigna unguiculata*)**

Adaptation

Cultivation

Harvest Flexibility

Advantage

6.4 Specific Innovations

Terrace Fodder Systems

Water Harvesting

Indigenous Practices

6.5 Economic Analysis

Recommended Books:-

1. Agriculture The Basics., 2014. 2nd Ed. Publisher: Ikhwan Printers & Peshawar Process by Dr. Inaam ullah and Asad Ali Khan.
2. Ali, M.A. 2012 Rahnmaay Rabi Crops for Agricultural Extension Workers, Published by Directorate General (Ext & A. R), Punjab 21-Davis Road Lahore -54000.
3. Baalasubramaniyan, P. 2007. Principles and Practices of Agronomy (2nd ed.), Agro Bios Publishers, India.
4. Prasad S. C. 2007. Crop Production and Tillage, Agro Bios Publishers, India.
5. Ready, S.R. 2007. Principles of Agronomy (3rd ed.), Kalyani Publishers, New Delhi, India.
6. Khalil, I.A. & Amanullah, C. 2002, Cropping Technology, National Book Foundation, Islamabad.

Instructional Objectives

1: Production Technology of Crops

1. Explain land preparation, sowing, irrigation, fertilization, weed and pest management, harvesting, and storage practices for major crops.
2. Differentiate production practices for cereal, oilseed, pulse, forage, fiber, sugar, and cash crops.
3. Apply seed selection, treatment, and crop-specific planting techniques.
4. Analyze critical growth stages and management requirements for efficient crop production.
5. Implement integrated pest management (IPM) and weed control strategies.
6. Evaluate post-harvest handling and storage methods to reduce losses.

2: Crop Improvement

1. Define crop improvement and explain its importance in agriculture.
2. Describe the goals of crop improvement and relate them to real-world examples.
3. Explain methods of crop improvement, including selection, hybridization, and modern biotechnological tools.
4. Apply genetic, physiological, and environmental approaches to improve crop performance.
5. Assess the risks and benefits of modern crop improvement techniques.
6. Evaluate the impact of crop improvement on productivity and sustainability.

3: Cropping Systems

1. Define cropping patterns, cropping intensity, and farming systems.
2. Identify factors influencing cropping patterns, including climate, soil, water, and socio-economic considerations.
3. Compare monocropping, multiple cropping, crop rotation, and intensive/extensive farming systems.
4. Apply modern innovations in cropping systems such as conservation agriculture and precision farming.
5. Analyze the benefits and challenges of different cropping systems.
6. Evaluate climate-smart and sustainable practices in cropping systems.

4: Seed Technology

1. Explain the importance of good seed quality and the parameters that define it.
2. Describe seed production levels and certification procedures.
3. Apply field inspection, seed testing, tagging, and traceability practices.
4. Demonstrate principles of seed storage and longevity.
5. Evaluate methods to maintain genetic purity and seed health.
6. Assess the role of high-quality seeds in crop productivity.

5: Modern Farming Methods

1. Define and explain vertical farming, hydroponics, aquaponics, regenerative agriculture, and precision agriculture.
2. Compare the technologies, practices, advantages, and limitations of modern farming methods.
3. Apply AI and digital tools in precision agriculture.
4. Analyze climate change impacts on agriculture and adaptation strategies.
5. Implement climate-smart agriculture principles in farm planning.
6. Evaluate innovative farming systems for sustainability and efficiency.

6: Fodder and Forage Crops

1. Identify major rabi and kharif fodder crops and their agro-ecological adaptations.
2. Apply best practices in sowing, irrigation, nutrient management, and harvesting of forage crops.
3. Explain fodder quality preservation and innovations such as terrace systems and water harvesting.
4. Analyze crop-specific innovations for yield and economic benefits.
5. Evaluate fodder production challenges and indigenous solutions.
6. Conduct economic analysis of fodder and forage production systems.

List of Practical 96 Hours

1. Collect and Identify seeds of different crops.
2. Demonstrate seed treatment methods.
3. Prepare silage and hay for fodder preservation.
4. Identify different fertilizers.
5. Demonstrate different fertilizer application methods.
6. Demonstrate different irrigation methods.
7. Demonstrate different sowing methods of field crops.
8. Apply fertilizers using different techniques.
9. Demonstrate harvesting and storage techniques of field crops.
10. Prepare and apply mulch and preparation of compost.
11. Apply mulch in conservation agriculture.
12. Conduct crop appraisal.
13. Establish seed production plots of field crops.
14. Estimate plant population of field crops.

Plant Protection

DAS-233

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

After studying this course, the students will be able to: -

a. understand the significance and role of plant protection in the development of agriculture and minimize losses caused by pests

b. know the various pests of crops, fruits, vegetables and store grains

c. know the different pest management techniques and their application in the field

d. know the plant protection equipment

1. Pest Management **10 Hours**

1.1 Natural Factors

1.1.1 Physical Factors

1.1.2 Biological Factors

1.2 Applied Management

1.2.1 Quarantine

1.2.2 Cultural Practices

1.2.3 Mechanical

1.2.4 Biological

1.2.5 Chemical

a. Bio pesticides

b. Synthetic Chemical

c. Minerals

2. Pesticides **06 Hours**

2.1 Introduction to Pesticides

2.2 Types of Pesticides

2.3 Classification of Insecticides

2.3.1 Based on origin

2.3.2 Based on the mode of entry into the insect body

2.3.3 Based on mode of action

2.3.4 Based on chemical nature

2.4 Classification of Fungicides

2.4.1 Based on mobility in the plant

2.4.2 Based on mode of action

2.4.3 Based on chemical nature

2.4.4 Based on the spectrum

2.4.5 Based on the time of application

3. Weeds and Their Management **10 Hours**

3.1 Introduction to weeds

3.2 Types of weeds

3.3 Characteristics of weeds

3.4 Losses caused by weeds

3.5 Introduction to weedicides

3.5.1 Classification of weedicides

3.6 Weeds Management

3.6.1 Cultural

3.6.2 Mechanical

3.6.3 Chemical

3.6.4 Biological

3.6.5 Integrated Weed Management (IWM)

4. Pest Scouting and Survey **8 Hours**

4.1 Introduction to pest scouting

4.2 Objectives of pest scouting

4.3 Methods of Pest scouting

4.4 Economic Threshold Level (ETL)

4.5 Pest Survey

4.6 Objectives of Pest Survey

4.7 Types of Pest Survey

5. Formulation of Pesticides **04 Hours**

5.1 Introduction to Pesticide Formulation

5.2 Purpose of Formulation

5.3 Types of Formulation

5.4 Label Abbreviation for Formulation

6. Toxicity and Residual Effect of Pesticides **04 Hours**

6.1 Introduction to toxicity

6.2 Types of Toxicity

6.3 Factors Affecting Toxicity

6.4 Classification of Toxicity based on LD50

6.5 Symptoms of Pesticide Poisoning

6.6 Residual Effect of Pesticides

6.7 Management of Residual Effects of Pesticides

7. Pest & Disease Management of Rabi & Kharif Crops **12 Hours**

7.1 Rabi Crops

7.1.1 Wheat and Barley

7.1.2 Rabi Pulses

7.1.3 Oilseed Crops

7.1.4 Rabi Vegetables

7.1.5 Rabi Fodder

7.2 Kharif Crops

7.2.1 Sugarcane

7.2.2 Maize and Sorghum

7.2.3 Rice

7.2.4 Oilseed Crops

7.2.5 Kharif Vegetables

7.2.6 Cotton

8. Pest & Disease Management of Major Fruits **04 Hours**

8.1 Pome Fruit

8.2 Citrus Fruit

8.3 Stone Fruit

8.4 Berries

8.5 Date Palm

8.6 Mango

8.7 Guava

8.8 Apple

8.9 Peach

9. Pest & Management of Stored Grains **04 Hours**

9.1 Introduction to sored grain pests

9.2 Economic importance/Losses

9.3 Management Practices

9.3.1 Preventive Measures

9.3.2 Fumigation

10. Sprayer Pumps **02 Hours**

10.1 Types of sprayer pumps

10.2 Nozzle and its types

10.3 Calibration of Sprayer Tank

10.4 Spraying Method

Recommended Books:-

1. Fenemore, P.G & Prakash, A. 2006. Applied Entomology, (2nd Ed.) New Age International Publisher, New Delhi, India.
2. Shah, H.A. & Saleem, M.A., 2002, Applied Entomology (3rd Ed.) Izhar Sons Publisher, Lahore
3. Lohar, M.K. 2001. Introductory Entomology. Department of Entomology, Sindh Agriculture University, Tandojam, Sindh, Pakistan.
4. Hashriat (Insects) by I.Ahmed, 2010, National Book Foundation Lahore".
5. Applied Entomology: A Pakistan Perspective (7th Ed.) by Dr. Mushtaq Ahmed Saleem, (2026). National Book Foundation Lahore

Instructional Objectives

1: Pest Management

1. Explain the role of natural factors (physical and biological) in pest incidence.
2. Describe applied pest management strategies, including quarantine, cultural, mechanical, biological, and chemical methods.
3. Differentiate between bio-pesticides, synthetic chemicals, and mineral-based pest controls.
4. Apply integrated pest management (IPM) principles in crop protection.
5. Evaluate the effectiveness of various pest management techniques for specific crops.
6. Identify critical stages for pest control interventions in crop production.

2: Pesticides

1. Define pesticides and describe their significance in agriculture.
2. Classify pesticides and insecticides based on origin, mode of entry, mode of action, and chemical nature.
3. Classify fungicides according to mobility, mode of action, chemical nature, spectrum, and application timing.
4. Compare different types of pesticides for effectiveness and safety.
5. Explain proper pesticide selection and use for targeted pest control.
6. Assess risks associated with pesticide use and safe handling practices.

3: Weeds and Their Management

1. Define weeds and describe their types, characteristics, and economic impact.
2. Identify different types of weedicides and classify them.
3. Apply cultural, mechanical, chemical, and biological weed management techniques.
4. Integrate weed management strategies through Integrated Weed Management (IWM).
5. Analyze the effectiveness of different weed control methods.
6. Plan weed management practices specific to crop type and season.

4: Pest Scouting and Survey

1. Define pest scouting and explain its objectives.
2. Describe methods of pest scouting and pest survey.
3. Determine the Economic Threshold Level (ETL) for pest interventions.
4. Identify and classify types of pest surveys.
5. Apply pest scouting techniques for effective monitoring and decision-making.
6. Evaluate pest population trends to support integrated pest management.

5: Formulation of Pesticides

1. Explain the purpose of pesticide formulation.
2. Identify different types of pesticide formulations and their applications.
3. Interpret label abbreviations for pesticide formulations.
4. Apply knowledge of formulations to select appropriate pesticide types for crops.
5. Evaluate the advantages and limitations of various formulation types.
6. Understand formulation impact on efficacy, safety, and environmental persistence.

6: Toxicity and Residual Effects of Pesticides

1. Define toxicity and describe its types and factors affecting it.
2. Classify pesticide toxicity based on LD50 values.
3. Recognize symptoms of pesticide poisoning and preventive measures.
4. Explain residual effects of pesticides on crops and the environment.
5. Apply strategies for management of residual pesticides.
6. Evaluate pesticide use for safe and sustainable crop protection.

7: Pest & Disease Management of Rabi and Kharif Crops

1. Identify major pests and diseases of Rabi and Kharif crops.
2. Apply crop-specific integrated pest and disease management strategies.
3. Evaluate timing and methods of interventions for different crop stages.
4. Compare chemical, biological, and cultural control measures for effectiveness.
5. Plan prevention and monitoring protocols for field crops.
6. Analyze the impact of pest and disease management on yield and quality.

8: Pest & Disease Management of Major Fruits

1. Identify major pests and diseases affecting pome, citrus, stone, berries, and tropical fruits.
2. Apply integrated management techniques for fruit crops.
3. Compare pest and disease risks across different fruit species.
4. Develop monitoring and control schedules for orchard management.
5. Evaluate the effectiveness of chemical, biological, and cultural methods.
6. Recommend best practices for sustainable fruit protection.

9: Pest & Disease Management of Stored Grains

1. Identify pests of stored grains and assess their economic impact.
2. Apply preventive measures to minimize storage losses.
3. Conduct fumigation and other control practices for stored grains.
4. Evaluate the effectiveness of storage management strategies.
5. Integrate storage pest management into post-harvest handling systems.
6. Analyze the cost -benefit of pest management in stored grains.

10: Sprayer Pumps

1. Identify different types of sprayer pumps and nozzles.
2. Demonstrate proper sprayer calibration techniques.
3. Apply correct spraying methods for pesticide application.
4. Evaluate equipment efficiency and uniformity in pesticide delivery.
5. Ensure safety and environmental compliance during spraying.
6. Maintain and troubleshoot sprayer pumps for long-term use.

List of Practical 96 Hours

1. Apply pesticides and demonstrate precautionary measures.
2. Operate and apply of spray machinery.
3. Identify different diseases of vegetables.
4. Identify different diseases of fruit plants.
5. Identify pests of ornamental plants.
6. Demonstrate safe use of pesticides.
7. Calibrate the spray machine.
8. Identify and use of different types of insect traps (light traps, sticky traps, pheromone traps, pitfall traps).
9. Perform pest scouting using appropriate methods.
10. Determine the Economic Threshold Level (ETL) of different crops.
11. Identify major insect pests of crops.
12. Collect and identify Rabi weeds.
13. Collect and identify Kharif weeds.
14. Perform fumigation using recommended methods.
15. Identify different types of spray nozzles.
16. Identify different formulations of pesticides.

Agriculture Machinery

DAS-243

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

By the end of this course, students will be able to:

1. To develop awareness regarding the importance and need of Farm Mechanization.
2. To enable students to identify different makes and models of tractors.
3. To enhance practical skills in the identification and use of agricultural implements.

01 **Tillage Implements** **6 hours**

1.1 Basic Concepts, Objectives and Classification of Farm Machinery

1.2 Objectives of Farm Machinery

1.3 Classification of Farm Machinery

1.4 Primary Tillage Implements

1.5 Secondary Tillage Implements

1.6 Precision Land Leveling Techniques and Equipment

02 Seeding and Planting Implements **10 Hours**

2.1 Minimum Tillage

2.2 Zero Tillage Seed Drill

2.3 Parts and Functions of a Seed Drill

2.4 Parts, Function and Types of Planters

2.5 Difference between Seed Drill and Planter

2.6 Super Seeder

03 Spray Machinery **8 Hours**

3.1 Hand Sprayer Parts and Types

3.2 Operation and application of power sprayers

3.3 Nozzle and Nozzle Types

3.4 Tractor-Mounted Sprayers

3.5 Safety and Use of Advanced Sprayers

04 Harvesting Machinery 8 Hours

4.1 Reaper

4.2 Combine Harvester

4.3 Difference between Reaper and Combine Harvester

4.4 Groundnut Digger, Potato Diggers and Cotton Pickers

05 Threshing Machines 6 Hours

5.1 Wheat Thresher

5.1.2 Maize Sheller

5.2 Common Defects in Wheat Thresher and Combine Harvester with Remedies

06 Miscellaneous Agricultural Implements 5 Hours

6.1 Identification and Functions of Various Implements

6.2 Use of Implements in Various Agricultural Operations

07 Tube Well / Irrigation / Pumps 5 Hours

7.1 Types of Water Pumps

7.2 Sprinkler Irrigation

7.3 Drip Irrigation

08 Power and Machinery Management 8 Hours

8.1 Purpose of Machinery Management

8.2 Factors That Reduce Operating Costs

8.3 Criteria for Selecting Tractor and Machinery

09 Agriculture Drones 8 Hours

9.1 Types of Agriculture Drones

9.2 Applications of Agriculture Drones

9.3 Benefits of Agriculture Drones

Recommended Books:-

1 Zakria, M. and M. A. Ali. 2012. Rahnmai Machini Kashtkari braai Tulba Diploma in Agricultural Sciences wa Zarai Karknan. Directorate General Agri. (Ext. & A. R.) Punjab Lahore.

2 Bell, B., 2008. Farm Machinery (5th Edition) Old Pond Publishing Company, USA.

3 Power, A.G., and Aware, V.V.2007. Farm Mechanization and Power, New India Printers, New Delhi, India.

4 Tahir, A.R. & Sabir, M.S. 2003, Fundamentals of Tractor & Agri. Machinery, Deptt. of Farm Machinery, University of Agriculture, Faisalabad.

5 Ransome, J.A. 2003, Implements of Agriculture. Old Pond Publishing Ltd. USA.

Instructional Objectives

1: Tillage Implements

1. Explain the basic concepts, objectives, and classification of farm machinery.
2. Identify and describe primary and secondary tillage implements and their uses.
3. Apply precision land leveling techniques using appropriate equipment.
4. Compare different types of tillage implements for soil preparation.
5. Evaluate the suitability of tillage tools for different crops and soil conditions.
6. Demonstrate safe and efficient operation of tillage machinery.

2: Seeding and Planting Implements

1. Explain minimum and zero tillage concepts and their advantages.
2. Identify parts and functions of seed drills and planters.
3. Differentiate between seed drills and planters for various crops.
4. Apply appropriate planting techniques using different machinery.
5. Demonstrate efficient seed placement for optimal crop establishment.
6. Evaluate the suitability of seeding and planting equipment for different farm sizes.
7. Demonstrate safe and efficient operation of the super seeder

3: Spray Machinery

1. Identify types and parts of hand and power sprayers.
2. Demonstrate operation of tractor-mounted and advanced sprayers.
3. Select appropriate nozzles and spraying techniques for crop protection.
4. Apply safe pesticide spraying practices.
5. Evaluate the efficiency of different spraying equipment.
6. Maintain spray machinery for long-term operational performance.

4: Harvesting Machinery

1. Identify reapers, combine harvesters, and crop-specific diggers/pickers.
2. Differentiate between reaper and combine harvester functions.
3. Apply harvesting techniques for different crops using machinery.
4. Evaluate harvesting efficiency and crop loss reduction.
5. Demonstrate safe operation of harvesting equipment.
6. Troubleshoot common issues during harvesting.

5: Threshing Machines

1. Identify wheat threshers, maize shellers and other threshing machines.
2. Explain the working principles of common threshing machinery.
3. Recognize common defects in threshers and combine harvesters and implement remedies.
4. Apply safe operational practices in threshing operations.
5. Evaluate the efficiency and productivity of threshing machines.
6. Integrate mechanized threshing into post-harvest management.

6: Miscellaneous Agricultural Implements

1. Identify and describe various agricultural implements and their functions.
2. Apply implements in different agricultural operations efficiently.
3. Evaluate the suitability of implements for specific farm tasks.
4. Demonstrate proper handling and maintenance of agricultural tools.
5. Integrate implements for optimum crop production and labor efficiency.
6. Assess innovations in agricultural implements for modern farming.

7: Tube Well, Irrigation, and Pumps

1. Identify types of water pumps and their applications.
2. Explain sprinkler and drip irrigation systems and their benefits.
3. Apply appropriate irrigation methods for different crops and farm sizes.
4. Evaluate water-use efficiency in irrigation systems.
5. Demonstrate operation and maintenance of irrigation equipment.
6. Integrate irrigation technology for sustainable crop production.

8: Power and Machinery Management

1. Explain the purpose of machinery management in farming operations.
2. Identify factors that reduce the operating costs of agricultural machinery.
3. Apply criteria for selecting tractors and machinery for different farm needs.
4. Evaluate the efficiency and cost-effectiveness of farm machinery.
5. Demonstrate maintenance and operational planning of machinery.
6. Integrate machinery management into overall farm productivity planning.

9: Agriculture Drones

1. Identify types of agricultural drones and their features.
2. Explain applications of drones in modern farming.
3. Evaluate the benefits of drones for crop monitoring and management.
4. Apply drone technology for precision agriculture tasks.
5. Analyze data collected by drones for informed decision-making.
6. Demonstrate safe operation and maintenance of agricultural drones.

List of Practical 96 hours

1. Identify and recognize different tillage implements and their uses
2. Observe and differentiate primary tillage implements
3. Examine secondary tillage implements for seedbed preparation
4. Operate a cultivator in the field
5. Perform precision land leveling using a laser leveler
6. Identify and label parts of a seed drill
7. Calibrate a seed drill for an accurate seed rate
8. Adjust row spacing in a planter for row crops
9. Operate a zero tillage drill for direct seeding
10. Identify parts of the hand and knapsack sprayers
11. Calibrate a spray machine for proper application
12. Examine nozzle types and observe spray patterns
13. Operate a tractor-mounted sprayer in field conditions
14. Practice safe handling and application of pesticides
15. Identify and examine parts of a combine harvester
16. Operate a reaper for crop harvesting
17. Measure harvesting losses in the field
18. Operate a thresher and observe its working
19. Identify irrigation pumps and demonstrate a sprinkler system
20. Measure and calculate the field capacity of farm implements

Horticulture-II

DAS-253

Total Contact Hours

Theory	**64**	**T**	**P**	**C**
Practical	**96**	**2**	**3**	**3**

Learning Outcomes

1. To develop an understanding in students of the production technology of common fruits.
2. To develop practical skills for raising fruit plant nurseries and their propagation.
3. To develop an understanding of orchard layout and management.

1. Importance and scope of horticultural crops 8 Hours

1.1 Nutritional

1.2 Medicinal,

1.3 Economical

1.4 Environmental

1.5 Farm & Food Security

2. Nursery Raising and Management 05 Hours

2.1 Nursery Raising of Pome Fruits

2.2 Nursery Raising of Stone Fruits

2.3 Nursery Raising of Citrus

2.4 Nursery Raising and Management of Berries

3. Propagation of Fruit plants 10 Hours

3.1 Propagation

3.2 Sucker and Runners

3.3 Cutting

3.4 Layering

3.5 Budding

3.6 Grafting

4. Establishment of Orchards 07 Hours

4.1 Site Selection

4.2 Plant Selection

4.3 Spacing

4.4 Plant number

4.5 Layout of an Orchard

4.5.1 Square System

4.5.2 Rectangle System

4.5.3 Quincunx System

4.5.4 Hexagonal System

5. Orchard Management 08 Hours

5.1 Irrigation

5.2 Fertilization

5.3 Weeding and hoeing

5.4 Plant protection

6. TRAINING & PRUNING 07 Hours

6.1 Training of Plants

6.1.1 Objectives and Importance of Training

6.1.2 Training of Deciduous and Evergreen plants

6.1.3 Stage and Precautions for Training

6.2 Pruning

6.2.1 Pruning Objectives, Importance and Types

6.2.2 Fruiting Habits of Different Fruit Plants

6.2.3 Pruning of Deciduous and Evergreen Plants

6.2.4 Stage and Precautions for Pruning

7. Production Technology of Different Horticultural Crops 15 Hours

7.1 Production Technology of Apple

7.2 Production Technology of Peach

7.3 Production Technology of Citrus

7.4 Production Technology of Guava

7.5 Production Technology of Mango

7.6 Production Technology of Grapes

7.7 Production Technology of Olive

7.8 Production Technology of Apricot

7.9 Production Technology of Gladiolus

7.10 Production Technology of Mushrooms

7.11 Production Technology of Plum

7.12 Production Technology of Pear

7.13 Production Technology of Marigold

7.14 Production Technology of Roses

8. Reasons for Decline of Orchards 04Hours

8.1 Management Issues

8.2 Marketing

8.3 Climatic Incompatibility

8.4 Surplus Produce Management

8.5 Cost-Benefit Ratio

Recommended Books:-

1. Noor M.A. & Dr. C. M Ayyoub. 2016. Aloom-e-Baghbani (Sabziat, Phal, Phool & Adviyati Pooday).
2. Muhammad, S. 2012, Amoor-e-Baghbani (Urdu), Kitab Markaz, Faisalabad
3. George, A. 2009. Horticulture: Principles & Practices. 4th Edition. Pearson Education, Inc., Upper Saddle River, Pearson Prentice Hall, New Jersey
4. Yadav, P.K. 2007. Fruit Production Technology, International Book Distributing Co. (Publishing Division). Lucknow, India.
5. Malik, M.N. Ed. 2015. Horticulture, National Book Foundation, Islamabad

Instructional Objectives

1: Importance and Scope of Horticultural Crops

1. Explain the nutritional, medicinal, and economic importance of horticultural crops.
2. Describe the environmental benefits of horticultural cultivation.
3. Analyze the role of horticulture in farm and food security.
4. Evaluate the scope of horticultural crops for local and commercial production.
5. Identify major horticultural crop categories and their uses.
6. Discuss the contribution of horticulture to sustainable agriculture and livelihoods.

2: Nursery Raising and Management

1. Explain principles of nursery raising for fruit crops.
2. Demonstrate nursery management practices for pome, stone, citrus, and berry crops.
3. Select appropriate nursery techniques for different fruit species.
4. Apply watering, fertilization, and pest management in nurseries.
5. Evaluate success factors in nursery establishment and management.
6. Identify common problems in nursery raising and solutions.

3: Propagation of Fruit Plants

1. Define and explain propagation techniques for fruit plants.
2. Demonstrate asexual propagation methods, including suckers, runners, cuttings, and layering.
3. Apply budding and grafting techniques for fruit plant multiplication.
4. Evaluate the suitability of different propagation methods for specific crops.
5. Ensure healthy plant establishment through proper propagation practices.
6. Identify stages, precautions, and maintenance for successful propagation.

4: Establishment of Orchards

1. Select suitable sites and plant varieties for orchard establishment.
2. Plan orchard layout and spacing using square, rectangle, quincunx, and hexagonal systems.
3. Determine the number of plants required for a given orchard area.
4. Apply best practices in planting and orchard establishment.
5. Evaluate the efficiency of different orchard layouts for growth and management.
6. Integrate site and plant selection with orchard design principles.

5: Orchard Management

1. Apply irrigation, fertilization, weeding, and hoeing practices for orchard crops.
2. Implement plant protection measures to reduce pests and diseases.
3. Monitor plant growth and health for optimal productivity.
4. Evaluate management practices for sustainable orchard production.
5. Integrate resource-efficient practices in daily orchard operations.
6. Analyze problems in orchard management and propose solutions.

6: Training and Pruning

1. Explain the objectives and importance of training and pruning.

2. Apply training techniques for deciduous and evergreen plants.
3. Demonstrate pruning practices based on fruiting habits and crop type.
4. Identify the correct stage and precautions for training and pruning.
5. Evaluate the effect of training and pruning on yield and plant health.
6. Integrate training and pruning practices into orchard management plans.

7: Production Technology of Different Horticultural Crops

1. Explain crop-specific production practices for major fruits, vegetables, flowers and mushrooms.
2. Apply irrigation, fertilization, pest control, and harvesting techniques for different horticultural crops.
3. Compare cultural practices and management requirements across crops.
4. Evaluate the efficiency of production technologies for yield improvement.
5. Demonstrate knowledge of crop-specific innovations and modern practices.
6. Integrate post-harvest handling and quality management in production planning.

8: Reasons for Decline of Orchards

1. Identify management and cultural issues leading to orchard decline.
2. Analyze marketing and economic factors affecting orchard sustainability.
3. Evaluate the impact of climatic incompatibility on orchard productivity.
4. Apply strategies for surplus produce management.
5. Assess the cost-benefit ratio of orchard operations.
6. Recommend improvements in orchard management to prevent decline.

List of Practical **96 Hours**

1. Identify different citrus fruit plants and their varieties.
2. Identify different mango varieties.
3. Identify different guava varieties.
4. Identify different jujube varieties.
5. Identify different mulberry varieties.
6. Prepare seedbed for nursery sowing of fruit crops.
7. Seed treatment and sowing methods of the fruit nursery.
8. Demonstrate propagation of plants through cuttings.
9. Demonstrate propagation of plants through layering.
10. Demonstrate propagation of plants through budding.
11. Demonstrate propagation of plants through grafting.
12. Design and demonstrate different layout methods of orchard establishment.
13. Demonstrate train and prune techniques in the orchard.
14. Demonstrate fertilizer application methods in orchard.
15. Demonstrate weed management techniques in the orchard.
16. Presentation of assignments and participation in visits to fruit orchards and nurseries.

Agri. Business Management

DAS-263

Paper (A&B)

Total Contact Hours

Theory	**96**	**T**	**P**	**C**
Practical	**00**	**3**	**0**	**3**

Learning Outcomes

1. To develop an understanding of economic principles and their effect on agricultural business.
2. To give knowledge for sustainable returns of the farm.
3. To create and supply agricultural products for end-consumption
4. To improve productivity and efficiency of agricultural operations, which ultimately leads to increased profitability of farmers and agribusiness

Paper A (48 hours)

1. Introduction to Agribusiness **08 Hours**

1.1 Definition of Agribusiness

1.2 Overview of Agribusiness

1. Input Sector
2. Farm Production Sector
3. Processing Sector
4. Marketing and Distribution Sector

1.3 Importance of Agribusiness

1.4 Scope of Agribusiness in Pakistan

2. Agricultural Production System **08 Hours**

2.1 Introduction to Agricultural Production System

2.2 Types of Agricultural Production Systems in Pakistan

1. Crop Production System
2. Livestock Production System
3. Mixed Farming System

2.3. Crop Production in Pakistan

1. Major Crops
2. Management Practices in Crop Production

2.4 Livestock Production in Pakistan

1. Types of Livestock
2. Management Practices in Livestock

2.5 Challenges in Agricultural Production in Pakistan

3. Agribusiness models and Value chains **10 Hours**

3.1. Introduction to Agribusiness Models

3.2. Types of Agribusiness Models in Pakistan

3.3. Characteristics of Agribusiness Models

3.4. Value Chains

1. Problems in Pakistan's Value Chains

4. Business Planning and Strategy **12 Hours**

4.1. Introduction to Business and Business Planning

4.2. Strategies

1. Relationship between Strategy and Business Planning

4.3. Types of Business Planning (with Agricultural Context)

1. Business Planning in Agriculture
2. Business Planning and Feasibility Study

5. Financial Management and Accounting **10 Hours**

5.1 Main Types of Financial Statements:

5.2. Meaning, Concept and Idea of Accounting

5.3. Importance of Accounting in Agriculture

Paper B (48 hours)

6. Marketing and Sales Management **16 Hours**

6.1 Marketing Strategies and Planning

6.2 Key Steps in Marketing Planning:

1. Branding and Product Development
2. Sales and Distribution Channels

6.3 Types of Channels in Agriculture

1. Direct Sales
2. Wholesalers
3. Retailers
4. Exporters

6.4. Digital Marketing and e-Commerce

1. Advantages of Digital Marketing in Agriculture
2. Disadvantages of Digital Marketing in Agriculture

6.5 E-Commerce in Agriculture

6.6 Linking Marketing and Sales Management with Agriculture

1. Sales & Distribution Channels:

1.1 Digital Marketing
1.2 E-Commerce
1.3 Link with Agriculture

7. Supply Chain Management **14 Hours**

7.1 Introduction to Supply Chain Management

7.2 Detailed Steps of the Agricultural Supply Chain:

1. Input Supply – Seeds, fertilizers, equipment
2. Production – Crop or livestock farming
3. Harvesting and Collection
4. Processing – Cleaning, drying, packing
5. Storage and Transportation
6. Wholesale and Retail Distribution
7. Consumption – Reaches the Final consumer

7.3 Agriculture Supply Chain Diagram

7.4 Procurement

7.5 Procurement Procedure:

1. Identify needs (e.g., seed requirement for wheat)
2. Select suppliers (local dealers or agri. companies)
3. Request quotations (price offers)
4. Evaluate offers (based on price, quality)
5. Place order (issue purchase order)
6. Receive and inspect goods
7. Payment and record-keeping

7.6 Rules of Procurement (Good Practices)

7.7 Logistics: its Overview and Distribution

7.8 Key Functions of Logistics:

1. Transportation – moving products (e.g., trucks for fruit delivery)

2. Warehousing – storing products safely

3. Inventory Management – keeping stock levels balanced

4. Packaging and Handling – ensuring products are secure during transit

7.9. Distribution Channels in Agriculture:

1. Direct Sales – Farmer to consumer

2. Retailers – Kiryana stores, supermarkets

3. Wholesalers – Buy in bulk from farmers

4. Exporters – For international markets

8. Agricultural Marketing and Trade **10 Hours**

8.1. Market Trends, Pricing, and International Trade

8.2. Types of Pricing

8.3. International Trade

1. Benefits of Agricultural Trade

2. Challenges

3. Key Trade Partners

8.4. Market Research Techniques

Common Techniques:

1. Surveys and Questionnaires – Ask consumers about preferences
2. Focus Groups – Small group discussions
3. Observation – Monitoring buying patterns in local markets
4. Data Analysis – Using mandi prices, export records
5. Mobile and Online Tools – SMS polls, WhatsApp feedback

8.5. Market Analysis and Trends

1. Key Elements:

1.1 Price trends over the last few years

1.2 Supply-demand gap

1.3 Profit margins

1.4 Regional consumption patterns

2. Tools for Market Trend Analysis

8.6. Consumer Behavior and Preferences

1. Factors influencing behavior

8.7. Competitor Analysis

1. Why it matters

2. Key Areas to Study

9. Entrepreneurship and Innovation **08 Hours**

9.1. Entrepreneurial Mindset

1. Entrepreneurship in agriculture

2. Examples of Entrepreneurship in Agriculture

3. Key Traits of an Entrepreneurial Mindset:

9.2. Innovation

1. Example of Innovation

2. Types of Innovation in Agriculture

3. Why Innovation Matters in Pakistan

Recommended Books:-

1. "Introduction to Agricultural Economics" by John B. Penson Jr.: A foundational text on economic theory in agriculture.
2. "Farm Management" by Ronald D. Kay and William M. Edwards: Focuses on the financial and management aspects of running a farm.
3. "Agricultural Development: New Perspectives in a Changing World" (File.pide.org.pk): Discusses policy, technology, and global challenges.

4. Agricultural Value Chain Finance: Tools and Lessons (Calvin Miller and Carlos Da Silva, 2011): A comprehensive guide focusing on financial mechanisms to support agribusiness and smallholder integration.
5. Abbas, N. (2026). Strategic Business Finance (CFAP 4) (16th ed.). PAC Publications. Available via CBP Book.

Instructional Objectives

1: Introduction to Agribusiness

1. Define agribusiness and explain its components and overview.
2. Describe the input, farm production, and processing, marketing, and distribution sectors of agribusiness.
3. Explain the importance and scope of agribusiness in Pakistan.
4. Analyze the role of agribusiness in agricultural development and food security.
5. Identify opportunities in agribusiness sectors for entrepreneurship and investment.
6. Evaluate the interconnection between different agribusiness sectors.

2: Agricultural Production System

1. Explain different agricultural production systems in Pakistan, including crop, livestock, and mixed farming.
2. Identify major crops and livestock types and their management practices.
3. Analyze challenges in agricultural production and strategies to overcome them.
4. Compare production practices across crop and livestock systems.
5. Apply best practices for farm management and resource optimization.
6. Evaluate the sustainability and efficiency of agricultural production systems.

3: Agribusiness Models and Value Chains

1. Define agribusiness models and explain their characteristics.
2. Identify types of agribusiness models in Pakistan.
3. Explain value chain concepts and components in agriculture.
4. Analyze problems in value chains and propose solutions.
5. Evaluate the efficiency of agribusiness models for different crops and livestock.
6. Integrate value chain thinking into agribusiness planning.

4: Business Planning and Strategy

1. Explain the concept of business planning and strategy in agriculture.
2. Describe types of business planning and their applications in agribusiness.
3. Conduct feasibility studies for agribusiness projects.
4. Develop strategic plans for agricultural enterprises.
5. Evaluate the alignment between business strategy and operational objectives.
6. Apply business planning principles for successful agribusiness management.

5: Financial Management and Accounting

1. Explain the concept and importance of accounting in agriculture.
2. Identify the main types of financial statements used in agribusiness.
3. Apply basic accounting practices for farm and agribusiness management.
4. Analyze the financial performance of agricultural enterprises.
5. Evaluate costs, revenues, and profitability in agribusiness operations.
6. Integrate financial management practices into decision-making and resource allocation.

6: Marketing and Sales Management

1. Explain marketing strategies and planning in agriculture.
2. Identify and evaluate sales and distribution channels for farm products.
3. Apply branding, product development, and digital marketing techniques.
4. Integrate e-commerce and modern marketing tools into agribusiness operations.

5. Analyze consumer behavior, market trends, and competitor strategies.
6. Develop marketing plans that link production with sales for profitability.

7: Supply Chain Management

1. Explain the concept and steps of agricultural supply chains.
2. Identify procurement, logistics, storage, and distribution practices.
3. Apply procurement procedures and good practices for agricultural inputs.
4. Evaluate the efficiency of transportation, warehousing, inventory, and packaging.
5. Integrate supply chain management into farm-to-market operations.
6. Analyze distribution channels for local and international markets.

8: Agricultural Marketing and Trade

1. Analyze market trends, pricing strategies, and international trade opportunities.
2. Conduct market research using surveys, focus groups, observation, and data analysis.
3. Evaluate consumer behavior, preferences, and regional consumption patterns.
4. Assess profit margins and supply-demand gaps for agricultural products.
5. Perform competitor analysis to inform marketing and trade decisions.
6. Develop strategies to enhance market access and trade competitiveness.

9: Entrepreneurship and Innovation

1. Define entrepreneurship in agriculture and explain its importance.
2. Identify key traits and mindset of agricultural entrepreneurs.
3. Apply innovation strategies to improve agricultural production and services.
4. Evaluate examples of successful agribusiness innovations in Pakistan.
5. Integrate entrepreneurship principles into agribusiness planning.
6. Develop innovative solutions for agricultural challenges and value addition.

English-II

ENG-242

Total Contact Hours

Theory	**192**	**T**	**P**	**C**
Practical	**00**	**6**	**0**	**2**

Course Contents:

As per the BISEs/General education boards of the country.

Urdu-II

GEN-272

Total Contact Hours

Theory	**192**	**T**	**P**	**C**
Practical	**00**	**6**	**0**	**2**

Course Contents:

As per BISEs/General education boards of the country.

Pakistan Study

GEN-291

Total Contact Hours

Theory	**96**	**T**	**P**	**C**
Practical	**00**	**3**	**0**	**1**

Course Contents:

As per the BISEs/General education boards of the country.

Ethics-II/ Civics-II / Tarjumat-ul-Quran-II

ETH211 / CIV211/TT211

Total Contact Hours

Theory	**32**	**T**	**P**	**C**
Practical	**00**	**1**	**0**	**1**

Course Contents:

As per the BISEs/General education boards of the country.

Diploma in Agriculture Sciences (DAS)

3rd Year

SOIL FERTILITY AND PLANT NUTRITION

DAS-313

Total Credit Hours

Theory : 64

Practical : 96

T	P	C
2	3	3

Learning Outcomes

After studying this course, students will be able to:

1. Understand the importance of soil.
2. Understand fundamental knowledge within the different areas of soil science.
3. Learn about soil and plant nutrient management.
4. Have a preliminary ability to investigate soil characteristics.
5. Learn how to manage soils and their properties for a multitude of objectives.

Course Contents

1. SOIL **16 Hours**

- 1.1 Basic Concept
- 1.2 Soil Composition
- 1.3 Soil Texture (Types of Soil/Classification)
- 1.4 Soil Structure
- 1.5 Soil Profile
- 1.6 Soil Formation Process
- 1.7 Physical and Chemical Properties of Sail
- 1.8 Soil Organisms
- 1.9 Soil Organic Matter

2. SOIL FERTILITY AND SOIL PRODUCTIVITY **16 Hours**

2.1 Plant Nutrients
2.3 Evaluation of soil fertility
2.4 Factors Affecting Soil Fertility and Management Strategies
2.5 Essential Plant Nutrients: Functions, Deficiency
2.6 Nitrogen Fertilizers and Their Fate in Soil
2.7 Phosphorus Forms and P-Fertilizers Behavior in Soil
2.8 Potassium Forms, Amount and Exchange Equilibrium in Soil
2.9 Soil-plant Relations (Nutrients' Movement and Uptake)
2.10 Antagonistic and Synergistic Nutrient Interactions

3. FERTILIZERS AND MANURES **12 Hours**

3.1 Classification of Fertilizers and Manures (Special Fertilizers)
3.2 Fertilizer Application Methods;
3.3 Balanced Use of Fertilizers

3.4 Fertilizer Use Efficiency
3.5 Fertilizer Application to Major Crops
3.6 Integrated Plant Nutrient Management System (IPNMS)
3.7 Environmental Implications of Fertilizer Use

4. SOIL PROBLEMS (Soil Salinity, Sodicity and Waterlogging) 12 Hours

4.1 Salt-affected Soils
4.2 Formation of Salt-affected Soils (Salination, Sodication)
4.3 Categories of Salt-affected Soils
4.4 Plant Growth on Salt-affected Soils
4.5 Management of Salt-affected Soils
4.6 Water-logged Soils
4.7 Sources of waterlogging
4.8 Effects on Plant Growth
4.9 Control measures of waterlogging

5. SOIL EROSION AND CONSERVATION 8 Hours

5.1 Erosion
5.2 Water Erosion
5.3 Causes of Water Erosion
5.4 Wind Erosion
5.5 Gravity Erosion
5.6 Erosion Control and Management
5.7 Soil Conservation
5.8 Principles of Soil Conservation
5.9 Soil Conservation Practices
5.10 Water Conservation and Management Practices, and Water Harvesting Techniques

Recommended Books:-

1. Bashir, E. and Bantel, R. 2001. Soil Science. National Book Foundation, Islamabad.
2. Brady N. C. and Weil, R. R. 2015. The Nature and Properties of Soil. (15th Edition) Prentice-Hall, Inc., USA.
3. DAS, P.C. 2008. Manures & Fertilizers. Somani, L.L Soil & Fertilizer at a Glance

Instructional Objectives

1. Soil

1.1 Describe Basic Concept
1.2 Explain Soil Composition
1.3 Explain Soil Texture (Types of Soil/Classification)
1.4 Describe Soil Structure
1.5 Describe Soil Profile
1.6 Describe Soil Formation Process
1.7 Explain Physical and Chemical Properties of Soil
1.8 Identify Soil Organisms
1.9 Prepare Soil Organic Matter

2. Soil Fertility and Soil Productivity

2.1 Explain Plant Nutrients
2.3 Describe the Evaluation of Soil Fertility
2.4 Enlist Factors Affecting Soil Fertility and Management Strategies
2.5 Explain Essential Plant Nutrients: Functions, Deficiency
2.6 Explain Nitrogen Fertilizers and Their Fate in Soil
2.7 Describe Phosphorus Forms and P-fertilizers Behavior in Soil
2.8 Describe Potassium Forms, Amount and Exchange Equilibrium in Soil
2.9 Describe Soil-plant Relations (Nutrients' Movement and Uptake)
2.10 Explain Antagonistic and Synergistic Nutrient Interactions

3. Fertilizers and Manures

3.1 Explain Classification of Fertilizers and Manures (Special Fertilizers)
3.2 Describe Fertilizer Application Methods;
3.3 State the Balanced Use of Fertilizers
3.4 Describe Fertilizer Use Efficiency
3.5 Explain Fertilizer Application to Major Crops
3.6 Describe Integrated Plant Nutrient Management System (IPNMS)
3.7 Describe Environmental Implications of Fertilizer Use

4. Soil Problems (Soil Salinity, Sodicity and Waterlogging)

4.1 Explain Salt-affected Soils
4.2 Enlist Formation of Salt-affected Soils (Salination, Sodication)
4.3 Describe Categories of Salt-affected Soils
4.4 Describe Plant Growth on Salt-affected Soils
4.5 Describe Management of Salt-affected Soils
4.6 Explain Waterlogged Soils
4.7 Explain Sources of Waterlogging
4.8 Describe Effects on Plant Growth
4.9 Explain Control Measures of Waterlogging

5. Soil Erosion and Conservation

5.1 Introduce Erosion
5.2 Describe Water Erosion
5.3 Explain Causes of Water Erosion
5.4 Describe Wind Erosion
5.5 Describe Gravity Erosion
5.6 Explain Erosion Control and Management
5.7 Describe Soil Conservation
5.8 Enlist Principles of Soil Conservation
5.9 Explain Soil Conservation Practices
5.10 Describe Water Conservation and Management Practices, and Water Harvesting Techniques

List of Practical (96 Hours)

1. Perform soil sampling using a soil auger following standard procedures.
2. Demonstrate and perform detailed soil sampling techniques.
3. Identify and classify different types of soil samples.
4. Collect and preserve water samples for analysis.
5. Prepare and compile technical soil and water analysis reports.
6. Interpret results and prepare soil samples for laboratory analysis.
7. Prepare a saturated soil paste for chemical analysis.
8. Determine and analyze soil texture using standard methods.
9. Identify and differentiate available fertilizers.
10. Operate and utilize a soil testing kit for nutrient analysis.
11. Install, operate, and record readings from a soil tensiometer.
12. Calibrate and measure soil pH using a pH meter.
13. Handle and operate a weighing balance accurately.
14. Calculate and recommend fertilizer requirements based on soil test values.
15. Complete and submit practical assignments related to soil and water analysis.

ON- FARM WATER MANAGEMENT

DAS-323

	T	P	C
Total Credit Hours	2	3	3

Theory 64

Practical 96

Learning Outcomes

By the end of this course, students will be able to:

1. Explain on farm water management.
2. Explain the water source and quality
3. Explain the soil water relationship.
4. Explain the irrigation system and design.
5. Explain flood irrigation.
6. Explain water conservation techniques.
7. Explain water harvesting and storage.

Course Contents

1: Introduction to On-Farm Water Management **06 Hours**

- 1.1 Overview of water management in agriculture.
- 1.2 Importance of water conservation in farming.
- 1.3 History
- 1.4 Economic Benefits
- 1.5 Social Benefits

2: Water Source And Quality **10 Hours**

- **2.1 Types of water sources**
  - 2.1.1 Rainwater harvesting
  - 2.1.2 Groundwater extraction
  - 2.1.3 Surface water collection
- **2.2 Water Quality Parameters**
  - 2.2.1 pH and Alkalinity
  - 2.2.2 Electrical Conductivity (EC) and Salinity
  - 2.2.3 Turbidity and sedimentation
- **2.3 Water testing methods**
  - 2.3.1 Laboratory testing methods
  - 2.3.2 Field testing methods (eg, pH meters, EC meters)

3: Soil Water Relationship **10 Hours**

- **3.1 Soil properties and water holding capacity**
  - 3.1.1 Soil texture and structure
  - 3.1.2 Organic matter and water holding capacity
- **3.2 Water infiltration and percolation**
  - 3.2.1 Factors affecting infiltration (e.g. Soil compaction, slope)
  - 3.2.2 Factors affecting percolation (e.g., soil depth, drainage
- **3.3 Soil moisture monitoring techniques**

3.3.1 Visual observation (e.g., soil color, moisture feel)
3.3.2 Instrumental measurement (e.g., tensiometer, neutron probes

4: Irrigation System and Design **08 Hours**

4.1 Types of Irrigation Systems
4.1.1 Drip Irrigation (micro irrigation)
4.1.2 Sprinkler irrigation

5: Flood Irrigation (Surface Irrigation) **10 Hours**

5.1 Irrigation system design and layouts
5.1.1 System components (eg, pumps, pipes values)
5.1.2 System layout and planning (eg, Field shape, slope)

5.2 Water application efficiency
5.2.1 Measuring water application efficiency
5.2.2 Factors affecting water application efficiency (e.g., nozzle pressure)

6: Water Conservation Techniques **10 Hours**

6.1 Crop Selection and Water Requirements
6.1.1 Water requirements for common crops
6.1.2 Drought-tolerant crops and varieties

6.2 Mulching and cover cropping
6.2.1 Benefits of mulching and cover cropping
6.2.2 Types of mulch and cover crops

6.3 Conservation tillage and reduced tillage
6.3.1 Benefits of conservation tillage
6.3.2 Types of conservation tillage (e.g., no tillage, reduced tillage)

7: Water Harvesting and Storage **10 Hours**

7.1 Rain harvesting system
7.1.1 Roof catchment system
7.1.2 Ground catchment system
7.1.3 System design and installation

7.2 Water Storage Options
7.2.1 Tanks (eg. steel, concrete, plastic)
7.2.2 Ponds and reservoirs
7.2.3 Water storage safety and maintenance

Recommended Books:-

1. Ali, M.H. 2001 volumes I and II "Fundamentals of Irrigation and On- Farm Water Management".
2. Ahmad and Qayoom, volumes I "Farm Irrigation Management: principles and practices, 1st Edition
3. Manual of Canal and Drainage Laws in Pakistan by Raja Farooq Aslam

Instructional Objectives:

1: On Farm Water Management

1. Define an overview of water management in agriculture.
2. Explain the importance of water conservation in farming.
3. Describe history
4. Describe economic benefits
5. Explain social benefits

2. Water Source and Quality

2.1 Explain Types of water sources

2.1.1 Rainwater harvesting

2.1.2 Ground water extraction

2.1.3 Surface water collection

2.2 Describe Water Quality Parameters

2.2.1 pH and Alkalinity

2.2.2 Electrical Conductivity (EC) and Salinity

2.2.3 Turbidity and sedimentation

2.3 Describe Water testing methods

2.3.1 Laboratory testing methods

2.3.2 Field testing methods (eg. pH meters, EC meters)

3. Soil Water Relationship

3.1 Introduce Soil properties and water holding capacity

3.1.1 Soil texture and structure

3.1.2 Organic matter and water holding capacity

3.2 Explain Water infiltration and percolation

3.2.1 Factors affecting infiltration (e.g., soil compaction, slope)

3.2.2 Factors affecting percolation (e.g., soil depth, drainage

3.3 Describe Soil moisture monitoring techniques

3.3.2 Visual observation (e.g., soil color, moisture feel)

3.3.3 Instrumental measurement (e.g., Tensiometer, neutron probes

4: Irrigation System and Design

4.1 Types of Irrigation Systems

4.1.1 Drip Irrigation (micro irrigation)

4.1.2 Sprinkler irrigation

5 : Describe Flood Irrigation (Surface Irrigation)

5.1 Explain Irrigation system design and layouts. System components (eg. pumps, pipes values)

2.2 System layout and planning (e.g., field shape, slope)

2.3 Explain Water application efficiency

5.3.1 Measuring water application efficiency

5.3.2 Factors affecting water application efficiency (eg nozzle pressure)

3. Water Conservation Techniques

6.1 Describe Crop Selection and Water Requirements

6.1.1Water requirements for common crops

6.2.1 Drought-tolerant crops and varieties

6.2 Describe Mulching and cover cropping

6.2.1 Benefits of mulching and cover cropping

6.2.2 Types of mulch and cover crops

6.3 Enlist Conservation tillage and reduced tillage

6.3.1 Benefits of conservation tillage

6.3.2 Types of conservation tillage (e.g. no tillage, reduced tillage)

7: Understand Water Harvesting and Storage

7.1 Introduce the rain harvesting system

7.1.1 Roof catchment system

7.2.2 Ground catchment system

7.2.3System design and installation

7.2 Describe Water Storage options

7.2.1 Tanks (eg. steel, concrete, plastic)

7.2.2 Ponds and reservoirs

7.2.3 Water storage safety and maintenance

List of Practical 96 Hours

1. Identify the canal system and its components.
2. Interpret the water cycle and its processes.
3. Demonstrate and compare different water treatment methods.
4. Demonstrate and assess disinfection methods in water treatment.
5. Interpret and apply water safety guidelines.
6. Assess and evaluate drinking water quality standards.
7. Inspect and evaluate irrigation systems.
8. Identify, diagnose, and recommend solutions for leaks, blockages, and worn-out parts in irrigation systems.
9. Collect and test water samples from various sources (well, pond, river) for pH.
10. Design and plan a rainwater harvesting system.

Introductory Plant Breeding

DAS-333

Total Credit Hours
Theory: 64
Practical: 96

T	P	C
2	3	3

Learning Outcomes

This course aims to enable students to understand basic concepts of plant breeding and genetics so they can identify different types of varieties and understand applied breeding methods, breeding objectives, reproduction methods, hybrid seed production and new trends in plant breeding.

Course contents

1. Introduction **04 Hours**

1.1 Introduction

1.2 History

1.3 Role in agriculture and food security

2. Basic Genetics for Plant Breeding **08 Hours**

2.1 Genes, alleles, genotype & phenotype

2.2 Mendelian laws (segregation, independent assortment)

2.3 Dominance, co-dominance, epistasis

2.4 Genetic variation and its importance

2.5 Heritability

2.6 Genotype by Environment Interaction (GE) with Examples

3. Reproduction and Pollination in Crops **08 Hours**

3.1 Sexual vs asexual reproduction

3.2 Sexual reproduction

3.2.1 Amphimixis

3.2.2 Gametogenesis

3.2.3 Megasporogenesis

3.2.4 Microsporogenesis

3.3 Asexual reproduction (Apomixis)

3.3.1 Parthenogenesis

3.3.2 Apospory

3.3.3 Pseudogamy

3.3.4 Apogamy

3.3.5 Advantages

3.3.6 Disadvantage

3.4 Vegetative reproduction

3.5 Floral biology of major crops

3.6 Mechanisms promoting self-pollination and cross-pollination

4. Breeding Objectives 10 Hours

4.1 Yield (horizontal, vertical farming)

4.2 Disease resistance (horizontal, vertical)

4.3 Short-duration varieties

4.4 Stress breeding (biotic abiotic)

4.5 Insect pest resistance

4.6 Quality Breeding

4.7 Hybrid varieties

4.8 Genetic engineering.

5. Plant Breeding Approaches for self-pollinated crops 10 Hours

5.1 Introduction

5.2 Selection

5.2.1 Mass selection

5.2.2 Pureline selection

5.2.3 Mass selection vs pureline selection (differences)

5.3 Hybridization

5.4 Bulk method

5.5 Pedigree method

5.6 Backcross method

6. Plant Breeding Approaches for cross-pollinated crops 10 Hours

6.1 Introduction

6.2 Selection

6.2.1 Mass selection

6.2.2 Recurrent selection

6.3 Hybridization in cross-pollinated

6.4 Development and evaluation of inbred lines

6.5 Development of hybrids

6.6 Synthetic and composite varieties

6.6.1 Synthetic vs composite (differences)

7. New Trends in Plant Breeding 08 Hours

7.1 Poly Ploidy

7.2 Mutation

7.3 Biotechnology

7.4 Genetic engineering

7.5 Tissue culture

8. Variety Registration 06 Hours

8.1 Introduction and Objective of Variety Registration

8.2 Classes of seeds

8.3 Procedure of Variety Registration

8.4 Registration authorities

Recommended Books:-

1. Singh, B. D. (2022). Plant Breeding: Principles and Methods (12th Edition). MedTech Science Press. ISBN: 9789393168061.

2. Khan, M. A. (2008). Plant Breeding. Daya Publishing House

3. Khan, M.A. (Ed.). (1994). Plant Breeding. Islamabad: National Book Foundation.

Instructional Objectives

1. Introduction

1.1 Define plant breeding and explain its scope.

1.2 Describe the historical development of plant breeding from traditional to modern methods.

1.3 Explain the role of plant breeding in agriculture and food security.

1.4 Discuss the importance of improved crop varieties in addressing global food challenges.

2. Basic Genetics for Plant Breeding

2.2 Define and differentiate between genes, alleles, genotype, and phenotype.

2.3 Explain Mendel's laws of segregation and independent assortment with examples.

2.4 Interpret patterns of inheritance, including dominance, co-dominance, and epistasis.

2.5 Describe sources of genetic variation and their significance in plant breeding.

2.6 Explain the concept of heritability and its application in selection.

2.7 Analyze genotype × environment interaction (G×E) with practical examples.

3. Reproduction and Pollination in Crops

3.1 Distinguish between sexual and asexual reproduction in plants.

3.2 Explain key processes of sexual reproduction, including:

3.2.1 Apomixis

3.2.2 Gametogenesis

3.2.3 Megasporogenesis

3.2.4 Microsporogenesis

3.3 Describe mechanisms of apomixis and its types (parthenogenesis, apospory, pseudogamy, apogamy).

3.4 Evaluate the advantages and disadvantages of apomixis in crop improvement.

3.5 Explain vegetative propagation methods in crops.

3.6 Describe the floral biology of major crops.

3.7 Analyze mechanisms promoting self- and cross-pollination.

4. Breeding Objectives

4.1 Define breeding objectives for different crops.

4.2 Explain strategies to improve yield (including horizontal and vertical approaches).

4.3 Differentiate between horizontal and vertical disease resistance.

4.4 Identify traits for developing short-duration crop varieties.

4.5 Explain breeding for biotic and abiotic stress tolerance.

4.6 Describe methods for improving insect pest resistance.

4.7 Evaluate quality traits in crop breeding.

4.8 Explain the concept and development of hybrid varieties.

4.9 Discuss the role of genetic engineering in crop improvement.

5. Plant Breeding Approaches for Self-Pollinated Crops

5.1 Describe characteristics of self-pollinated crops.

5.2 Compare and apply selection methods

5.3 Differentiate between mass selection and pure line selection.

5.4 Explain the process and objectives of hybridization.

5.5 Describe breeding methods, including the Bulk method, Pedigree method and Backcross method

5.6 Select appropriate breeding methods for specific crop improvement goals.

6. Plant Breeding Approaches for Cross-Pollinated Crops

6.1 Describe characteristics of cross-pollinated crops.

6.2 Apply selection methods such as: Mass selection and recurrent selection

6.3 Explain hybridization techniques in cross-pollinated crops.

6.4 Describe the development and evaluation of inbred lines.

6.5 Explain the development and advantages of hybrid varieties.

6.6 Differentiate between synthetic and composite varieties.

6.7 Evaluate the advantages and limitations of each breeding approach.

7. New Trends in Plant Breeding

7.1 Explain the concept and applications of polyploidy in crop improvement.

7.2 Describe mutation breeding and its role in creating variability.

7.3 Explain the role of biotechnology in modern plant breeding.

7.4 Describe principles and applications of genetic engineering.

7.5 Explain the use of tissue culture in plant breeding programs.

8. Variety Registration

8.1 Explain the purpose and importance of variety registration.

8.2 Identify different classes of seeds.

8.3 Describe the step-by-step procedure of variety registration.

8.4 Identify national and international variety registration authorities.

8.5 Explain legal and quality control aspects of seed certification.

List of Practical (96 Hours)

1. Identify and label flower parts
2. Identify types of Flower
3. Demonstrate emasculation Techniques
4. Demonstrate Pollination Mechanisms that Prevent Self-pollination
   - 4.1 Heterostyly
   - 4.2 Self-incompatibility
5. Demonstrate General procedure of hybridization
   - 5.1 Hybridization types
   - 5.2 Hybridization definitions
6. Identify Morphological features of wheat
7. Demonstrate Crossing technique in wheat
8. Visit to PBG experimental farm/field
9. Identify Morphological features of maize
10. Demonstrate Crossing technique in maize
11. Identify Morphological features of rice
12. Demonstrate Crossing technique in rice

Computer Science

COMP- 383

Total Credit Hours
Theory: 64
Practical: 96

T	P	C
2	3	3

Learning Outcomes

Aim of this course is to enable students to understand fundamental concepts of IT, computer systems, Artificial Intelligence (AI), ICT, GPS, Internet, and practical MS-Office skills. Students will develop hands-on skills in Windows, MS Office, the Internet, and GPS applications.

Course contents

1. Electronic Data Processing (E.D.P.) 16 Hrs

1.1 IT and its importance

1.2 Data, types of data and information

1.3 Computer: definition, history, and characteristics

1.4 Classification of computers

1.5 Components of a computer system

1.6 Applications in Engineering, Education, Business, and Agriculture

2. Hardware and Software 16 Hrs

2.1 Hardware vs software

2.2 CPU and its components

2.3 Motherboard, processor, and memory types

2.4 Storage devices (HDD, CD/DVD, Floppy)

2.5 Expansion cards (Graphics, Sound, Modem), ports, and UPS

2.6 Operating system: types and functions

3. Artificial Intelligence (AI) 12 Hrs

3.1 Introduction and history

3.2 Types of AI

3.3 Machine Learning and Automation basics

3.4 Applications in daily life, education, business, and agriculture

3.5 Common AI tools (chatbots, image generation)

3.6 Ethical and responsible use

4. Internet & E-Mail 12 Hrs

4.1 Internet, WWW, browsers

4.2 Search engines, searching techniques

4.3 ISP, DNS, URL

4.4 Searching, saving, and printing web pages

4.5 Creating, sending, and receiving E-mails and attachments

4.6 Spam control and password security

4.7 Introduction to social media

5. Information & Communication Technology (ICT) and GPS 8 Hrs

5.1 ICT: definition and importance

5.2 Types, advantages, disadvantages

5.3 ICT in Agriculture

5.4 GPS: introduction, components

5.5 GPS applications in Agriculture

Recommended Books

1. Mustafa, T. et al. (2010). *Business I.T.*, IT Series Publications, Faisalabad
2. Gallen, A. Grams (2006). *Computer Hardware aur Software* (Urdu), Lahore
3. Artificial Intelligence by Zeeshan Usmani; Guftagu Publications.

Instructional Objectives

1. Understand Electronic Data Processing (E.D.P.)

1.1 Explain IT and its importance
1.2 Describe data, types of data, and information
1.3 Explain the computer, history, and characteristics
1.4 Describe the classification and components of a computer system
1.5 Identify applications in Engineering, Education, Business, and Agriculture

2. Understand Hardware and Software

2.1 Explain hardware vs software
2.2 Describe the CPU and its components
2.3 Explain motherboard, processor, and memory types
2.4 Identify storage devices and expansion cards
2.5 Explain ports, UPS, and operating system types/functions

3. Understand Artificial Intelligence (AI)

3.1 Explain the concept and history of AI
3.2 Describe types of AI
3.3 Explain basic Machine Learning and Automation
3.4 Identify applications of AI in daily life, education, business, and agriculture
3.5 Understand ethical use of AI

4. Understand Internet & E-Mail

4.1 Explain the Internet, WWW, and browsers
4.2 Describe search engines and searching techniques
4.3 Explain ISP, DNS, and URL
4.4 Describe creating, sending, and receiving E-mails and attachments
4.5 Explain spam control and password security

5. Understand ICT and GPS

5.1 Explain ICT and its importance
5.2 Describe types, advantages, and disadvantages of ICT
5.3 Explain the ICT impact on Agriculture
5.4 Explain GPS and its components
5.5 Identify GPS applications in Agriculture

6. Develop Practical Skills

6.1 Operate the Windows operating system
6.2 Create and format documents using MS-Word
6.3 Perform calculations and charts using MS-Excel
6.4 Create presentations using MS-PowerPoint
6.5 Use the Internet and E-mail effectively
6.6 Use GPS applications in Agriculture

List of Practical (96 Hours)

1. Windows & Basic Operations

1. Practice loading and shutdown of operating system
2. Practice Desktop settings: icons, shortcuts, taskbar modification
3. Practice Control panel: add/remove programs, date & time, mouse, user accounts
4. Practice Searching files and folders

2. MS-Office (MS-WORD)

5. Identify the MS-Word screen and menus
6. Create, save, and open documents
7. Edit and format text
8. Page formatting: margins, orientation, borders, fonts
9. Spell check and grammar
10. Paragraph alignment, bullets, numbering
11. Insert pictures, shapes, symbols, text boxes
12. Header, footer, page numbering
13. Create and edit tables
14. Print documents
15. Save documents as PDF

C. MS-OFFICE (MS-EXCEL)

16. Identify the MS-Excel screen and menus
17. Create, save, and open worksheets
18. Enter and edit data
19. Format cells, rows, and columns
20. Formulas: Add, Subtract, Multiply, Divide, Average
21. Create charts and graphs
22. Page setup, print preview, and printing

D. MS-OFFICE (MS-POWER POINT)

24. Identify MS-PowerPoint screen and menus
25. Create and save presentations
26. Edit and format slides
27. Insert pictures, videos, animations
28. Slide shows and transitions

E. INTERNET & E-MAIL

29. Web browsing and searching for information
30. Create and manage E-mail accounts
31. Send, receive, and download attachments

F. Basic Use of GPS in Agriculture

32. Measurement of localized weather elements

Post-Harvest Horticulture
DAS-343

Total Credit Hours	T	P	C
	2	**3**	**3**

Theory : 64 Hours
Practical : 96Hours

Learning Objectives

By the end of this course, students will be able to:

1. Explain the definition and future scope of post-harvest horticulture.
2. Explain the biochemistry & physiology of fruits and vegetables.
3. Explain Harvesting, Packing, Storage and Transportation.
4. Explain Biochemical Changes during the ripening of fruit.
5. Explain Post-Harvest Losses in Fruits and Vegetables.
6. Explain Marketing of Horticultural Crops.
7. Explain post-harvest techniques to extend the shelf life of fruits and vegetables.

1. Introduction **2 Hour**

1.1 Definition

1.2 Present status

1.3 Future scope of postharvest Horticulture in Pakistan.

2. Physiology and Biochemistry of fruits & vegetables. **8 Hour**

2.1 Fruit growth and developmental stages

2.2 Nutrient uptake and transport

2.3 Water uptake and transport

2.4 Enzymes

2.5 Ripening and respiration of fruits (climacteric fruits, non-climacteric fruits)

3. Harvesting **6 Hours**

3.1 Hand harvesting

3.2 Mechanized harvesting

3.3 Chemical harvesting

4. Biochemical Changes during the ripening of fruit **8 Hours**

4.1 Changes in the rate of Respiration

4.2 Ethylene production

4.3 Softness of pulp

4.4 Changes in fruit color

4.5 Development of Aroma and Flavor

5. Post-Harvest Losses in Fruits and Vegetables 6 Hours

5.1 Causes

5.2 Remedies

6. Post-harvest techniques to extend the shelf life of fruits and vegetables 10 Hours

6.1 Cooling of post-harvest fruits and vegetables

6.1.1 Precautionary Measures.

6.1.2 Methods of cooling

6.1.3 Hydro cooling

6.1.4 Forced Air

6.1.5 Package icing

6.2 Curing

6.3 Wax coatings

6.4 Anti-fungal Agents

6.5 Gamma irradiations

7. Packaging 4 Hours

7.1 Different packaging materials and their characteristics

8. Storage 04 Hour

8.1 Storage principal

8.2 Factors affecting storage

8.3 Storage techniques

9. Transportation 6 Hours

9.1. Principles of Transportation

9.2 Mode of transportation

9.2.1 Highways

9.2.2 Sea routes

9.2.3 Air Freight

10. Marketing of Horticultural Crops 10 Hours

10.1 Importance of marketing in horticulture

10.2 Marketing channels and structures

10.3 Market trends and demand

10.4 Promotional Strategies (Advertising, Sales Promotion, Public Relate)

10.5 Distribution Channels and Logistics

10.6 Retailing and Wholesale Marketing

Recommended Books

1. "Physiology of Fruits and Vegetables" by Dr. Muhammad Shahid (University of Punjab, Lahore).
2. "Postharvest Technology of Horticultural Crops" by Dr. Muhammad Aslain (University of Peshawar).
3. "Postharvest Handling and Storage of Fruits and Vegetables" by Dr. Muhammad Shahid (University of Punjab, Lahore)
4. "Postharvest Management of Fruits and Vegetables: A Practical Approach Muhammad Amjad (University of Agriculture, Faisalabad).

Instructional Objectives

1. Introduce the post-harvest horticulture

Explain Definition, present status and future scope of postharvest Horticulture in Pakistan.

2. Understand Physiology and Biochemistry of fruits & vegetables.

2.1 Explain Fruit growth and developmental stages
2.2 Explain Nutrient uptake and transport
2.3 Explain Water uptake and transport
2.4 Explain Enzymes
2.5 Explain Ripening and Respiration of fruits (climacteric fruits, non-Climacteric Fruits)

3. Describe Harvesting

3.1 Describe Hand Harvesting
3.2 Describe Mechanized Harvesting
3.3 Describe Chemical Harvesting

4. Understand Biochemical Changes during the ripening of fruit

4.1 Explain Changes in the Rate of Respiration
4.2 Explain Ethylene production
4.3 Explain the softness of pulp
4.4 Describe Changes in fruit color
4.5 Explain the development of aroma and flavor

5. Understand Post-Harvest Losses in Fruits and Vegetables

5.1 Explain Causes
5.2 Enlist Remedies

6. Explain post-harvest techniques to extend the shelf life of fruits and vegetables

6.1 Explain the cooling of post-harvest fruits and vegetables
- 6.1.2 Precautionary measures.
- 6.1.3 Methods of cooling
- 6.1.4 Hydro cooling
- 6.1.5 Forced Air
- 6.1.6 Package icing

6.2 Explain Curing
6.3 Explain Wax coatings
6.4 Describe Anti-fungal Agents
6.5 Explain Gamma irradiations

7. Describe Packaging

7.1 Enlist Different packaging materials and their characteristics

8. Understand Storage

8.1 Describe Storage principal
8.2 Explain Factors affecting storage
8.3 Prepare Storage techniques

9. Understand Transportation

9.1. Enlist Principles of Transportation

9.2 Explain Mode of transportation
- 9.2.1 Highways
- 9.2.2 Sea routes
- 9.2.3 Air Freight

10. Understand Marketing of Horticultural Crops

10.1 Explain Importance of marketing in horticulture
10.2 Describe Marketing channels and structures
10.3 Describe Market trends and demand
10.4 Explain Promotional Strategies (Advertising, Sales Promotion, Public Relate)
10.5 Explain Distribution Channels and Logistics
10.6 Describe Retailing and Wholesale Marketing

List of Practical **96 Hours**

1. Identify different types of vegetables, their characteristics, and uses.
2. Identify different types of fruits, their characteristics, and uses.
3. Visit the food industry to identify machinery and equipment used for various operations.
4. Visits to the fruit and vegetable markets, packing houses and cold storages.
5. Demonstrate handling techniques for fruits and vegetables to minimize damage and losses.
6. Grade fruits and vegetables according to Market standards.
7. Visit to different food industries to demonstrate different packaging materials techniques for fruit & vegetables.
8. Conduct experiments on the temperature effect for various fruits and vegetables.
9. Conduct experiments on humidity and ventilation effects for various fruits and vegetables.
10. Demonstrate loading and unloading techniques for fruits and vegetables during transportation.
11. Demonstrate fumigation techniques for pest control and extending the shelf life of fruits and vegetables
12. Determine moisture of different fruits and vegetables for extending shelf life

Applied Chemistry in Food Science

DAS-353

	T	P	C
Total Contact Hours	2	3	3

Theory : 64
Practical : 96

Learning Outcomes:

Students will be able to:
1. Explain food science and technology.
2. Explain the food industry and food sources.
3. Explain food constituents and their functions.
4. Explain Food classification, spoilage, and preservation principles.
5. Explain Postharvest handling and preparation of foods for food processing.
6. Explain heat processing and low-temperature preservation.
7. Explain evaporation and dehydration.
8. Explain the use of chemical additives and preservation by fermentation technology.

Course Contents

1. Introduction to food science and technology **5 Hours**

1.1 Food science

1.2 Food technology

1.3 Relationship with other disciplines

1.4 Career opportunities

1.5 Significance of food science and technology

1.6 Global and national food and nutrition situation

2. Food industry **3 Hours**

2.1 History

2.2 Developments

2.3 Important food industries in Pakistan

3. Food sources: **4 Hours**

3.1 Plants

3.2 Animals

3.3 Marine

4. Food constituents and their functions: 10 Hours

4.1 Water

4.2 Carbohydrates

4.3 Lipids

4.4 Proteins

4.5 Vitamins

4.6 Minerals

4.7 Vitamins

4.8 Food additives

4.9 Food preservatives

4.10 Flavor and aroma

4.11 Colorants and pigments

5. Food classification, spillage and preservation principles 10 Hours

5.1 Classification of foods

5.2 Perishability

5.3 PH

5.4 Food spoilage agents

5.5 Enzymes -

5.6 Microorganisms

5.7 Pests

5.8 Physical factors

5.9 Principles of food preservation

5.10 Prevention or delay of autolysis

5.11 Microorganisms

5.12 Pests

5.13 Physical defects

6. Postharvest handling and preparation of foods for food processing 06 Hours

6.1 Properties of raw materials

6.2 Storage and transportation of raw materials

6.3 Preparatory operations

6.4 Cleaning, Sorting, Grading, Size reduction, Blanching, Slanting

7. Heat processing 6 Hours

7.1 Pasteurization

7.2 HTST

7.3 Commercial sterilization

7.4 UHT

7.5 Canning

7.6 Unit operations

7.7 Retort operation

7.8 Equipment

7.9 Effect of heat processing: nutrients, microorganisms

8. Low temperature preservation 03 Hours

8.1 Refrigeration

8.2 Cold storage

8.3 Freezing

9. Evaporation and dehydration 03 Hours

9.1 Evaporation

9.2 Drying

9.3 Dehydration

10. Use of chemical additives 04 Hours

10.1 Contaminants

10.2 Adulterants

10.3 Additives

10.4 Food additives: Classification, criteria for selection

11. Preservation by fermentation technology **05 Hours**

11.1 Principles, objectives, types: alcoholic, acetic and lactic fermentations

11.2 Fermented foods

11.3 Bread, Wine, Vinegar, Yoghurt, Sausages, Pickles

12. Food irradiation **05 Hours**

12.1 Principles, Applications, Equipment's

12.2 Safety aspect

12.3 Effect on food properties

12.4 Detection methods

Recommended Books:

1. Food Science & Technology by Dr. J.A. Awan
2. Food Science by Norman N. Potter and Joseph H. Hotchkiss (Fifth Edition)
3. Food Science by Sumati R. Mudambi, Shalini M. Rao & M.V. Rajagopal
4. Dr. Abdul Sattar Jatoi (Dawood University of Engineering and Technology, Karachi) Integrated Food and Bioprocessing (2025) Publisher: Springer ISBN: 978-3031872082
5. **Innovations in Engineering and Food Science** (2024) Shilpa Mehta, Fakhar Islam (NUR International University, Pakistan), Ali Imran (Government College University, Pakistan) **Publisher**: IGI Global **ISBN**: 979-8369308196
6. **Nanotechnology Innovations for Food Security and Sustainable Agriculture** (2026) Dr. Ilyas Ahmad (Pir Mehr Ali Shah Arid Agriculture University, Pakistan), Dr. Shah Fahad (Abdul Wali Khan University, Pakistan), and others **Publisher**: John Wiley & Sons Inc. **ISBN**: 978-1394348985

Instructional Objectives

1. Introduction to food science and technology

1.1 Explain Food Science
1.2 Explain Food Technology
1.3 Explain the relationship with other disciplines
1.4 Explain Career Opportunities
1.5 Describe the significance of food science and technology
1.6 Describe the global and national food and nutrition situation

2. Understand the food industry

2.1 Explain History
2.2 Explain Developments
2.3 Explain important food industries in Pakistan

3. Understand Food Sources

3.1 Describe Plants
3.2 Describe Animals
3.3 Describe Marine

4. Explain Food constituents and their functions

4.1 Describe Water
4.2 Describe Carbohydrates
4.3 Describe Lipids
4.4 Describe Proteins
4.5 Describe Vitamins
4.6 Describe Minerals
4.7 Describe Vitamins
4.8 Describe Food Additives
4.9 Describe Food preservatives
4.10 Describe Flavor and aroma
4.11 Describe Colorants and Pigments

5. Describe Food classification, spillage and preservation principles

5.1 Explain the classification of foods
5.2 Describe Perishability
5.3 Explain PH
5.4 Explain Food spoilage agents
5.5 Describe Enzymes -
5.6 Describe Microorganisms
5.7 Describe Pests
5.8 Explain Physical factors

5.9 Describe the principles of food preservation
5.10 Describe the prevention or delay of autolysis
5.11 Explain Microorganisms
5.12 Describe Pests
5.13 Describe Physical Defects

6. Understand Postharvest handling and preparation of foods for food processing:

6.1 Enlist the properties of raw materials
6.2 Explain the storage and transportation of raw materials
6.3 Describe Preparatory Operations
6.4 Describe Cleaning, Sorting, Grading, Size Reduction, Blanching, Slanting

7. Understand Heat processing:

7.1 Describe Pasteurization
7.2 Describe HTST
7.3 Describe Commercial sterilization
7.4 Describe UHT
7.5 Describe Canning
7.6 Describe Unit Operations
7.7 Describe the Retort operation
7.8 Describe Equipment
7.9 Enlist the effect of heat processing: nutrients, microorganisms

8. Low temperature preservation:

8.1 Define Refrigeration
8.2 Explain Cold Storage
8.3 Describe Freezing

9. Differentiate Evaporation and dehydration

9.1 Describe Evaporation
9.2 Describe Drying
9.3 Describe Dehydration

10. Use of chemical additives:

10.1 Explain Contaminants
10.2 Describe Adulterants
10.3 Describe Additives
10.4 Enlist Food additives: Classification, criteria for selection

11. Describe Preservation by fermentation technology:

11.1 Explain Principles, objectives, types of alcoholic, acetic and lactic fermentations
11.2 Describe Fermented foods
11.3 Describe Bread, Wine, Vinegar, Yoghurt, Sausages, Pickles

12. Describe Food irradiation

12.1 Explain Principles, Applications, Equipment

12.2 Learn about the safety aspect

12.3 Learn effect on food properties

12.4 Detection methods

List of Practical **96 Hours**

1. Identify food science laboratory equipment and laboratory SOP's
2. Prepare fruit syrup
3. Prepare fruit squash
4. Prepare synthetic syrup
5. Prepare jam
6. Prepare jelly
7. Prepare marmalades
8. Prepare tomato ketchup
9. Prepare pickle
10. Prepare vinegar
11. Preserve fruits and vegetables through drying

PROJECT

DAS-363

Evaluation & Assessment of the project

40% Marks of the Project will be assigned as final to be assessed by the examiner, to be appointed by Boards of Technical Education of the country.

60% Marks of the Project will be assigned to the institution concerned.

In order to have passed both components, i.e. Practical & sessional a minimum 50% marks in each component is required.

LIST OF TOOLS, EQUIPMENT & MACHINERY FOR DIPLOMA IN AGRICULTURAL SCIENCES

LIST OF LABS

1. Agriculture and Food Science Lab
2. Demonstration and Practical Farm
3. Forestry Nursery Area
4. Farm Machinery Workshop
5. Computer Lab

1: Agriculture and Food Science Lab

Sr. No.	Nomenclature of Tools/ Equipment/ Machinery	Quantity Nos.
1.	Soil Testing Kit	01
2.	pH Meter	02
3.	Low Temperature Incubator	01
4.	Soil Auger	05
5.	Tensiometer	02
6.	Electrical Balance	01
7.	Flasks	15
8.	Beakers	15
9.	Sprit Lamp	10
10.	Measuring Tapes 50’	02
11.	Measuring Tapes 100’	02
12.	Thermometer: Dry and wet	01
13.	Microscope	03
14.	Wash Bottle 500ML	05
15.	Sieve	02
16.	Tray and Balti	01 each
17.	Goggles	05
18.	Gas Mask	05
19.	Rain Coat	02
20.	Triple Beam Balance	01
21.	Setting Board	10
22.	Cover Slip	20
23.	Collection Box	50
24.	Bottle Stand	05
25.	Chemical Bottles	25
26.	Vase	05
27.	Sprit Lamp	05
28.	Jar Glass	10
29.	Petri Dish	10
30.	Disease Sample Box	10
31.	Spray Machine	01
32.	Insect Collection Net	50
33.	Insect Order Frame	12
34.	Butterfly Net	30
35.	Chemical Jars	25
36.	Insects Dissection Board	10
37.	Pest Scouting Kits	10
38.	Measuring Jars	25
39.	Flat Fan Nozzle	01
40.	Hollow Cone Nozzle	01

41.	Food Factory (Citrus Juice)	01
42.	Rose Head Machine	01
43.	Hand Extractor	01
44.	Abrasive Peeler	01
45.	Hand Refractometer	02
46.	Gas Cylinder	02
47.	Gas Burner	02
48.	Digital Balance	01
49.	Simple Balance	01
50.	Pan (Silver Steel)	02
51.	Mug (Steel)	06
52.	Buckets (Steel)	04
53.	Tub (Steel)	04
54.	Sieves (Stainless Steel)	03
55.	Knives	10
56.	Hand Juicer Machine	01
57.	Multipurpose Peeler	01
58.	Double Bottom Cooking Pan	02
59.	Bottle Filler	01
60.	Mixing Tank	01
61.	Pressure Cooker (9 and 11 liter)	02
62.	Laboratory Table	06
63.	Barometer	1
64.	Thermometer	1
65.	EC meter	1
66.	pH Paper	9
67.	Dry and wet Thermometer	02
68.	Minimum and maximum Thermometer	1
69.	Hygrometer	1
70.	Institute’s Model	1
71.	Single row cotton drill	1
72.	Rabi Drill	1
73.	Kharif Drill	1
74.	Pakistani Plough	1
75.	Raja plough	1
76.	Bar harrow	1
77.	KR Krundi	1
78.	Tarphali	1
79.	Rain gauge	1
80.	Plastic tray	2
81.	Pruning Scissors	10
82.	Secateurs	10
83.	Picking bags	15
84.	Saw	10
85.	Iron ladder	02
86.	Iron stool	02
87.	Safety cap	20
88.	Pole pruner	05
89.	Rose cutter	10

90.	Hedge Cutter	10
91.	Chuha ramba	10
92.	Budding knife	10
93.	Cylinder 100ml	2
94.	Dish iron	5
95.	China dish	20
Furniture and Fixture		
1	Whiteboard	01
2	Teacher chair	01
3	Teacher Table	01
4	Student Chairs	50
5	Lab Tables	03
6	Show case	03
7	Steel Almirah	03
8	Wooden Almirah	02
9	Demonstration Table	02
10	Ceiling Fan	04

2: Demonstration and Practical Farm

Sr No	Nomenclature of Tools/Equipment/Machinery	Quantity/No.
1	Student demonstration area	06 acres
2	Crops Sown in the Kharif Season	Pearl millet, sorghum, rice, maize, mong, mash, sesame, cotton
3	Crops Sown in Rabi Season	Wheat, canola, Gram, Lentil, Linseed, Barseem, Lucerne
4	Tractor 85Hp	1
5	Tractor 65Hp	1
6	Trolley 2 wheel	1
7	Pedestal fan	1
8	Cultivator (11 tines)	1
9	Rotavator	1
10	Disc plough	1
11	Mould Board Plough	1
12	Rabi Drill	1
13	Chisel Plough (3 Tines)	1
14	Disc harrow (16 discs)	1
15	Border Disc	1
16	Laser Land Leveler	1
17	Land Scrapper	1
18	Corn sheller	1
19	Rotary slasher	1
20	Power spray machine	1
21	Clod breaker	1
22	Land scraper (karah)	1
23	Bar harrow	1
24	Knapsack Sprayer	2
25	Tarpaulin	2
26	Seed grader	1
27	Disc Plough (3 discs)	1
28	Ridger (3 tines)	1
29	Drawbar	1
30	Cotton bed planter	1
31	Wheat Thrasher	1
32	Bar Harrow manual	1
33	Chuha Ramba	3
34	Single row cotton drill	1
35	Planker	1
36	Label Boards (large)	25

37	Label boards (small)	50
38	Measuring tape	2
39	Tarangli	1
40	Hand held chopper	6
41	Panji	1
42	Khurpa	25
43	Gainti	1
44	Hammer	1
45	Manual wheat drill	1
46	Axe	2
47	Hand Corn sheller	1
48	Electric drill	1
49	Pliers	1
50	Screw driver	1
51	Kasola	20
52	Sickle	15
53	Peter diesel engine	1
54	Tarphali	1
55	Weighing balance	1
56	Electric Weighing balance	1
57	ULV Spray Machine	1
58	Light Trap	2
59	Tractor-mounted boom sprayer	1
60	Electric tube well	1

3: Forestry Nursery Area

Sr. No.	Nomenclature of Tools/ Equipment/ Machinery	Quantity Nos.
1	Spade	05
2	Shovel	05
3	Hoe (hand hoe / spade hoe)	05
4	Digging fork	05
5	Pruning knife	05
6	Budding knife	05
7	Measuring tape	01
8	Dibblers (for seed sowing)	05
9	Watering cans	05
10	Garden hose pipes	01
11	Sprinklers	02
12	Sprayer	01
13	Water storage tank	01
14	Motor pump	01
15	Seed trays	10
16	Polybags/pots	As per the requirement
17	Grafting knives	05
18	Germination beds	As per the requirement
19	Labels/plant tags	As per the requirement
20	Root pruning shears	05
21	Hand carts/trolleys	01
22	Seedling transport crates	10
23	Baskets or bags	10

4: Farm Machinery Workshop

Sr. No.	Nomenclature of Tools/Equipment/Machinery	Quantity/No.
1	Mouldboard Plough	01
2	Chisel Plough	01
3	Subsoiler	01
4	Rotavator	01
5	Disc Harrow	01
6	Cultivator	01
7	Seed-cum-Fertilizer Drill	01
8	Knapsack Hand Sprayer	01
9	Knapsack Power Sprayer	01
10	Boom Sprayer	01
11	T-Jet Nozzle	01
12	Hollow Cone Nozzle	01
13	Solid Cone Nozzle	01
14	Wheat Thresher	01
15	Corn Sheller	01
16	Wheat Sheller	01
17	Drip Irrigation System	01
18	Laser Land Leveler	01
19	Land Planer	01
20	Post Hole Digger	01
21	Fertilizer Broadcaster	01
22	Ridger	01
23	Ditcher	01

24	Tractor 85Hp	01
25	Spanners Set	01
26	Wrenches	02
27	Screwdrivers	03
28	Pliers	05
29	Hammer	02
30	Grease Gun	01
31	Oil Can	01
32	Drill Machine	01
33	Grinder Machine	01
34	Welding Machine	01
35	Vice (Bench Vice)	01
36	Air compressor	01

5: Computer Lab

Sr. No.	Nomenclature of Tools/ Equipment/ Machinery	Quantity Nos.
1	Desktop Computers (including mouse and keyboard)	25
2	Computer Tables	25
3	Computer chairs	25
4	Air conditioner (1.5 Ton)	1
5	Ceiling Fans	4
6	Exhaust Fans	2
7	Tube Lights	2
8	LED Bulb 45W	2
9	Multimedia Projector	1
10	Whiteboard	1
11	Printer	1

LIST OF CONSUMABLE MATERIALS

1: Agriculture & Food Sc. Lab

Sr. No.	Name of Material	Quantity Nos.
1	Board marker	1
2	Calcium Chloride	1kg
3	Sodium Chloride	1kg
4	Calcium Sulphate	1kg
5	Buffer Tablet	5 packs
6	Spirit	1 litre
7	**Buffer Solution**	
a	PH4	1 litre
b	PH7	1 litre
c	PH9	1 litre
8	Potassium cyanide	500 g
9	Entomological Pins	1000
10	Board Marker	05
11	Paper Charts	20
12	Sodium Benzoate	460g
13	Orange Food Colour (Bottles)	02
14	Red Food Colour (Bottles)	02
15	Mango Essence (Bottles)	02
16	Almond Essence (Bottles)	02
17	Bottles (Plastic)	50
18	Bottles (Glass)	50
19	Jar (Plastic)	50
20	Mixing Spoon	04
21	Board Marker	02
22	Distilled water	1000 ml
23	Hydrochloric acid (HCl)	500 ml
24	Sulfuric acid (H_2SO_4)	1000 ml

25	Urea fertilizer sample	1 kg
26	DAP fertilizer sample	1 kg
27	SOP/MOP fertilizer sample	1 kg
28	Micronutrients fertilizer sample	1 kg
29	Wheat, rice, maize seeds sample	1 kg each
30	Pulses & oilseed crops seed sample	1 kg each
31	Vegetable seeds sample	250 g each
32	Field soil samples	1 kg
33	Sand	1 kg
34	Compost / FYM (farmyard manure)	5 kg
35	Peat moss	5 kg
36	Filter paper	100
37	Detergents	1 litre
38	Lab cleaning solutions	10 litre
39	Tissue paper/wipes	10 boxes
40	Gloves	10 boxes
41	Face masks	20 boxes
42	First aid materials	1 kit
43	Flower seeds (marigold, petunia)	5 g each
44	Fruit plant cuttings, citrus	50
45	Fruit plant cuttings, guava	200
46	Buds	100
47	grafting tape	2
48	Compost	I ton
49	Gibberellic acid (GA_3)	1box
50	Wax for grafting	1 kg
51	Labels & tags	200
52	Plastic pots	100
53	Polybags	200
54	Seed trays	25
55	Disposable gloves	4 boxes

2: Demonstration and Practical Farm

Sr. No.	Name of Material	Quantity Nos.
1	Certified crop seeds (Different crops)	As per the requirements of the cropping scheme
2	Vegetable seeds (Different vegetables)	As per the requirements of the cropping scheme
3	Fodder seeds (Different fodders)	As per the requirements of the cropping scheme
4	Urea	As per the requirement
5	DAP	As per the requirement
6	Potash (SOP)	As per the requirement
7	Organic manure (FYM – farmyard manure)	As per the requirement
8	Compost green manure & Peat Moss	As per the requirement
9	Insecticides	As per the requirement
10	Fungicides	As per the requirement
11	Herbicides	As per the requirement
12	Amino acid	1000 ml
13	Zinc Sulfate	3000 g
14	Borax	3000 g
15	Supporting strings	5 kg
16	Packing polythene bags	5 kg
17	Polythene sheet	50 kg
18	Polythene bags	500
19	Diesel and electricity (for tube wells)	As per the sown area of each crop
20	Labels/tags	350
21	Lubricants (engine oil, grease)	12 litres
22	Replacement filters	4
23	Replacement belts	2
24	Sacks (bardana)	200
25	Twine/jute rope	200

26	Gloves	10 boxes
27	Masks	10 boxes

3: Forestry Nursery Area

1	Forest tree seeds	As per the requirement
2	Seedlings/cuttings	As per the requirement
3	Soil	As per the requirement
4	Sand	As per the requirement
5	Compost	As per the requirement
6	Coco peat	As per the requirement
7	Polythene nursery bags	As per the requirement
8	Organic fertilizer	As per the requirement
9	NPK fertilizer	As per the requirement
10	Shade net	1
11	Plastic sheets	02
12	Plant labels/tags	As per the requirement
13	Tying rope	As per the requirement
14	Bamboo sticks or small stakes	As per the requirement
15	Marker	1

4: Farm Machinery Workshop

Sr. No.	Name of Material	Quantity Nos.
1	Seeds (wheat/maize/cotton)	5–10 kg each
2	Fertilizers (Urea, DAP)	5–8 kg each
3	Pesticides (insecticide/herbicide/fungicide)	500 ml – 1 liter each
4	Clean water	100–200 liters
5	Diesel fuel	5–10 liters
6	Lubricating oil	500 ml – 1 liter
7	Grease	250–500 grams
8	Cotton waste/cleaning cloth	1–2 kg
9	Measuring containers (graduated)	1–2 pieces (1 liter capacity)
10	Polythene bags (for samples)	10–15 pieces
11	Marking flags or pegs	15–20 pieces
12	Rope or measuring tape	1 (20–30 meters)
13	Chalk or markers	2–3 pieces
14	Personal protective equipment (gloves, masks)	2–3 sets
15	Filters (sprayer/pump)	1–2 pieces

5: Computer Lab

Sr. No.	Name of Material	Quantity Nos.
1	Board marker	1
2	USB Flash Drive (16 GB)	1

Minimum Qualifications of an Instructor

Subjects	Minimum Qualification and Experience Details
Agriculture-relevant subjects	M.Sc. (Hons.)Agri or B.Sc. (Hons.)Agri or as per criteria set by provincial government.
Computer application	M.Sc. in IT/Computer Science
Agriculture Machinery/ On-Farm Water Management	M.Sc. (Hons.) in Agricultural Engineering/B-Tech in Auto & Farm Machinery or B.Sc. (Hons.) in Agricultural Engineering or as per criteria set by provincial government.
Agriculture Economics/Farm Management	M.Sc.(Hons.) in Agricultural Economics
English Islamiat Pakistan Studies Urdu	Master's degree in English/Islamiat/Pst /Urdu

Employability of the Pass-Out Students

The pass-out of this course may work in the following sectors/areas

Sr. No.	Potential Employers (Industry/Sectors)	Sr. No.	Potential Employers (Industry/Sectors)
1.	Agriculture Department	2.	Agricultural field officer in the banking sector
3.	Rural development projects	4.	Rural banks
5.	Agriculture extension services	6.	Microfinance institutions
7.	Irrigation departments	8.	Crop insurance companies
9.	Seed companies	10.	Agro service centers
11.	Fertilizer companies	12.	Fertilizer and pesticide dealerships
13.	Agrochemical firms	14.	Seed distribution agencies
15.	Farm machinery companies	16.	Farm equipment sales
17.	Rural development NGOs	18.	Soil testing labs
19.	Seed testing labs	20.	Agricultural research centers
21.	Biotechnology labs (as technical assistants)	22.	Start your own nursery
23.	Organic farming	24.	Dairy farming
25.	Poultry farming	26.	Mushroom cultivation
27.	Vermicomposting unit	28.	Agri-consultancy services
29.	Watershed development projects	30.	Further studies like B.Sc. (Hons.) Agriculture

The pass-out of this course may work in the following positions:

Sr. No.	Potential Jobs / Designation	Sr. No.	Potential Jobs / Designation
1.	Field Assistant (Agriculture Department)	2.	Agri Service Center In-charge
3.	Agriculture Extension Worker	4.	Field Office in the banking sector
5.	Agriculture Assistant	6.	Rural Development Assistant in the banking sector
7.	Soil Conservation Assistant	8.	Microfinance Field Executive
9.	Irrigation Assistant	10.	Crop Insurance Field Coordinator
11.	Junior Technical Assistant	12.	Soil Testing Lab Assistant
13.	Field Officer (Seeds/Fertilizers/Pesticides)	14.	Seed Testing Lab Technician
15.	Sales Officer / Marketing Executive (Agri-inputs)	16.	Research Assistant (in agri projects)
17.	Crop Advisor	18.	Quality Control Assistant
19.	Farm Supervisor	20.	Dairy Farm Supervisor
21.	Plantation Supervisor	22.	Poultry Farm Supervisor
23.	Tunnel/Greenhouse Technician	24.	Nursery Manager
25.	Organic Farm Manager	26.	Mushroom Production Supervisor
27.	Community Mobilizer (Agriculture Projects)	28.	Watershed Project Assistant
29.	FPO (Farmer-Producer Organization) Coordinator	30.	Clerk in different departments

Curriculum Development Committee

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