ICTQual AB

Qualification Specification

Level 6 Diploma in Agriculture Engineering
360 Credits – Three Years

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Contents

Qualification Specifications about

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About ICTQual AB

ICTQual AB UK Ltd. is a distinguished awarding body based in the United Kingdom, dedicated to fostering excellence in education, training, and skills development. Committed to global standards, ICTQual AB provides internationally recognized qualifications that empower individuals and organizations to thrive in an increasingly competitive world. Their offerings span diverse industries, including technical fields, health and safety, management, and more, ensuring relevance and adaptability to modern workforce needs.

The organization prides itself on delivering high-quality educational solutions through a network of Approved Training Centres worldwide. Their robust curriculum and innovative teaching methodologies are designed to equip learners with practical knowledge and skills for personal and professional growth. With a mission to inspire lifelong learning and drive positive change, ICTQual AB continuously evolves its programs to stay ahead of industry trends and technological advancements.

ICTQual AB's vision is to set benchmarks for educational excellence while promoting inclusivity and integrity. Their unwavering focus on quality and accessibility makes them a trusted partner in shaping future-ready professionals and advancing societal progress globally.

Course Overview

The ICTQual Level 6 Diploma in Agriculture Engineering is a comprehensive three-year program designed to equip learners with advanced knowledge and skills to address modern challenges in agriculture through engineering innovation. Spanning 360 credits, this qualification integrates core principles of mechanical, civil, electrical, and biological engineering, tailored specifically to the agriculture sector.

The program emphasizes the development of innovative solutions for sustainable food production, resource management, and farm operations. It is ideal for individuals who aspire to revolutionize agricultural practices, enhance efficiency, and contribute to global food security.
Learners will gain expertise in areas such as precision agriculture technologies, renewable energy applications, advanced irrigation systems, and sustainable farm design. The qualification also fosters skills in project management and entrepreneurship, preparing graduates to lead in the evolving agricultural landscape.

This diploma serves as a pathway to career opportunities in agricultural engineering, consultancy, research, and sustainable farming practices, offering a balance of theoretical knowledge and practical application. Graduates will emerge as pioneers ready to drive advancements in the agriculture and engineering sectors.

Certification Framework

Qualification title	**ICTQual Level 6 Diploma in Agriculture Engineering 360 Credits – Three Years**
Course ID	AGE0001
Qualification Credits	360 Credits
Course Duration	36 Months
Grading Type	Pass / Fail
Competency Evaluation	Coursework / Assignments / Verifiable Experience
Assessment	The assessment and verification process for ICTQual qualifications involves two key stages: **Internal Assessment and Verification:** ✓ Conducted by the staff at the Approved Training Centre (ATC). Ensures learners meet the required standards through continuous assessments. ✓ Internal quality assurance (IQA) is carried out by the centre's IQA staff to validate the assessment processes. **External Quality Assurance:** ✓ Managed by ICTQual AB verifiers, who periodically review the centre's assessment and IQA processes. ✓ Verifies that assessments are conducted to the required standards and ensures consistency across centres

Entry Requirements

To enroll in the ICTQual Level 6 Diploma in Agriculture Engineering 360 Credits – Three Years, candidates must meet the following entry requirements:

- ✓ Applicants must be at least 16 years old.
- ✓ A minimum of a Level 5 qualification (or equivalent) in a related field such as engineering, technology, or a technical discipline. Alternatively, applicants should have A-levels or equivalent qualifications, including Mathematics and English.
- ✓ Applicants should demonstrate a strong interest in both agriculture and engineering, and may be required to submit a personal statement or attend an interview to assess their motivation and suitability for the course.
- ✓ While prior experience in agricultural engineering is not mandatory, applicants with a background in mechanics, engineering, or agriculture will be considered favorably.
- ✓ For non-native English speakers, proof of English language proficiency is required to ensure that applicants can fully engage with the course material.

Qualification Structure

This qualification comprises 36 mandatory units, totaling 360 credits. Candidates must successfully complete all mandatory units to achieve the qualification.

Mandatory Units		
Unit Ref#	**Unit Title**	**Credits**
Year 1: Foundational Knowledge		
AGE0001-1	Introduction to Agricultural Engineering	10
AGE0001-2	Basics of Soil Science	10
AGE0001-3	Plant Science and Crop Physiology	10
AGE0001-4	Introduction to Farm Machinery	10
AGE0001-5	Principles of Irrigation and Drainage	10
AGE0001-6	Environmental Science in Agriculture	10
AGE0001-7	Mathematics for Engineers	10
AGE0001-8	Fundamentals of Agricultural Economics	10
AGE0001-9	Introduction to Renewable Energy in Agriculture	10
AGE0001-10	Agricultural Chemistry	10
AGE0001-11	Engineering Drawing and CAD	10
AGE0001-12	Workshop Practices in Agricultural Engineering	10
Year 2: Intermediate Concepts and Applications		
AGE0001-13	Advanced Soil and Water Management	10
AGE0001-14	Farm Power and Mechanization	10
AGE0001-15	Agricultural Structures and Materials	10
AGE0001-16	Irrigation Systems Design	10
AGE0001-17	Introduction to Precision Agriculture	10
AGE0001-18	Agricultural Waste Management	10
AGE0001-19	Crop Protection Technologies	10
AGE0001-20	Advanced Farm Machinery Operations	10
AGE0001-21	Principles of Agro-Processing	10
AGE0001-22	Renewable Energy Technologies in Agriculture	10
AGE0001-23	Land Surveying and Mapping	10
AGE0001-24	Practical Training in Agricultural Engineering	10
Year 3: Advanced Studies and Specialization		
AGE0001-25	Sustainable Agriculture Practices	10
AGE0001-26	Advanced Irrigation and Drainage Engineering	10
AGE0001-27	Farm Business Management	10
AGE0001-28	Design of Agricultural Machinery	10
AGE0001-29	Precision Farming Systems	10
AGE0001-30	Advanced Soil Mechanics	10
AGE0001-31	Climate-Smart Agriculture	10
AGE0001-32	Renewable Energy Systems for Farms	10
AGE0001-33	Post-Harvest Technology	10
AGE0001-34	Automation in Agriculture	10
AGE0001-35	Research Methods in Agriculture Engineering	10
AGE0001-36	Final Project in Agricultural Engineering	10

Centre Requirements

Even if a centre is already registered with ICTQual AB, it must meet specific requirements to deliver the ICTQual Level 6 Diploma in Agriculture Engineering 360 Credits – Three Years. These standards ensure the quality and consistency of training, assessment, and learner support.

1. Approval to Deliver the Qualification

- ✓ Centres must obtain formal approval from ICTQual AB to deliver this specific qualification, even if they are already registered.
- ✓ The approval process includes a review of resources, staff qualifications, and policies relevant to the program.

2. Qualified Staff

- ✓ **Tutors:** Must have relevant qualifications in Agriculture Engineering at Level 7 or higher, alongside teaching/training experience.
- ✓ **Assessors:** Must hold a recognized assessor qualification and demonstrate expertise in Agriculture Engineering.
- ✓ **Internal Quality Assurers (IQAs):** Must be appropriately qualified and experienced to monitor the quality of assessments.

3. Learning Facilities

Centres must have access to appropriate learning facilities, which include:

- ✓ **Classrooms:** Modern classrooms equipped with multimedia tools to deliver comprehensive theoretical instruction on agricultural systems, sustainable practices, and modern farming technologies.
- ✓ **Practical Areas:** Hands-on training areas featuring advanced agricultural machinery, irrigation systems, soil testing kits, and greenhouse facilities to provide practical experience in real-world farming and engineering techniques.
- ✓ **Technology Access**: High-performance computers with industry-standard software (e.g., GIS for land management, precision farming tools, and crop modeling software) and internet connectivity for research, simulations, and project development.

4. Health and Safety Compliance

- ✓ Centres must ensure that practical training environments comply with relevant health and safety regulations.
- ✓ Risk assessments must be conducted regularly to maintain a safe learning environment.

5. Resource Requirements

- ✓ Learning Materials: Approved course manuals, textbooks, and study guides aligned with the curriculum.
- ✓ Assessment Tools: Templates, guidelines, and resources for conducting and recording assessments.
- ✓ E-Learning Systems: If offering online or hybrid learning, centres must provide a robust Learning Management System (LMS) to facilitate remote delivery.

6. Assessment and Quality Assurance

- ✓ Centres must adhere to ICTQual's assessment standards, ensuring that all assessments are fair, valid, and reliable.
- ✓ Internal quality assurance (IQA) processes must be in place to monitor assessments and provide feedback to assessors.
- ✓ External verification visits from ICTQual will ensure compliance with awarding body standards.

7. Learner Support

- ✓ Centres must provide learners with access to guidance and support throughout the program, including:

- ✓ Academic support for coursework.
- ✓ Career guidance for future progression.
- ✓ Additional support for learners with specific needs (e.g., disabilities or language barriers).

8. Policies and Procedures

Centres must maintain and implement the following policies, as required by ICTQual:

- ✓ Equal Opportunities Policy.
- ✓ Health and Safety Policy.
- ✓ Safeguarding Policies and Procedures.
- ✓ Complaints and Appeals Procedure.
- ✓ Data Protection and Confidentiality Policy.

9. Regular Reporting to ICTQual

- ✓ Centres must provide regular updates to ICTQual AB on learner enrollment, progress, and completion rates.
- ✓ Centres are required to maintain records of assessments and learner achievements for external auditing purposes.

Support for Candidates

Centres should ensure that materials developed to support candidates:

- ✓ Facilitate tracking of achievements as candidates progress through the learning outcomes and assessment criteria.
- ✓ Include information on how and where ICTQual's policies and procedures can be accessed.
- ✓ Provide mechanisms for Internal and External Quality Assurance staff to verify and authenticate evidence effectively.

This approach ensures transparency, supports candidates' learning journeys, and upholds quality assurance standards.

Assessment

This qualification is competence-based, requiring candidates to demonstrate proficiency as defined in the qualification units. The assessment evaluates the candidate's skills, knowledge, and understanding against the set standards. Key details include:

1. **Assessment Process:**

   - ✓ Must be conducted by an experienced and qualified assessor.
   - ✓ Candidates compile a portfolio of evidence that satisfies all learning outcomes and assessment criteria for each unit.

2. **Types of Evidence:**

   - ✓ Observation reports by the assessor.
   - ✓ Assignments, projects, or reports.
   - ✓ Professional discussions.
   - ✓ Witness testimonies.
   - ✓ Candidate-produced work.

- ✓ Worksheets.
- ✓ Records of oral and written questioning.
- ✓ Recognition of Prior Learning (RPL).

3. **Learning Outcomes and Assessment Criteria:**

- ✓ **Learning Outcomes:** Define what candidates should know, understand, or accomplish upon completing the unit.
- ✓ **Assessment Criteria:** Detail the standards candidates must meet to demonstrate that the learning outcomes have been achieved.

This framework ensures rigorous and consistent evaluation of candidates' competence in line with the qualification's objectives.

Unit Descriptors

AGE0001-1 : Introduction to Agricultural Engineering

This unit aims to introduce learners to the fundamental principles of agricultural engineering and its essential role in modern agriculture. Students will explore the various engineering techniques and technologies that enhance agricultural practices, improving productivity, sustainability, and efficiency. The unit provides a foundational understanding of how agricultural engineering integrates with farming systems to address the challenges of modern agriculture.

Learning Outcome:	Assessment Criteria:
1. Understand the role of agricultural engineering in modern farming.	1.1. Demonstrates a comprehensive understanding of the key concepts in agricultural engineering and its application in modern farming systems. 1.2. Analyzes the integration of engineering principles in optimizing agricultural productivity and sustainability. 1.3. Evaluates the impact of technological advancements in agricultural engineering, such as automation, precision farming, and machinery innovation. 1.4. Assesses the role of agricultural engineering in enhancing resource management, including water, soil, and energy conservation. 1.5. Explores the contributions of agricultural engineering to reducing environmental impact through sustainable farming practices and eco-friendly technologies. 1.6. Investigates the development and application of modern farming equipment, machinery, and infrastructure to improve efficiency and crop yield. 1.7. Critically evaluates the challenges and opportunities for agricultural engineers in addressing global food security and climate change. 1.8. Demonstrates an understanding of the interdisciplinary nature of agricultural engineering, collaborating with other fields such as biology, environmental science, and economics. 1.9. Communicates the role of agricultural engineering in advancing rural development and improving the livelihoods of farmers worldwide.

2. Learn the basic principles and applications of agricultural engineering in crop and livestock production.	2.1. Understands the fundamental principles of agricultural engineering, including mechanics, thermodynamics, and fluid dynamics, and how they apply to farming systems. 2.2. Demonstrates knowledge of the design, operation, and maintenance of machinery and equipment used in crop production, such as tractors, planters, and harvesters. 2.3. Analyzes the role of agricultural engineering in improving crop production through technologies like irrigation systems, soil management, and crop protection techniques. 2.4. Evaluates the use of automation and precision farming technologies in optimizing crop yield, minimizing resource usage, and enhancing sustainability. 2.5. Understands the principles of livestock production engineering, including the design and management of housing, feeding systems, and waste management for livestock. 2.6. Explores the application of engineering technologies in improving animal health, welfare, and productivity through innovations in nutrition, genetics, and veterinary care. 2.7. Investigates the role of agricultural engineering in ensuring the efficient use of resources, including water, energy, and feed, in both crop and livestock production. 2.8. Applies knowledge of engineering solutions to address environmental challenges, such as waste disposal, pollution control, and sustainable farming practices. 2.9. Demonstrates the ability to assess and recommend appropriate engineering technologies for improving the efficiency, sustainability, and profitability of crop and livestock farming systems.

AGE0001-2 Basics of Soil Science

The aim of this study unit is to provide students with a fundamental understanding of soil science, focusing on the identification of different soil types and their properties. It emphasizes the importance of soil fertility and the techniques used to manage soil health in agricultural systems. Students will learn how to assess soil conditions and apply appropriate practices to enhance soil productivity and sustainability in farming.

Learning Outcome:	Assessment Criteria:
1. Identify different soil types and their properties.	1.1. Demonstrates knowledge of the classification of soil types based on texture, structure, and composition, including sand, silt, clay, and loam. 1.2. Identifies key properties of different soil types, such as soil texture, moisture retention, drainage capacity, and nutrient-holding ability. 1.3. Understands the impact of soil pH, salinity, and organic matter content on plant growth and crop production. 1.4. Recognizes the importance of soil permeability and infiltration rates in relation to water movement and irrigation management. 1.5. Evaluates the role of soil fertility and nutrient content, including macro and micronutrients, in supporting healthy plant growth. 1.6. Assesses the effect of soil compaction, erosion, and degradation on agricultural productivity and land management. 1.7. Investigates the influence of soil structure on root development, aeration, and overall soil health. 1.8. Analyzes the relationship between soil type and suitability for different crops or livestock farming practices. 1.9. Applies knowledge of soil properties to recommend soil management practices that improve soil health, productivity, and sustainability.
2. Understand soil fertility and its management in agricultural systems.	2.1. Demonstrates a comprehensive understanding of soil fertility, including the role of essential nutrients (nitrogen, phosphorus, potassium, and micronutrients) in plant growth and development. 2.2. Identifies factors affecting soil fertility, such as soil texture, organic matter content, pH, and microbial activity. 2.3. Evaluates the impact of soil nutrient

	deficiencies and imbalances on crop yields and soil health. 2.4. Understands the principles of soil nutrient cycles, including nitrogen fixation, mineralization, and nutrient uptake by plants. 2.5. Analyzes different soil fertility management practices, such as crop rotation, cover cropping, organic amendments, and the use of synthetic fertilizers. 2.6. Assesses the environmental implications of fertilizer use, including nutrient leaching, runoff, and the potential for water and soil pollution. 2.7. Explores the role of soil testing and monitoring in evaluating soil nutrient status and guiding fertilizer application strategies. 2.8. Investigates sustainable soil fertility management techniques, such as integrated nutrient management (INM) and precision farming, to optimize nutrient use efficiency. 2.9. Demonstrates the ability to recommend appropriate soil fertility management practices based on specific crop needs, soil types, and environmental conditions.

AGE0001-3 Plant Science and Crop Physiology

The aim of this study unit is to provide students with a foundational understanding of plant physiology and the key processes that influence plant growth and development. It focuses on the relationship between environmental factors, such as light, temperature, and soil conditions, and their impact on plant health and productivity. Students will gain insights into how these physiological processes can be managed to optimize crop production and ensure sustainable agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Grasp the basic physiological processes in plants.	1.1. Demonstrates a comprehensive understanding of plant physiological processes, including photosynthesis, respiration, and transpiration. 1.2. Accurately explains the role of plant cells and tissues in physiological functions, highlighting key structures such as chloroplasts, stomata, and xylem. 1.3. Identifies and describes the processes involved in water and nutrient uptake in plants. 1.4. Demonstrates knowledge of the factors affecting plant growth and development, such as light, temperature, and soil conditions. 1.5. Applies the principles of plant physiology to real-world scenarios, including agriculture, horticulture, and environmental sustainability. 1.6. Demonstrates proficiency in interpreting experimental data related to plant physiology. 1.7. Critically evaluates the impact of environmental stressors, such as drought, salinity, and pollutants, on plant physiological processes. 1.8. Demonstrates the ability to integrate theoretical knowledge with practical applications in plant science. 1.9. Effectively communicates plant physiological concepts through written and oral formats, using appropriate scientific terminology.
2. Understand the relationship between plant growth and environmental factors.	2.1. Demonstrates a thorough understanding of how environmental factors, such as light, temperature, humidity, and soil composition, influence plant growth. 2.2. Identifies the key environmental variables that affect plant physiological processes, including photosynthesis, respiration, and transpiration. 2.3. Describes the mechanisms through which plants sense and respond to changes in their environment, such as photoreceptors and

	temperature sensors. 2.4. Explains the role of abiotic factors like water availability, soil pH, and nutrient levels in regulating plant growth and development. 2.5. Analyzes the impact of both natural and human-induced environmental changes (e.g., climate change, pollution) on plant growth. 2.6. Demonstrates knowledge of how plants adapt to environmental stressors, including drought, extreme temperatures, and high salinity. 2.7. Applies knowledge of environmental factors to optimize plant growth in agricultural and horticultural settings. 2.8. Evaluates the effects of different environmental conditions on plant productivity and crop yield. 2.9. Effectively communicates the complex relationship between plant growth and environmental factors using appropriate scientific terminology.

AGE0001-4 Introduction to Farm Machinery

The aim of this study unit is to introduce students to the operation, selection, and maintenance of farm machinery. It focuses on understanding the different types of farm equipment, their functions, and how to select the appropriate machinery for specific agricultural tasks. Students will also learn essential maintenance and safety practices to ensure the efficient and safe operation of farm machinery, contributing to improved productivity and longevity of equipment.

Learning Outcome:	Assessment Criteria:
1. Understand the operation and selection of farm machinery.	1.1. Demonstrates a thorough understanding of the different types of farm machinery used in agricultural practices, including tractors, harvesters, plows, and irrigation systems. 1.2. Accurately explains the basic operating principles and functions of various farm machines, including power sources, mechanical systems, and control mechanisms. 1.3. Identifies the key factors influencing the selection of farm machinery, such as soil type, crop type, field size, and terrain. 1.4. Demonstrates knowledge of the maintenance and servicing requirements of farm machinery to ensure optimal performance and longevity. 1.5. Evaluates the economic and environmental considerations involved in selecting and operating farm machinery, including fuel efficiency and emissions. 1.6. Applies principles of farm machinery operation to improve efficiency and productivity in agricultural practices. 1.7. Demonstrates the ability to troubleshoot common mechanical issues and perform basic repairs on farm machinery. 1.8. Assesses the safety protocols and risk management strategies associated with the operation of farm machinery. 1.9. Effectively communicates technical aspects of farm machinery operation and selection, using appropriate terminology and clear instructions.
2. Learn the basic maintenance and safety practices for farm equipment.	2.1. Demonstrates a comprehensive understanding of basic maintenance practices for farm equipment, including regular inspections, cleaning, lubrication, and adjustments. 2.2. Identifies key components of farm equipment that require routine maintenance, such as

	engines, hydraulic systems, belts, and tires. 2.3. Explains the importance of preventive maintenance in extending the lifespan and ensuring the reliability of farm machinery. 2.4. Applies knowledge of manufacturer guidelines and service manuals to maintain farm equipment according to recommended schedules. 2.5. Demonstrates proficiency in identifying and addressing common mechanical issues, including troubleshooting and basic repairs. 2.6. Understands and implements safety practices for operating and maintaining farm equipment, including proper handling, storage, and use of machinery. 2.7. Adheres to personal protective equipment (PPE) requirements and safety standards to minimize risk of injury during equipment operation and maintenance. 2.8. Evaluates and applies safety protocols for handling hazardous materials, such as fuels, lubricants, and chemicals used in equipment maintenance. 2.9. Effectively communicates maintenance schedules, safety procedures, and troubleshooting techniques to team members or operators.

AGE0001-5 Principles of Irrigation and Drainage

The aim of this study unit is to provide students with a solid understanding of the principles and methods of irrigation and drainage in agricultural systems. It focuses on water management techniques that optimize water use, improve crop production, and promote sustainability. Students will learn how to design and implement effective irrigation and drainage systems, ensuring efficient water use and supporting the long-term health and productivity of agricultural land.

Learning Outcome:	Assessment Criteria:
1. Learn the principles and methods of irrigation and drainage.	1.1. Demonstrates a thorough understanding of the basic principles of irrigation, including the importance of water management for crop growth and soil health. 1.2. Explains the different types of irrigation systems, such as drip, sprinkler, and surface irrigation, and their suitability for various crop types and environmental conditions. 1.3. Identifies key factors influencing irrigation efficiency, including water availability, soil properties, and climate conditions. 1.4. Understands the principles of drainage systems, including the prevention of waterlogging and the promotion of optimal root growth. 1.5. Describes the methods used for designing and implementing effective irrigation and drainage systems, considering factors such as field layout, slope, and water flow. 1.6. Applies knowledge of water conservation techniques and efficient irrigation methods to reduce water wastage and improve sustainability. 1.7. Evaluates the environmental impact of irrigation practices, including water use efficiency and potential effects on local ecosystems. 1.8. Demonstrates the ability to assess soil moisture levels and adjust irrigation practices accordingly to meet crop water requirements. 1.9. Effectively communicates irrigation and drainage principles, methods, and their practical applications to stakeholders or team members.
2. Understand water management in agricultural systems for sustainable crop production.	2.1. Demonstrates a comprehensive understanding of the principles of water management in agricultural systems, including water cycles,

	irrigation techniques, and water conservation practices. 2.2. Evaluates the impact of water management on crop yield, soil health, and overall agricultural sustainability. 2.3. Analyzes different water sources (rainwater, groundwater, surface water) and their suitability for various agricultural practices. 2.4. Assesses the role of climate variability and weather patterns in water management strategies for sustainable crop production. 2.5. Applies knowledge of efficient irrigation systems (e.g., drip, sprinkler, and furrow) to optimize water use in different crop production environments. 2.6. Identifies best practices for managing water use efficiency in both rain-fed and irrigated farming systems. 2.7. Integrates knowledge of soil-water relationships and their influence on crop growth and productivity. 2.8. Evaluates the socio-economic and environmental implications of water management practices in agriculture, considering local, regional, and global perspectives. 2.9. Proposes innovative and adaptive strategies for improving water management in response to emerging challenges such as climate change and water scarcity.

AGE0001-6 Environmental Science in Agriculture

The aim of this study unit is to provide students with a comprehensive understanding of the environmental impacts of agricultural practices. It focuses on the role of agriculture in environmental degradation and the importance of adopting sustainable practices to mitigate these effects. Students will learn about the principles of environmental protection, conservation, and how to integrate sustainable solutions into agricultural systems to promote ecological balance and long-term agricultural productivity.

Learning Outcome:	Assessment Criteria:
1. Understand the impact of agriculture on the environment.	1.1. Demonstrates a comprehensive understanding of the direct and indirect environmental impacts of agricultural practices, including soil degradation, water pollution, and biodiversity loss. 1.2. Analyzes the effects of agricultural land use changes, such as deforestation and urbanization, on ecosystems and carbon emissions. 1.3. Assesses the role of agricultural inputs, such as fertilizers, pesticides, and herbicides, on soil health, water quality, and surrounding ecosystems. 1.4. Evaluates the environmental consequences of different farming practices (e.g., monoculture, intensive farming, and organic farming) on long-term sustainability. 1.5. Identifies the contribution of agriculture to greenhouse gas emissions and the role of sustainable practices in mitigating climate change. 1.6. Examines the impact of agricultural waste, including crop residues and livestock by-products, on the environment and potential solutions for waste management. 1.7. Investigates the relationship between agricultural water usage and its effects on local and global water resources. 1.8. Considers the influence of agricultural practices on wildlife habitats, including both positive (e.g., agroforestry) and negative (e.g., habitat destruction) impacts. 1.9. Proposes strategies to reduce the environmental footprint of agriculture, emphasizing conservation practices, sustainable land management, and the adoption of eco-friendly technologies.

2. Learn about sustainable practices and the role of agriculture in environmental protection.	2.1. Demonstrates a thorough understanding of sustainable agricultural practices, including crop rotation, agroforestry, organic farming, and conservation tillage, and their role in maintaining environmental health. 2.2. Evaluates the benefits of integrated pest management (IPM) and other eco-friendly approaches to reduce the use of harmful chemicals and promote biodiversity. 2.3. Analyzes the role of soil conservation techniques, such as contour farming, terracing, and cover cropping, in preventing soil erosion and maintaining soil fertility. 2.4. Assesses the contribution of sustainable irrigation practices, such as drip irrigation and rainwater harvesting, to water conservation and efficient resource use. 2.5. Investigates the role of agroecology in promoting resilience and sustainability in agricultural systems by integrating ecological principles into farming practices. 2.6. Examines the potential of precision agriculture technologies in optimizing resource use, minimizing waste, and enhancing productivity in an environmentally responsible manner. 2.7. Explores the importance of sustainable livestock management practices, including rotational grazing, waste management, and feed efficiency, in reducing the environmental impact of animal farming. 2.8. Identifies the role of agriculture in carbon sequestration and its potential to mitigate climate change through practices like agroforestry and soil carbon management. 2.9. Proposes strategies for scaling up sustainable agriculture and integrating it into broader environmental protection efforts, considering economic, social, and policy aspects.

AGE0001-7 Mathematics for Engineers

The aim of this study unit is to equip students with the mathematical skills necessary to solve complex engineering problems in agricultural systems. It focuses on the application of algebra, calculus, and statistics to analyze and model agricultural engineering challenges. Students will develop the ability to use mathematical techniques to optimize design, improve processes, and enhance decision-making in agricultural engineering projects.

Learning Outcome:	Assessment Criteria:
1. Apply mathematical techniques to solve engineering problems in agriculture.	1.1. Demonstrates a thorough understanding of mathematical principles and techniques relevant to agricultural engineering problems. 1.2. Applies appropriate mathematical methods (e.g., algebra, calculus, differential equations, linear programming) to analyze and solve engineering challenges in agriculture. 1.3. Accurately interprets agricultural data, formulating mathematical models to represent real-world scenarios. 1.4. Selects and utilizes advanced mathematical tools (e.g., numerical methods, statistical analysis) for solving complex engineering problems in agricultural systems. 1.5. Effectively solves optimization problems, considering agricultural constraints such as resource availability, environmental impact, and economic feasibility. 1.6. Evaluates the accuracy and reliability of mathematical models and solutions, validating results through comparison with experimental or real-world data. 1.7. Integrates interdisciplinary knowledge (e.g., biology, physics, economics) with mathematical techniques to address multifaceted agricultural engineering problems. 1.8. Demonstrates the ability to communicate mathematical solutions and methodologies clearly and effectively to both technical and non-technical stakeholders. 1.9. Continuously updates mathematical techniques and approaches to incorporate emerging trends and technologies in agricultural engineering.
2. Develop skills in algebra, calculus, and statistics for agricultural engineering applications.	2.1. Demonstrates proficiency in algebra, calculus, and statistics to solve agricultural engineering problems.

	2.2. Applies algebraic methods to model and analyze agricultural systems, such as crop yield prediction and irrigation efficiency. 2.3. Utilizes calculus to solve optimization problems related to resource allocation, system design, and performance analysis in agriculture. 2.4. Uses statistical techniques to analyze agricultural data, ensuring accurate interpretation and decision-making in engineering projects. 2.5. Effectively applies multivariable calculus to model and optimize complex agricultural processes involving multiple variables. 2.6. Integrates statistical methods to design experiments, analyze variability, and ensure the reliability of engineering solutions in agricultural contexts. 2.7. Demonstrates the ability to solve real-world agricultural engineering problems using a combination of algebra, calculus, and statistics. 2.8. Continuously applies advanced mathematical concepts to enhance the efficiency and sustainability of agricultural engineering systems. 2.9. Communicates mathematical solutions and findings clearly, making them accessible to both technical and non-technical stakeholders in agricultural engineering.

AGE0001-8 Fundamentals of Agricultural Economics

The aim of this study unit is to provide students with a solid understanding of the economic principles that govern agricultural systems. It focuses on key concepts such as supply and demand, market dynamics, and cost-benefit analysis, helping students analyze and make informed decisions in farming practices. The unit equips students with the tools to evaluate the financial viability of agricultural operations and implement strategies that enhance the economic sustainability of farms.

Learning Outcome:	Assessment Criteria:
1. Understand the economic principles in agricultural systems.	1.1. Demonstrates a clear understanding of fundamental economic principles and their application to agricultural systems. 1.2. Analyzes the impact of supply and demand dynamics on agricultural production, pricing, and resource allocation. 1.3. Applies cost-benefit analysis to assess the economic viability of agricultural engineering projects and technologies. 1.4. Evaluates the role of market structures, such as monopolies and competitive markets, in influencing agricultural system efficiency and sustainability. 1.5. Understands the economic implications of agricultural policies, subsidies, and trade regulations on local and global agricultural markets. 1.6. Assesses the financial feasibility of agricultural practices, including investment in technology, infrastructure, and resource management. 1.7. Integrates economic models with agricultural engineering to optimize the allocation of resources, improve productivity, and enhance profitability. 1.8. Evaluates the environmental and social costs of agricultural practices, balancing economic objectives with sustainability goals. 1.9. Communicates economic analyses and findings effectively to stakeholders, providing insights that inform decision-making in agricultural engineering projects.
2. Learn the concepts of supply, demand, and cost-benefit analysis in farming practices.	2.1. Demonstrates a comprehensive understanding of supply and demand principles and their influence on agricultural production and pricing. 2.2. Applies supply and demand concepts to evaluate the effects of market fluctuations on

	farming practices and decision-making. 2.3. Understands the factors that shift supply and demand curves in the context of agricultural commodities, including seasonal variations, weather conditions, and technological advancements. 2.4. Effectively applies cost-benefit analysis to evaluate farming practices, considering both economic returns and environmental or social impacts. 2.5. Assesses the financial implications of different farming practices, including the costs of inputs (e.g., labor, equipment, seeds) and the benefits derived from crop yields and product sales. 2.6. Uses cost-benefit analysis to compare alternative farming methods, technologies, or crop choices to determine the most economically viable option. 2.7. Evaluates the role of government policies, subsidies, and market interventions in shaping supply, demand, and the cost-benefit outcomes for farmers. 2.8. Demonstrates the ability to integrate supply and demand concepts with cost-benefit analysis to optimize resource use and enhance farm profitability. 2.9. Communicates findings from supply, demand, and cost-benefit analyses effectively to stakeholders, facilitating informed decision-making in farming practices.

AGE0001-9 Introduction to Renewable Energy in Agriculture

The aim of this study unit is to introduce students to the principles and applications of renewable energy sources in agriculture, focusing on solar, wind, and bioenergy technologies. It emphasizes the role of these renewable energy systems in enhancing farm operations, improving energy efficiency, and promoting sustainability. Students will gain a foundational understanding of how to integrate renewable energy solutions into agricultural practices to reduce reliance on non-renewable resources and contribute to environmentally responsible farming.

Learning Outcome:	Assessment Criteria:
1. Learn about renewable energy sources and their applications in agriculture.	1.1. Demonstrates a comprehensive understanding of various renewable energy sources (solar, wind, biomass, geothermal, etc.) and their potential applications in agriculture. 1.2. Analyzes the environmental, economic, and social impacts of renewable energy adoption in agricultural practices. 1.3. Evaluates the feasibility and effectiveness of renewable energy solutions in reducing energy costs and enhancing sustainability in agriculture. 1.4. Identifies key technological innovations in renewable energy that can be applied to farming, including irrigation systems, crop drying, and greenhouse heating. 1.5. Assesses the challenges and barriers to the implementation of renewable energy in agricultural settings, including cost, infrastructure, and policy limitations. 1.6. Examines case studies of successful integration of renewable energy solutions in agricultural operations across different regions and climates. 1.7. Proposes practical strategies for integrating renewable energy into agricultural production systems, considering local context and available resources. 1.8. Demonstrates an understanding of government policies, incentives, and global trends that support the adoption of renewable energy in agriculture. 1.9. Effectively communicates the benefits and potential of renewable energy in agriculture to diverse stakeholders, including farmers, policymakers, and investors.
2. Understand the principles of solar, wind, and bioenergy for farm operations.	2.1. Demonstrates a thorough understanding of the fundamental principles of solar energy,

	including photovoltaic systems, solar thermal applications, and their suitability for farm operations. 2.2. Explains the mechanics of wind energy, including wind turbine technology, site selection, and its application in powering agricultural machinery and irrigation systems. 2.3. Describes the principles of bioenergy, including the production of biogas, biofuels, and biomass energy, and their role in reducing dependence on fossil fuels in farming. 2.4. Analyzes the potential of each renewable energy source (solar, wind, bioenergy) in improving farm energy efficiency, sustainability, and reducing operational costs. 2.5. Evaluates the technical and economic viability of integrating solar, wind, and bioenergy systems into farm operations based on factors such as location, scale, and available resources. 2.6. Identifies key challenges in the adoption of solar, wind, and bioenergy technologies in agriculture, including technical limitations, infrastructure requirements, and economic considerations. 2.7. Assesses the environmental benefits of adopting renewable energy sources in farm operations, including reduced greenhouse gas emissions and resource conservation. 2.8. Explores emerging technologies and trends in solar, wind, and bioenergy that could further enhance farm productivity and sustainability. 2.9. Communicates effectively the principles and advantages of solar, wind, and bioenergy systems to stakeholders in the agricultural sector, including farmers, agribusinesses, and policymakers.

AGE0001-10 Agricultural Chemistry

The aim of this study unit is to provide students with a comprehensive understanding of the chemical processes that underpin agricultural practices. It focuses on the role of fertilizers, pesticides, and soil amendments in enhancing crop production, improving soil health, and managing pests. Students will learn how to apply chemical principles to optimize agricultural inputs and ensure sustainable, efficient crop management while minimizing environmental impact.

Learning Outcome:	Assessment Criteria:
1. Understand the chemical processes involved in agriculture.	1.1. Demonstrates a comprehensive understanding of the fundamental chemical processes involved in soil fertility, nutrient cycling, and plant growth. 1.2. Explains the role of essential nutrients (macronutrients and micronutrients) in plant development and the chemical reactions that facilitate nutrient uptake and assimilation. 1.3. Analyzes the chemical processes involved in soil-plant-water interactions, including soil pH, ion exchange, and the impact of soil amendments on plant health. 1.4. Understands the chemical principles behind the use of fertilizers, pesticides, and herbicides, including their composition, mode of action, and potential environmental impacts. 1.5. Describes the biochemical processes of photosynthesis, respiration, and transpiration in plants and their importance for agricultural productivity. 1.6. Evaluates the role of organic matter decomposition in soil chemistry and its impact on soil structure, microbial activity, and nutrient availability. 1.7. Identifies the chemical processes involved in the fermentation and production of biofuels and biogas from agricultural residues and waste. 1.8. Assesses the impact of chemical imbalances in the soil and water on crop yields, plant health, and ecosystem sustainability. 1.9. Applies knowledge of chemical processes to improve agricultural practices, such as optimizing irrigation, reducing chemical inputs, and promoting sustainable farming methods.
2. Learn the role of fertilizers, pesticides, and soil amendments in crop production.	2.1. Demonstrates a comprehensive understanding of the different types of fertilizers (organic,

	synthetic, slow-release) and their role in promoting soil fertility and supporting plant growth. 2.2. Explains the chemical composition and mechanisms of action of various pesticides, including insecticides, herbicides, and fungicides, and their impact on crop protection. 2.3. Analyzes the benefits and risks associated with the use of fertilizers, pesticides, and soil amendments, including potential environmental, health, and economic effects. 2.4. Assesses the importance of balanced nutrient management in crop production, considering the optimal use of fertilizers and soil amendments to avoid nutrient deficiencies or excesses. 2.5. Evaluates the role of soil amendments (such as lime, compost, and organic matter) in improving soil structure, enhancing water retention, and promoting microbial activity for healthier crops. 2.6. Understands the principles of integrated pest management (IPM) and the role of biological control, crop rotation, and other sustainable practices in reducing reliance on chemical pesticides. 2.7. Identifies the impact of fertilizer and pesticide overuse on soil health, water quality, and biodiversity, and explores alternative sustainable practices for minimizing negative effects. 2.8. Explores the role of precision agriculture technologies in optimizing the use of fertilizers, pesticides, and soil amendments for maximum efficiency and minimal environmental impact. 2.9. Effectively communicates the importance of proper fertilizer, pesticide, and soil amendment application to farmers and stakeholders, emphasizing the need for sustainable and responsible agricultural practices.

AGE0001-11 Engineering Drawing and CAD

The aim of this study unit is to equip students with the skills to interpret and create technical drawings and schematics essential for agricultural engineering projects. It focuses on developing proficiency in using Computer-Aided Design (CAD) software to design and model agricultural systems, machinery, and structures. Students will gain the ability to produce precise, detailed engineering designs that support the development of innovative solutions in agricultural engineering.

Learning Outcome:	Assessment Criteria:
1. Learn to interpret and create technical drawings and schematics.	1.1. Demonstrates the ability to accurately interpret technical drawings, including understanding symbols, scales, dimensions, and annotations used in agricultural equipment and infrastructure designs. 1.2. Applies knowledge of drafting standards and conventions to read and analyze schematics for farm machinery, irrigation systems, renewable energy installations, and other agricultural systems. 1.3. Understands the principles of design and layout in technical drawings, including the use of proper symbols, line types, and labeling to communicate engineering concepts effectively. 1.4. Creates clear and precise technical drawings and schematics for agricultural systems, incorporating relevant details such as material specifications, dimensions, and functional components. 1.5. Utilizes CAD software or other tools to develop technical drawings, ensuring accuracy, scalability, and ease of interpretation. 1.6. Assesses the functionality and efficiency of designs based on technical drawings, ensuring that all components and systems are logically represented and aligned with operational requirements. 1.7. Explains the significance of technical drawings in the planning, installation, and maintenance of agricultural systems, emphasizing their role in improving communication and reducing errors. 1.8. Demonstrates an understanding of how to create and interpret electrical, mechanical, and plumbing schematics for agricultural operations, including renewable energy systems and irrigation networks.

	1.9. Communicates effectively with engineers, designers, and other stakeholders using technical drawings, ensuring a shared understanding of system designs and requirements.
2. Develop skills in using CAD software for agricultural engineering design.	2.1. Demonstrates proficiency in using CAD (Computer-Aided Design) software to create detailed and accurate designs for agricultural systems, including machinery, infrastructure, and renewable energy installations. 2.2. Understands the key features and tools of CAD software, such as drawing, modeling, dimensioning, and annotation, and applies them effectively in agricultural engineering design. 2.3. Creates 2D and 3D models of agricultural equipment, irrigation systems, and farm layouts, ensuring proper scale, proportions, and functionality. 2.4. Applies principles of agricultural engineering to design efficient, cost-effective, and sustainable systems using CAD, considering factors such as materials, energy use, and environmental impact. 2.5. Integrates technical specifications, including dimensions, tolerances, and materials, into CAD designs to ensure compatibility with manufacturing and installation processes. 2.6. Utilizes CAD software to perform simulations and analysis to optimize designs for agricultural applications. 2.7. Collaborates with team members and stakeholders, using CAD files to communicate design ideas, make modifications, and ensure that the final design meets all technical and operational requirements. 2.8. Demonstrates the ability to troubleshoot and resolve design issues within CAD software, ensuring the accuracy and functionality of agricultural engineering designs. 2.9. Keeps up-to-date with advancements in CAD software tools and techniques, incorporating new features and best practices into agricultural design projects.

AGE0001-12 Workshop Practices in Agricultural Engineering

The aim of this study unit is to provide students with hands-on experience and practical skills in using tools and machinery commonly employed in agricultural engineering. It focuses on teaching students the proper safety protocols, workshop procedures, and maintenance practices to ensure efficient and safe operation of equipment. Through this unit, students will develop the technical competencies required to support agricultural engineering projects and contribute to the advancement of farming technologies.

Learning Outcome:	Assessment Criteria:
1. Gain practical skills in using tools and machinery for agricultural engineering.	1.1. Demonstrates the ability to safely and effectively operate a variety of agricultural engineering tools and machinery. 1.2. Exhibits proficiency in the setup, calibration, and maintenance of agricultural equipment. 1.3. Understands the operational principles and technical specifications of different machinery used in agricultural engineering. 1.4. Applies industry-standard safety protocols and guidelines while handling tools and machinery. 1.5. Troubleshoots and resolves basic mechanical issues in agricultural machinery with minimal supervision. 1.6. Demonstrates the ability to perform routine maintenance and repairs on agricultural equipment to ensure optimal performance. 1.7. Adapts to new technologies and equipment in the field of agricultural engineering with ease and efficiency. 1.8. Maintains high standards of accuracy and quality when using machinery for agricultural tasks. 1.9. Demonstrates effective time management and organizational skills when working with agricultural machinery on tasks.
2. Understand the safety protocols and workshop procedures in agricultural engineering.	2.1. Demonstrates a comprehensive understanding of safety protocols and risk management strategies in an agricultural engineering environment. 2.2. Consistently follows established workshop safety procedures to ensure personal and team safety. 2.3. Identifies potential hazards in the workshop and takes appropriate actions to mitigate risks. 2.4. Understands the correct use of personal protective equipment (PPE) and ensures it is worn as required.

	2.5. Demonstrates knowledge of emergency procedures, including fire safety, first aid, and machinery shutdown protocols. 2.6. Adheres to environmental safety standards to prevent contamination or accidents during workshop operations. 2.7. Ensures that tools and machinery are properly maintained and operated in compliance with safety regulations. 2.8. Displays awareness of relevant health and safety regulations and standards in the agricultural engineering industry. 2.9. Participates in safety training and demonstrates an ongoing commitment to maintaining a safe working environment.

AGE0001-13 Advanced Soil and Water Management

The aim of this study unit is to equip students with advanced techniques in soil and water conservation, focusing on optimizing the management of these critical resources for sustainable agricultural production. It emphasizes understanding soil-water relationships and applying best practices in water resource management to enhance soil health, improve crop yields, and minimize environmental impact. Students will develop the skills to design and implement effective soil and water management strategies in diverse agricultural settings.

Learning Outcome:	Assessment Criteria:
1. Apply advanced techniques in soil and water conservation.	1.1. Demonstrates a thorough understanding of advanced soil and water conservation principles and techniques. 1.2. Applies appropriate methods for soil erosion control, including terracing, contour farming, and windbreaks, based on site-specific conditions. 1.3. Implements effective water management strategies, such as rainwater harvesting, irrigation systems, and water storage techniques, to optimize resource use. 1.4. Utilizes soil fertility management techniques to enhance soil health and prevent degradation, including crop rotation, cover cropping, and organic amendments. 1.5. Applies modern technologies, such as remote sensing and GIS, to assess and monitor soil and water conservation efforts. 1.6. Designs and installs effective drainage systems to manage excess water and prevent soil erosion. 1.7. Demonstrates the ability to assess the impact of conservation practices on local ecosystems and biodiversity. 1.8. Collaborates with stakeholders, including farmers, environmental agencies, and local communities, to promote sustainable conservation practices. 1.9. Evaluates and adapts conservation strategies to address changing environmental conditions and climate change impacts.
2. Understand soil-water relationships and manage water resources for optimal agricultural production.	2.1. Demonstrates a deep understanding of soil-water relationships, including the movement, retention, and availability of water in different soil types. 2.2. Analyzes soil properties such as texture, structure, and permeability to determine

	optimal water management practices. 2.3. Applies irrigation methods that align with soil characteristics and crop requirements to ensure efficient water use. 2.4. Utilizes soil moisture monitoring tools and techniques to assess and manage water availability in agricultural systems. 2.5. Implements water conservation strategies, including mulching, rainwater harvesting, and efficient irrigation systems, to optimize water use in agriculture. 2.6. Understands the impact of water stress on crop growth and takes proactive measures to mitigate water scarcity. 2.7. Designs and manages drainage systems to prevent waterlogging and optimize water flow in agricultural fields. 2.8. Incorporates sustainable water management practices that preserve water quality and prevent contamination. 2.9. Monitors and adapts water management strategies based on seasonal variations, climate conditions, and crop demands to ensure optimal agricultural productivity.

AGE0001-14 Farm Power and Mechanization

The aim of this study unit is to provide students with a solid understanding of the principles behind farm power systems and their role in modern agriculture. It focuses on the operation, integration, and optimization of mechanized systems, including tractors, harvesters, and other farm machinery. Students will learn how to enhance the efficiency and productivity of agricultural operations through the effective use of mechanized systems while considering factors such as energy use, maintenance, and sustainability.

Learning Outcome:	Assessment Criteria:
1. Learn the principles of farm power systems.	1.1. Demonstrates a solid understanding of the fundamental principles behind farm power systems, including energy sources and mechanical power transmission. 1.2. Understands the operation, components, and functions of internal combustion engines and electric motors used in agricultural machinery. 1.3. Applies knowledge of power systems to select appropriate equipment for various agricultural tasks, ensuring efficiency and effectiveness. 1.4. Demonstrates proficiency in the design and integration of power systems in agricultural machinery, including engines, hydraulics, and transmission systems. 1.5. Understands the principles of torque, horsepower, and fuel efficiency in relation to farm power systems and machinery performance. 1.6. Analyzes and interprets power requirements for specific agricultural tasks and adjusts systems to meet these demands. 1.7. Applies maintenance and troubleshooting techniques to ensure the optimal functioning of power systems in farm machinery. 1.8. Understands the impact of power system efficiency on operational costs and environmental sustainability in agricultural practices. 1.9. Keeps abreast of advancements in farm power technologies and applies emerging innovations to enhance farm productivity and sustainability.
2. Understand the operation and integration of mechanized systems in agriculture.	2.1. Demonstrates a comprehensive understanding of the operation and functionality of various mechanized systems used in agriculture, including planting, harvesting, and irrigation systems.

	2.2. Analyzes the integration of different mechanized components, such as tractors, harvesters, and automated systems, to optimize farm operations. 2.3. Understands the interaction between mechanized systems and agricultural processes, ensuring efficiency in resource use and productivity. 2.4. Applies knowledge of hydraulics, electronics, and automation in the integration of mechanized systems for seamless operation. 2.5. Assesses the compatibility of mechanized systems with various crop types and farming practices to ensure optimal performance. 2.6. Evaluates the environmental and economic impacts of mechanized systems and identifies opportunities for sustainability and cost reduction. 2.7. Demonstrates the ability to troubleshoot and maintain integrated mechanized systems to ensure continuous and reliable operation. 2.8. Understands the role of precision agriculture technologies, such as GPS and data analytics, in enhancing the integration of mechanized systems. 2.9. Stays informed on the latest advancements in agricultural machinery and automation technologies to improve system integration and farm productivity.

AGE0001-15 Agricultural Structures and Materials

The aim of this study unit is to provide students with a thorough understanding of the design and construction of agricultural structures, such as barns, greenhouses, and storage facilities. It focuses on the selection and application of appropriate materials for building durable, efficient, and sustainable agricultural buildings. Students will learn how to consider factors such as environmental conditions, functionality, and cost-effectiveness in the design process to support modern farming practices.

Learning Outcome:	Assessment Criteria:
1. Understand the design and construction of agricultural structures (e.g., barns, greenhouses).	1.1. Demonstrates comprehensive knowledge of the fundamental principles involved in the design and construction of agricultural structures, including barns, greenhouses, and related facilities. 1.2. Identifies and evaluates the specific requirements of different agricultural structures based on intended use, climate conditions, and operational needs. 1.3. Analyzes the materials commonly used in agricultural structures, considering factors such as durability, sustainability, cost-effectiveness, and environmental impact. 1.4. Assesses the integration of structural elements, including foundations, walls, roofs, and ventilation systems, ensuring compliance with safety standards and building codes. 1.5. Understands the role of environmental factors (e.g., temperature, humidity, light) in the design of agricultural buildings and applies this knowledge to optimize performance and productivity. 1.6. Applies principles of energy efficiency and sustainability in the selection of materials, design strategies, and technologies used in agricultural structures. 1.7. Evaluates the potential for future expansion or modification of agricultural structures to meet evolving operational needs and technological advancements. 1.8. Demonstrates the ability to assess the financial feasibility of construction projects, considering budget constraints, material costs, and labor requirements. 1.9. Critically evaluates the risks and challenges associated with the construction of agricultural structures, including environmental,

	regulatory, and operational factors.
2. Learn about materials used in agricultural building design.	2.1. Demonstrates an in-depth understanding of the various materials used in agricultural building design, including their properties, advantages, and limitations. 2.2. Identifies and compares common construction materials such as wood, steel, concrete, and advanced composites, considering their suitability for different agricultural applications. 2.3. Evaluates the impact of environmental conditions (e.g., temperature, humidity, exposure to chemicals) on the selection of materials for durability and performance. 2.4. Understands the principles of sustainability and energy efficiency in material selection, emphasizing renewable, recyclable, and locally sourced options. 2.5. Analyzes the role of insulation materials in agricultural buildings, particularly for temperature control and energy conservation. 2.6. Assesses the potential for material innovations, such as smart materials or eco-friendly alternatives, to enhance the functionality and environmental impact of agricultural buildings. 2.7. Considers the cost-effectiveness of materials, balancing initial investment with long-term maintenance and operational costs. 2.8. Demonstrates knowledge of the regulatory standards and codes that influence material selection for agricultural buildings. 2.9. Evaluates the integration of materials in construction to ensure safety, stability, and structural integrity in agricultural environments.

AGE0001-16 Irrigation Systems Design

The aim of this study unit is to equip students with the knowledge and skills necessary to design efficient irrigation systems tailored to specific agricultural needs. It focuses on applying principles of soil science, climate considerations, and crop water requirements to develop optimized irrigation plans. Students will learn to design systems that maximize water use efficiency, promote sustainable agricultural practices, and enhance crop productivity.

Learning Outcome:	Assessment Criteria:
1. Learn the design principles for efficient irrigation systems.	1.1. Demonstrates a thorough understanding of the fundamental design principles for efficient irrigation systems, including water source, distribution methods, and system components. 1.2. Analyzes the different types of irrigation systems (e.g., drip, sprinkler, surface irrigation) and evaluates their suitability based on crop type, soil conditions, and climate. 1.3. Applies principles of water conservation and efficiency in irrigation design, considering factors such as water usage, pressure management, and system automation. 1.4. Assesses the role of soil moisture monitoring and weather data integration in optimizing irrigation scheduling and reducing water wastage. 1.5. Understands the importance of designing irrigation systems that minimize energy consumption while ensuring adequate water delivery to crops. 1.6. Evaluates the economic feasibility of various irrigation system designs, including installation, maintenance, and operational costs. 1.7. Demonstrates knowledge of modern technologies such as smart irrigation systems, sensors, and remote monitoring to improve system efficiency and sustainability. 1.8. Considers environmental impacts in the design process, ensuring that irrigation systems are sustainable and compliant with water use regulations. 1.9. Analyzes potential risks and challenges in irrigation system design, including water availability, system failures, and maintenance requirements.

2. Apply knowledge of soil, climate, and crop requirements to develop irrigation plans.	2.1. Demonstrates the ability to analyze soil characteristics, including texture, permeability, and water-holding capacity, to inform irrigation planning and ensure effective water distribution. 2.2. Applies knowledge of local climate conditions, such as rainfall patterns, temperature, and humidity, to develop irrigation plans that optimize water use efficiency throughout different seasons. 2.3. Understands the specific water requirements of various crops and tailor's irrigation plans to meet their needs while minimizing water wastage. 2.4. Evaluates crop growth stages and adapts irrigation schedules to ensure appropriate water application at critical times, such as germination, flowering, and fruiting. 2.5. Integrates soil moisture monitoring and climate forecasting tools to create dynamic irrigation schedules that adjust based on real-time environmental conditions. 2.6. Considers the potential for water stress and adjusts irrigation strategies to prevent under-irrigation or over-irrigation, promoting healthy crop growth. 2.7. Develops irrigation plans that incorporate efficient water delivery systems (e.g., drip, sprinkler) suitable for different crop types and field layouts. 2.8. Assesses the economic and environmental impacts of irrigation plans, aiming for a balance between optimal crop production and sustainable water use. 2.9. Ensures that irrigation plans comply with relevant local regulations and best practices in water management and conservation.

AGE0001-17 Introduction to Precision Agriculture

The aim of this study unit is to introduce students to the principles and technologies behind precision agriculture, focusing on how data-driven approaches can enhance crop management and farming efficiency. It emphasizes the role of advanced technologies such as GPS, sensors, and data analytics in optimizing resource use, improving yields, and promoting sustainable agricultural practices. Students will learn how to leverage technology to make informed decisions and improve overall farm productivity.

Learning Outcome:	Assessment Criteria:
1. Understand the role of technology in precision farming.	1.1. Demonstrates a comprehensive understanding of how technology contributes to the efficiency and sustainability of precision farming practices. 1.2. Identifies and explains key technological innovations used in precision farming, such as GPS, sensors, drones, and data analytics. 1.3. Analyzes the impact of technology on crop yield optimization, resource management, and environmental sustainability. 1.4. Evaluates the role of real-time data collection and analysis in improving decision-making processes within farming operations. 1.5. Demonstrates awareness of how technology enables targeted application of inputs like water, fertilizers, and pesticides, reducing waste and increasing cost-efficiency. 1.6. Assesses the integration of automation and robotics in precision farming, including their impact on labor efficiency and operational costs. 1.7. Critically examines the challenges and barriers to implementing technology in precision farming, such as cost, infrastructure, and training requirements. 1.8. Understands the ethical considerations related to the use of technology in farming, including data privacy, security, and accessibility for farmers. 1.9. Communicates effectively how technology in precision farming aligns with global sustainability goals and food security challenges.
2. Learn how data-driven decisions can improve crop management and efficiency.	2.1. Demonstrates understanding of key concepts in data-driven decision-making and its application to crop management. 2.2. Analyzes and interprets data from various

	sources (e.g., satellite imagery, sensors, weather forecasts) to identify patterns and trends affecting crop performance. 2.3. Evaluates the potential impact of different data-driven techniques on crop yield, resource optimization, and cost efficiency. 2.4. Integrates data-driven insights into practical strategies for pest management, irrigation scheduling, and fertilizer application. 2.5. Assesses the role of precision agriculture tools and technologies in enhancing crop productivity and sustainability. 2.6. Effectively communicates the benefits and challenges of implementing data-driven approaches in crop management to diverse stakeholders. 2.7. Demonstrates proficiency in using software or platforms designed for agricultural data analysis and decision support systems. 2.8. Critically evaluates the ethical, economic, and environmental implications of data-driven farming practices. 2.9. Proposes recommendations for improving crop management practices through data-driven decision-making, considering local agricultural contexts and resources.

AGE0001-18 Agricultural Waste Management

The aim of this study unit is to provide students with a comprehensive understanding of agricultural waste management, focusing on effective strategies for reducing, recycling, and repurposing agricultural waste. It covers methods for converting waste into valuable products, such as bioenergy, compost, and other sustainable materials. The unit emphasizes the importance of minimizing environmental impact while promoting resource efficiency and sustainability in agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Understand the management and recycling of agricultural waste.	1.1. Demonstrates knowledge of various types of agricultural waste, including organic, inorganic, and hazardous materials. 1.2. Understands the environmental impact of improper disposal of agricultural waste and the importance of waste management in sustainable agriculture. 1.3. Analyzes different waste management techniques, such as composting, anaerobic digestion, and biogas production, for recycling agricultural by-products. 1.4. Assesses the potential for recycling agricultural waste into valuable products, such as organic fertilizers, bioenergy, or animal feed. 1.5. Evaluates the role of waste management practices in reducing pollution, conserving resources, and improving farm profitability. 1.6. Identifies relevant technologies and equipment used in the collection, sorting, and processing of agricultural waste. 1.7. Critically examines policies, regulations, and industry standards related to agricultural waste management and recycling. 1.8. Promotes awareness of best practices in waste reduction, recycling, and reusing agricultural by-products among farmers and agricultural professionals. 1.9. Proposes practical strategies for integrating waste recycling into farm management systems to enhance sustainability and reduce operational costs.
2. Learn methods of reducing waste and converting it into useful products.	2.1. Demonstrates a clear understanding of different types of waste generated in agricultural, industrial, and domestic contexts. 2.2. Evaluates various methods of waste reduction, including waste prevention, minimization techniques, and efficient resource use.

	2.3. Analyzes the role of circular economy principles in converting waste into valuable products, emphasizing sustainability and resource conservation. 2.4. Understands key technologies and processes for waste conversion, such as composting, recycling, anaerobic digestion, and upcycling. 2.5. Assesses the feasibility of converting organic waste into useful products like biofertilizers, bioplastics, or bioenergy (e.g., biogas, biodiesel). 2.6. Identifies economic and environmental benefits of waste-to-product approaches, including cost savings, reduced landfill dependence, and lower carbon footprint. 2.7. Explores innovations in waste conversion, including advanced techniques like waste-to-chemicals, waste-to-food, and waste-to-water technologies. 2.8. Critically examines the challenges and barriers in waste reduction and conversion, such as technical limitations, economic viability, and regulatory constraints. 2.9. Proposes actionable solutions or strategies for integrating waste reduction and conversion into sustainable business or production systems.

AGE0001-19 Crop Protection Technologies

The aim of this study unit is to provide students with a thorough understanding of crop protection technologies, focusing on effective pest and disease management techniques. It covers the use of crop protection chemicals, biological control methods, and integrated pest management strategies. The unit emphasizes sustainable practices in safeguarding crops, enhancing productivity, and minimizing environmental impact through the application of innovative and responsible crop protection solutions.

Learning Outcome:	Assessment Criteria:
1. Learn about pest and disease management techniques.	1.1. Demonstrates a thorough understanding of common pests and diseases affecting crops, including their life cycles, symptoms, and economic impact. 1.2. Evaluates various pest and disease management techniques, including chemical, biological, and cultural control methods. 1.3. Analyzes the principles and practices of Integrated Pest Management (IPM) and its role in minimizing pest damage while reducing environmental impact. 1.4. Understands the use of resistant crop varieties, crop rotation, and companion planting as preventive measures against pests and diseases. 1.5. Assesses the effectiveness and risks of chemical control methods, including the appropriate use of pesticides and their impact on human health, beneficial organisms, and ecosystems. 1.6. Explores biological control methods, such as the use of natural predators, parasites, or microbial agents to control pest populations. 1.7. Demonstrates proficiency in using modern technologies like remote sensing, drones, and pest-monitoring systems for early detection and targeted pest management. 1.8. Critically evaluates the role of soil health, water management, and proper fertilization in reducing susceptibility to pest and disease outbreaks. 1.9. Proposes sustainable and cost-effective pest and disease management strategies tailored to specific crops, environments, and farming practices.
2. Understand the use of crop protection chemicals and biological control methods.	2.1. Demonstrates a comprehensive understanding of the different types of crop protection

	chemicals, including pesticides, herbicides, fungicides, and their modes of action. 2.2. Evaluates the appropriate use, application methods, and safety protocols for chemical crop protection to minimize risks to human health, non-target organisms, and the environment. 2.3. Understands the concept of pesticide resistance and the importance of integrated strategies to prevent and manage resistance in pest populations. 2.4. Assesses the role of biological control methods, including natural predators, parasitoids, and beneficial microorganisms, in managing pest and disease outbreaks. 2.5. Critically evaluates the effectiveness and limitations of biological control methods compared to chemical alternatives, considering factors such as cost, sustainability, and ecological impact. 2.6. Demonstrates knowledge of how crop protection chemicals and biological control methods can be integrated within an Integrated Pest Management (IPM) framework to reduce reliance on chemical treatments. 2.7. Explores advances in biotechnology, such as genetically modified crops with built-in pest resistance or biopesticides derived from natural sources. 2.8. Understands the regulatory frameworks governing the use of crop protection chemicals, including safety standards, residue limits, and environmental impact assessments. 2.9. Proposes sustainable crop protection strategies that balance the benefits of chemical and biological controls to optimize crop yield while minimizing negative environmental effects.

AGE0001-20 Advanced Farm Machinery Operations

The aim of this study unit is to equip students with advanced skills in operating and managing complex farm machinery, focusing on optimizing their performance in modern agricultural systems. It emphasizes the importance of maintenance practices to enhance the lifespan, efficiency, and reliability of farm equipment. Students will gain practical experience in the safe operation, troubleshooting, and upkeep of advanced machinery, contributing to increased productivity and sustainability in farming operations.

Learning Outcome:	Assessment Criteria:
1. Develop advanced skills in operating complex farm machinery.	1.1. Demonstrates proficiency in operating a wide range of complex farm machinery, including tractors, harvesters, sprayers, planters, and tillage equipment. 1.2. Understands the technical specifications, functions, and maintenance requirements of various types of machinery used in modern farming operations. 1.3. Applies advanced knowledge of machine calibration, setting adjustments, and operation to ensure optimal performance and efficiency in different farming tasks. 1.4. Effectively manages machinery to optimize field operations, reduce fuel consumption, and minimize wear and tear on equipment. 1.5. Demonstrates skill in troubleshooting common machinery malfunctions and performing minor repairs or adjustments to ensure continuous operations. 1.6. Understands the integration of technology with farm machinery, including GPS guidance systems, auto-steering, variable rate technology, and sensor-based automation. 1.7. Applies safety protocols and best practices for machinery operation, including proper handling, maintenance, and adherence to occupational safety standards. 1.8. Assesses the environmental impact of machinery use, including soil compaction, fuel consumption, and emissions, and implements strategies to mitigate negative effects. 1.9. Continuously updates knowledge on emerging machinery technologies and innovations to improve operational efficiency and sustainability in farm management.
2. Learn maintenance practices to increase the lifespan and efficiency of farm equipment.	2.1. Demonstrates a comprehensive understanding of the key components and systems of farm

	equipment, including engines, hydraulics, electrical systems, and drivetrain. 2.2. Applies routine maintenance practices, such as lubrication, cleaning, and replacing consumables (filters, belts, and hoses), to ensure optimal equipment performance. 2.3. Understands and follows manufacturer-recommended service schedules and maintenance intervals for various types of farm machinery. 2.4. Performs systematic inspections to identify early signs of wear and tear, addressing potential issues before they lead to equipment failure or downtime. 2.5. Implements preventive maintenance strategies, such as checking fluid levels, calibrating machinery, and adjusting settings to maintain peak efficiency. 2.6. Demonstrates proficiency in troubleshooting and diagnosing mechanical, electrical, or hydraulic issues in farm equipment, and takes corrective actions when necessary. 2.7. Applies proper storage and protection techniques to extend the lifespan of equipment during off-seasons, including cleaning, rust prevention, and battery maintenance. 2.8. Monitors the condition of tires, tracks, and undercarriages, ensuring correct inflation and alignment to improve fuel efficiency and minimize operational costs. 2.9. Integrates technology, such as telematics or diagnostic tools, to monitor equipment performance and track maintenance needs in real-time.

AGE0001-21 Principles of Agro-Processing

The aim of this study unit is to provide students with a comprehensive understanding of the principles and processes involved in agro-processing, focusing on the transformation of raw agricultural products into value-added goods. It covers various processing technologies, including food and fiber processing, and emphasizes the role of innovation and efficiency in enhancing product quality, increasing market value, and supporting sustainable agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Understand the processes involved in transforming raw agricultural products into value-added products.	1.1. Demonstrates a clear understanding of the stages involved in processing raw agricultural products, including harvesting, handling, storage, and transportation. 1.2. Analyzes the principles of value addition, including the transformation of raw materials into processed goods that offer higher economic value and extended shelf life. 1.3. Evaluates various processing techniques, such as fermentation, drying, freezing, milling, and packaging, and their impact on product quality and marketability. 1.4. Understands the role of food safety and quality standards (e.g., HACCP, ISO, and local regulations) in the transformation of raw agricultural products into consumable or industrial products. 1.5. Assesses the economic, environmental, and social benefits of value-added agriculture, including increased income for farmers, reduced food waste, and enhanced product diversity. 1.6. Identifies the technological innovations, machinery, and equipment required for the efficient transformation of raw agricultural products into value-added goods. 1.7. Demonstrates awareness of market trends, consumer preferences, and branding strategies that influence the demand for value-added agricultural products. 1.8. Explores the supply chain and distribution processes necessary to deliver value-added products from production to consumers, considering logistics, retail, and export markets. 1.9. Proposes strategies for scaling up value-added product development, considering both small-scale and industrial processing systems

	tailored to different agricultural sectors.
2. Learn about processing technologies, including food and fiber processing.	2.1. Demonstrates an in-depth understanding of the various processing technologies used in food and fiber industries, including mechanical, thermal, chemical, and biological methods. 2.2. Analyzes the principles and applications of food processing techniques, such as canning, drying, pasteurization, fermentation, and freezing, to preserve and enhance food products. 2.3. Evaluates the role of modern technologies in fiber processing, including spinning, weaving, and dyeing, and how these processes affect the quality and marketability of fiber products. 2.4. Understands the role of machinery and automation in both food and fiber processing, optimizing efficiency, consistency, and product quality. 2.5. Assesses the impact of processing technologies on product safety, shelf life, nutritional value, and sensory qualities in food products. 2.6. Explores innovations in processing technologies, such as high-pressure processing, microwave-assisted drying, and biotechnology-driven processes like enzymatic treatments or GMOs. 2.7. Demonstrates knowledge of sustainability practices in food and fiber processing, including waste reduction, energy-efficient technologies, and eco-friendly materials. 2.8. Evaluates the economic viability and scalability of different processing methods for both small-scale and large-scale operations, considering cost, resource usage, and market demand. 2.9. Understands the regulatory standards and quality assurance systems (e.g., HACCP, GMP) that govern food and fiber processing industries to ensure consumer safety and product integrity.

AGE0001-22 Renewable Energy Technologies in Agriculture

The aim of this study unit is to provide students with an in-depth understanding of various renewable energy technologies and their practical applications in agriculture. It focuses on equipping students with the knowledge to design, integrate, and optimize renewable energy systems, such as solar, wind, and biomass, for use on farms. The unit emphasizes the role of renewable energy in enhancing sustainability, reducing operational costs, and improving energy efficiency in agricultural operations.

Learning Outcome:	Assessment Criteria:
1. Learn about various renewable energy technologies and their applications in farming.	1.1. Demonstrates comprehensive understanding of different renewable energy technologies, including solar, wind, biomass, and geothermal energy, and their applications in agricultural contexts. 1.2. Analyzes the suitability of various renewable energy technologies for specific farming environments, considering factors such as climate, farm size, and energy demand. 1.3. Evaluates the environmental, economic, and social benefits of integrating renewable energy solutions into farming operations. 1.4. Identifies challenges and barriers to the adoption of renewable energy technologies in farming, including technical, financial, and regulatory considerations. 1.5. Assesses the potential for renewable energy technologies to enhance farm sustainability, reduce carbon footprint, and increase resilience to climate change. 1.6. Applies knowledge of renewable energy systems to propose innovative solutions for improving energy efficiency and production in farming operations. 1.7. Demonstrates ability to assess the technical feasibility, cost-effectiveness, and long-term viability of renewable energy solutions in farming. 1.8. Demonstrates awareness of global trends, policies, and incentives related to renewable energy adoption in agriculture. 1.9. Effectively communicates the potential impacts of renewable energy technologies on farming, providing clear recommendations for practical implementation.
2. Understand the design and integration of energy systems on farms.	2.1. Demonstrates a clear understanding of the principles and concepts involved in the design

	of energy systems tailored for agricultural applications. 2.2. Analyzes the requirements of energy systems for various farming operations, including irrigation, heating, cooling, and mechanization, ensuring efficient energy use. 2.3. Assesses the integration of renewable and conventional energy sources in farming, considering energy demands, supply stability, and sustainability. 2.4. Evaluates the role of energy storage solutions (e.g., batteries, thermal storage) in optimizing energy availability and reducing operational costs on farms. 2.5. Identifies key technical factors influencing the selection and configuration of energy systems, such as energy generation, transmission, and distribution within the farm infrastructure. 2.6. Demonstrates knowledge of energy system control, monitoring, and automation to improve operational efficiency and reduce energy waste in farming systems. 2.7. Assesses the scalability and adaptability of energy systems for farms of different sizes, from smallholdings to large commercial operations. 2.8. Considers the environmental impact and regulatory standards for energy system design and integration, ensuring compliance with local and international guidelines. 2.9. Provides well-reasoned recommendations for optimizing energy system performance, based on a thorough understanding of farm-specific needs and technological capabilities.

AGE0001-23 Land Surveying and Mapping

The aim of this study unit is to equip students with the skills necessary for land surveying and mapping in the context of agricultural projects. It focuses on teaching students how to accurately survey land, create detailed maps, and utilize Geographic Information Systems (GIS) for effective land management. The unit emphasizes the application of these techniques to support decision-making, improve agricultural productivity, and optimize land use for sustainable farming practices.

Learning Outcome:	Assessment Criteria:
1. Develop skills in surveying land for agricultural projects.	1.1. Demonstrates a solid understanding of land surveying principles, tools, and techniques relevant to agricultural projects. 1.2. Applies knowledge of topographical and soil surveys to assess land suitability for various agricultural uses, including crop production, livestock, and infrastructure development. 1.3. Utilizes GPS, GIS, and other modern surveying technologies to collect and analyze spatial data for land evaluation and planning. 1.4. Accurately measures land contours, elevations, and slopes to inform irrigation system design, drainage solutions, and land grading for agricultural purposes. 1.5. Evaluates soil characteristics, including fertility, drainage, and compaction, to determine optimal land use and resource management strategies. 1.6. Assesses environmental factors such as water availability, climate conditions, and potential hazards (e.g., flooding, erosion) to guide land-use decisions. 1.7. Develops land survey reports that clearly communicate findings, including recommendations for land development, conservation, and resource allocation. 1.8. Demonstrates proficiency in creating detailed maps and layouts for agricultural infrastructure, including planting zones, irrigation networks, and access roads. 1.9. Adheres to best practices in land surveying, ensuring accuracy, ethical considerations, and compliance with local regulations and industry standards.
2. Learn how to create maps and use geographic information systems (GIS) for agricultural purposes.	2.1. Demonstrates proficiency in using Geographic Information Systems (GIS) software to create, analyze, and interpret spatial data for

	agricultural applications. 2.2. Understands the principles of cartography and map design, ensuring the creation of clear, accurate, and useful maps for agricultural decision-making. 2.3. Applies GIS techniques to assess and visualize land use patterns, soil types, crop distributions, and environmental factors that affect farm productivity. 2.4. Integrates remote sensing data (e.g., satellite imagery, drones) with GIS to monitor crop health, track environmental changes, and optimize resource use. 2.5. Utilizes GIS to design and plan agricultural infrastructure, including irrigation systems, drainage networks, and farm layout optimization. 2.6. Analyzes spatial data to assess land suitability for different crops, predict yield potential, and identify areas for improvement or conservation. 2.7. Applies GIS-based tools for precision agriculture, including variable rate application of fertilizers, water, and pesticides, to increase efficiency and reduce environmental impact. 2.8. Uses GIS to monitor and manage natural resources, such as water availability, soil moisture, and vegetation health, for sustainable farming practices. 2.9. Demonstrates the ability to generate detailed GIS reports and visualizations to support farm management decisions and communicate findings to stakeholders.

AGE0001-24 Practical Training in Agricultural Engineering

The aim of this study unit is to provide students with the opportunity to apply theoretical knowledge to real-world agricultural engineering scenarios. It focuses on gaining practical, hands-on experience with machinery, tools, and technology commonly used in the field, enhancing students' technical skills and preparing them for professional roles in agricultural engineering. The unit emphasizes problem-solving and innovation in real-world contexts, fostering the development of practical expertise in agricultural systems.

Learning Outcome:	Assessment Criteria:
1. Apply theoretical knowledge in real-world agricultural engineering scenarios.	1.1. Demonstrates the ability to translate theoretical knowledge of agricultural engineering principles into practical solutions for real-world farming challenges. 1.2. Applies engineering concepts, such as thermodynamics, mechanics, and fluid dynamics, to design and optimize agricultural machinery, irrigation systems, and energy solutions. 1.3. Effectively integrates multidisciplinary knowledge (e.g., renewable energy, soil science, crop management) into engineering solutions tailored to specific agricultural environments and needs. 1.4. Analyzes and solves engineering problems related to farm infrastructure, such as drainage, water management, and equipment design, ensuring operational efficiency and sustainability. 1.5. Utilizes engineering tools and simulations to model and predict the performance of agricultural systems, validating assumptions with field data and real-world testing. 1.6. Identifies potential risks and challenges in implementing engineering solutions on farms, developing strategies to mitigate these issues while maintaining safety and compliance. 1.7. Works collaboratively with farmers, agronomists, and other stakeholders to understand their needs and adapt engineering solutions to optimize productivity and reduce costs. 1.8. Demonstrates a hands-on approach by conducting field tests, collecting data, and refining engineering designs based on real-world performance feedback. 1.9. Evaluates the long-term sustainability and scalability of engineering solutions, ensuring

	they align with the economic, environmental, and social goals of the agricultural industry.
2. Gain hands-on experience with machinery, tools, and technology in the field.	2.1. Demonstrates the ability to operate, maintain, and troubleshoot a variety of agricultural machinery, including tractors, harvesters, irrigation systems, and other field equipment. 2.2. Applies safety protocols and industry best practices while handling machinery and tools to minimize risks and ensure safe working conditions in the field. 2.3. Gains practical experience in calibrating and adjusting agricultural machinery for optimal performance in different farming operations, such as planting, spraying, and harvesting. 2.4. Develops proficiency in using advanced agricultural technologies, such as GPS-guided equipment, drones, and automated systems, to enhance productivity and precision. 2.5. Troubleshoots common mechanical and technological issues, applying technical knowledge to make real-time repairs or adjustments in the field. 2.6. Demonstrates the ability to assess and maintain equipment performance, identifying signs of wear, inefficiency, or damage, and conducting preventive maintenance to extend machinery lifespan. 2.7. Works with digital tools and software to monitor and manage machinery data, improving operational efficiency, reducing downtime, and optimizing field operations. 2.8. Understands the integration of different technological tools (e.g., sensors, IoT devices) with machinery to collect data and support precision agriculture practices. 2.9. Reflects on hands-on experiences, analyzing the performance and impact of machinery and tools on agricultural productivity, sustainability, and resource efficiency.

AGE0001-25 Sustainable Agriculture Practices

The aim of this study unit is to provide students with a comprehensive understanding of sustainable agriculture practices and the principles of environmental stewardship. It focuses on equipping students with the knowledge and techniques to enhance farm productivity while minimizing environmental impact, promoting resource conservation, and ensuring long-term sustainability in agricultural systems. Students will learn how to implement practices that balance economic, environmental, and social factors for sustainable farming.

Learning Outcome:	Assessment Criteria:
1. Understand the principles of sustainable farming and environmental stewardship.	1.1. Demonstrates a comprehensive understanding of sustainable farming practices, including crop rotation, conservation tillage, agroforestry, and integrated pest management. 1.2. Evaluates the principles of environmental stewardship, emphasizing the responsible management of natural resources, such as soil, water, and biodiversity, in agricultural systems. 1.3. Analyzes the environmental impacts of farming activities and identifies strategies to minimize carbon footprints, water usage, and waste generation while maintaining farm productivity. 1.4. Applies knowledge of sustainable practices to enhance soil health, reduce erosion, and prevent land degradation, ensuring long-term farm viability. 1.5. Identifies and assesses renewable energy solutions, such as solar and wind power, that can be integrated into farming operations to reduce dependency on non-renewable energy sources. 1.6. Demonstrates an understanding of water conservation techniques, including efficient irrigation systems, rainwater harvesting, and watershed management, to protect water resources. 1.7. Understands the role of biodiversity in farming systems and promotes practices that enhance habitat preservation, pollinator health, and ecosystem resilience. 1.8. Evaluates and implements waste reduction strategies, including composting, recycling, and the use of organic inputs, to minimize environmental pollution and promote circular agriculture. 1.9. Communicates the importance of sustainable

	farming and environmental stewardship to stakeholders, providing clear recommendations for policy, practice, and education.
2. Learn techniques for increasing farm productivity while minimizing environmental impact.	2.1. Demonstrates a thorough understanding of sustainable farming techniques aimed at increasing productivity, such as precision agriculture, agroecology, and organic farming practices. 2.2. Applies principles of integrated pest management (IPM) to reduce the use of chemical pesticides, promoting natural pest control and enhancing crop health. 2.3. Evaluates and implements soil health management strategies, including cover cropping, reduced tillage, and organic amendments, to improve soil fertility and prevent erosion. 2.4. Utilizes water-efficient irrigation systems, such as drip irrigation and rainwater harvesting, to optimize water use and reduce wastage while ensuring crop growth. 2.5. Incorporates agroforestry and intercropping practices to enhance biodiversity, improve land use efficiency, and provide additional income streams without compromising environmental health. 2.6. Implements crop rotation and diversification strategies to maintain soil health, prevent pest cycles, and reduce dependency on synthetic fertilizers and pesticides. 2.7. Uses data-driven approaches, such as GIS and remote sensing, to monitor crop performance and adjust inputs (e.g., fertilizers, water) to improve yields while minimizing environmental impact. 2.8. Analyzes the carbon footprint of farming practices and explores strategies for carbon sequestration, such as agroforestry, mulching, and the use of biochar. 2.9. Assesses the trade-offs between productivity and environmental impact, applying cost-benefit analysis to identify the most sustainable practices that optimize both.

AGE0001-26 Advanced Irrigation and Drainage Engineering

The aim of this study unit is to provide students with advanced knowledge and practical expertise in the design and implementation of irrigation and drainage systems for large-scale agriculture. It focuses on equipping students with the skills to apply modern techniques in water management, addressing challenges related to efficient irrigation, drainage, and resource conservation. The unit emphasizes the importance of sustainable practices in managing water resources, ensuring optimal agricultural productivity while minimizing environmental impact.

Learning Outcome:	Assessment Criteria:
1. Apply advanced techniques in irrigation design and drainage systems.	1.1. Demonstrates a deep understanding of advanced irrigation design principles, including the selection, sizing, and installation of various irrigation systems such as drip, sprinkler, and surface irrigation. 1.2. Applies water-use efficiency principles to design irrigation systems that minimize water wastage while ensuring optimal crop irrigation based on soil, crop, and climate conditions. 1.3. Utilizes modern tools and technologies, such as GIS, remote sensing, and soil moisture sensors, to assess irrigation needs and optimize system performance. 1.4. Integrates water conservation strategies, such as rainwater harvesting, greywater reuse, and the use of treated wastewater, into irrigation system designs to maximize resource utilization. 1.5. Designs and implements automated irrigation systems that incorporate weather forecasts, soil moisture data, and crop water requirements to deliver precise and efficient irrigation. 1.6. Applies drainage design techniques to mitigate waterlogging and soil erosion, ensuring proper drainage for different land types and farm layouts. 1.7. Assesses the impact of drainage systems on soil health and water quality, incorporating best practices in sustainable drainage management, including the use of biofilters and constructed wetlands. 1.8. Evaluates the environmental impact of irrigation and drainage systems, recommending practices that reduce runoff, promote groundwater recharge, and protect local water bodies. 1.9. Conducts cost-benefit analysis to evaluate the economic feasibility of irrigation and drainage system designs, balancing installation and

	operational costs with expected benefits in productivity and resource conservation.
2. Solve complex problems related to water management in large-scale agriculture.	2.1. Demonstrates a comprehensive understanding of water management principles, including water availability, distribution, and efficiency, within large-scale agricultural systems. 2.2. Analyzes and evaluates factors such as soil properties, crop water requirements, climate conditions, and water resources to develop tailored water management solutions for large farms. 2.3. Applies advanced irrigation techniques, such as precision irrigation and automated systems, to optimize water use while minimizing waste and ensuring consistent crop yield. 2.4. Identifies and addresses challenges related to water scarcity, water quality, and seasonal variability, proposing solutions to mitigate risks and enhance water availability. 2.5. Integrates sustainable water management practices, including water conservation, rainwater harvesting, and groundwater recharge, into large-scale farming operations to reduce reliance on external water sources. 2.6. Utilizes modern technologies such as remote sensing, GIS, and soil moisture sensors to monitor and manage water use effectively, making data-driven decisions to improve water efficiency. 2.7. Designs and implements drainage and runoff management systems to prevent waterlogging, soil erosion, and nutrient loss, ensuring optimal water retention and soil health. 2.8. Evaluates the environmental impacts of water management practices, ensuring compliance with local regulations and promoting the health of surrounding ecosystems and water bodies. 2.9. Collaborates with stakeholders, including farmers, engineers, and environmental experts, to develop and implement integrated water management strategies that balance agricultural needs with sustainability goals.

AGE0001-27 Farm Business Management

The aim of this study unit is to provide students with a comprehensive understanding of the financial and operational aspects of farm business management. It focuses on equipping students with the skills to develop business plans, manage farm finances effectively, and analyze profitability, enabling them to make informed decisions and enhance the sustainability and success of agricultural enterprises.

Learning Outcome:	Assessment Criteria:
1. Understand the financial and operational aspects of running a farm business.	1.1. Demonstrates a solid understanding of the key financial principles and tools needed to manage a farm business, including budgeting, cash flow management, and financial forecasting. 1.2. Analyzes the cost structure of farming operations, identifying fixed and variable costs, and develops strategies to optimize resource allocation for maximum profitability. 1.3. Applies knowledge of farm profitability analysis, including break-even analysis, margin analysis, and return on investment (ROI), to guide financial decision-making. 1.4. Understands the principles of farm business planning, including the development of short- and long-term financial goals, risk management strategies, and business sustainability practices. 1.5. Evaluates and implements strategies to improve operational efficiency, reduce waste, and increase labor productivity while maintaining high-quality standards. 1.6. Demonstrates knowledge of agricultural marketing, including pricing strategies, market analysis, and distribution channels, to maximize sales and improve competitive advantage. 1.7. Understands the financial impact of agricultural policies, subsidies, grants, and loans on farm operations, and uses this knowledge to seek financial support and optimize funding opportunities. 1.8. Assesses the role of technology and innovation in improving farm business operations, including the integration of automation, data analytics, and precision farming tools to reduce costs and increase productivity. 1.9. Develops and implements risk management

	strategies, such as crop insurance, diversification, and hedging, to protect farm businesses against market volatility, climate risks, and economic fluctuations.
2. Learn to develop business plans, manage finances, and analyze profitability.	2.1. Demonstrates a clear understanding of the key components of a farm business plan, including mission and vision statements, market analysis, operational strategies, and financial projections. 2.2. Applies principles of financial management to develop and manage budgets, track expenses, and monitor cash flow for efficient farm operation. 2.3. Utilizes financial tools and techniques, such as profit and loss statements, balance sheets, and cash flow analysis, to evaluate the financial health of the farm business. 2.4. Develops and implements strategies for managing working capital, securing financing, and optimizing farm investments to ensure long-term business sustainability. 2.5. Conducts profitability analysis, including cost of production, break-even analysis, and return on investment (ROI), to assess the financial viability of different farming activities. 2.6. Identifies and evaluates financial risks, including fluctuations in commodity prices, labor costs, and environmental factors, and develops risk management strategies to mitigate these risks. 2.7. Understands the role of pricing strategies, sales forecasting, and market trends in enhancing farm profitability and ensuring competitive advantage. 2.8. Demonstrates the ability to assess operational efficiency, recommending improvements in farm processes, resource allocation, and labor management to increase profitability. 2.9. Communicates financial results and business performance effectively to stakeholders, providing insights and recommendations for future business growth and investment opportunities.

AGE0001-28 Design of Agricultural Machinery

The aim of this study unit is to equip students with the knowledge and skills required for the design and development of agricultural machinery and equipment. It focuses on the principles of selecting appropriate materials, components, and technologies, while considering factors such as functionality, efficiency, and sustainability in the design process to meet the needs of modern farming systems.

Learning Outcome:	Assessment Criteria:
1. Learn the process of designing agricultural machinery and equipment.	1.1. Demonstrates a solid understanding of the fundamental principles of agricultural machinery design, including mechanical engineering, hydraulics, and materials science. 1.2. Applies knowledge of farm operations and specific crop/livestock needs to design machinery that enhances productivity, efficiency, and safety in agricultural tasks such as planting, harvesting, irrigation, and soil preparation. 1.3. Understands the mechanical components and systems involved in agricultural equipment, including engines, transmissions, gear systems, and control systems, ensuring optimal functionality and durability. 1.4. Utilizes computer-aided design (CAD) software and simulation tools to create, model, and analyze machinery designs, ensuring accuracy and feasibility before production. 1.5. Evaluates and integrates advanced technologies, such as automation, GPS, and IoT, into agricultural machinery designs to enhance precision, efficiency, and ease of operation. 1.6. Considers environmental impact in the design process, incorporating energy-efficient technologies and sustainable materials to minimize the carbon footprint and reduce resource consumption. 1.7. Understands and applies safety standards and regulatory requirements in the design and operation of agricultural machinery, ensuring compliance with industry safety protocols. 1.8. Collaborates with farmers and industry experts to gather feedback and refine machinery designs based on practical needs, performance, and field testing results. 1.9. Demonstrates the ability to conduct cost-benefit analysis and evaluate the long-term economic feasibility of agricultural machinery, considering

	initial investment, operational costs, and return on investment.
2. Understand how to select materials, components, and technologies for designing farm machinery.	2.1. Demonstrates a deep understanding of the properties and characteristics of various materials (e.g., metals, polymers, composites) used in the design of agricultural machinery, considering factors such as strength, durability, weight, and cost. 2.2. Evaluates the performance requirements of agricultural machinery to select appropriate materials and components that meet operational needs while ensuring safety, longevity, and reliability. 2.3. Applies knowledge of material science to choose components that resist wear, corrosion, and environmental stresses, ensuring machinery performs effectively in diverse field conditions. 2.4. Understands the role of advanced technologies (e.g., automation, sensors, GPS, IoT) in farm machinery design, selecting technologies that enhance operational efficiency, precision, and data collection capabilities. 2.5. Considers the environmental impact of material and component choices, prioritizing sustainable options that reduce resource consumption, waste, and emissions during both production and operation. 2.6. Integrates cutting-edge technologies, such as electric or hybrid power systems, into machinery designs to improve energy efficiency and reduce the carbon footprint of farming operations. 2.7. Demonstrates the ability to assess cost-effectiveness, balancing the selection of high-quality materials and advanced technologies with budget constraints and operational goals. 2.8. Ensures that selected components and materials comply with relevant safety standards, industry regulations, and performance benchmarks, guaranteeing the safety and functionality of the machinery. 2.9. Collaborates with engineers, farmers, and suppliers to identify and source the most appropriate materials and technologies based on specific farming needs and machinery design requirements.

AGE0001-29 Precision Farming Systems

The aim of this study unit is to provide students with a thorough understanding of precision farming technologies and their integration into modern agricultural systems. It focuses on equipping students with the skills to design, implement, and optimize precision farming solutions, enhancing land use efficiency, crop management, and resource conservation to support sustainable agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Understand the integration of precision technologies in farming systems.	1.1. Demonstrates a comprehensive understanding of precision agriculture concepts, including the use of data-driven technologies to optimize farming practices and enhance resource efficiency. 1.2. Analyzes how precision technologies, such as GPS, remote sensing, soil sensors, and drones, can be integrated into farming systems to monitor and manage variables like soil moisture, crop health, and nutrient levels. 1.3. Understands the role of Geographic Information Systems (GIS) and data analytics in processing and visualizing spatial data to support decision-making in field management, planting, irrigation, and harvesting. 1.4. Evaluates the benefits of using variable rate technology (VRT) for inputs like water, fertilizers, and pesticides, ensuring precise application that reduces waste and minimizes environmental impact. 1.5. Integrates automation and robotics into farming systems to enhance operational efficiency, such as autonomous tractors, harvesters, and drones, reducing labor costs and improving precision. 1.6. Assesses the economic and environmental impact of adopting precision technologies, calculating return on investment (ROI) and long-term sustainability benefits for farm operations. 1.7. Identifies potential challenges in adopting precision technologies, such as high initial costs, technical complexity, and data management, and develops strategies to overcome these barriers. 1.8. Understands the importance of interoperability between various precision technologies, ensuring seamless data exchange between machines, software platforms, and farm management systems. 1.9. Demonstrates the ability to implement precision farming strategies that optimize crop yields,

	reduce input costs, and minimize environmental footprint while maintaining farm profitability and sustainability.
2. Learn to design and implement precision farming solutions for efficient land use.	2.1. Demonstrates a clear understanding of precision farming principles, including data collection, analysis, and technology integration, to optimize land use and improve farming practices. 2.2. Applies knowledge of soil mapping, topography, and field variability to design precision farming solutions that match crop needs to specific areas within the field, ensuring efficient use of resources. 2.3. Utilizes GPS and GIS technologies to map and monitor field conditions, ensuring precise identification of soil types, moisture levels, and nutrient requirements for targeted interventions. 2.4. Develops and implements variable rate technology (VRT) strategies for seed planting, irrigation, fertilization, and pesticide application, optimizing input use while minimizing waste and environmental impact. 2.5. Integrates sensor technologies (e.g., soil moisture sensors, weather stations) into farm operations to provide real-time data, enabling timely decisions on irrigation, fertilization, and crop management. 2.6. Designs and deploys automated systems, such as robotic machinery and drones, for precision planting, monitoring, and harvesting, reducing labor costs and increasing operational efficiency. 2.7. Evaluates the cost-effectiveness and sustainability of precision farming solutions, considering factors like initial investment, operational savings, and long-term benefits in yield and resource efficiency. 2.8. Analyzes field performance data to continuously improve precision farming strategies, adjusting management practices based on changing conditions such as weather patterns and crop growth stages. 2.9. Demonstrates the ability to train and support farm operators in using precision farming technologies, ensuring proper implementation and maximizing the benefits of these systems for improved land use.

AGE0001-30 Advanced Soil Mechanics

The aim of this study unit is to deepen students' understanding of soil mechanics principles and their application in agricultural engineering. It focuses on equipping students with advanced techniques for analyzing and improving soil structure, managing soil compaction, and optimizing soil conditions to enhance the efficiency and sustainability of farming systems.

Learning Outcome:	Assessment Criteria:
1. Apply principles of soil mechanics in agricultural engineering applications.	1.1. Demonstrates a thorough understanding of soil properties, including texture, structure, density, compaction, and porosity, and their implications for agricultural engineering applications. 1.2. Applies principles of soil mechanics to design and evaluate soil stabilization techniques for improving soil structure and preventing erosion in agricultural fields. 1.3. Analyzes the effects of soil compaction on root growth, water infiltration, and crop yields, recommending appropriate methods for compaction mitigation in farming operations. 1.4. Utilizes soil strength and shear parameters to design effective drainage systems, ensuring optimal water management, reducing waterlogging, and promoting soil health in agricultural environments. 1.5. Integrates soil mechanics principles in the design of farm infrastructure, such as roads, irrigation channels, and foundations, to ensure structural stability and longevity under varying soil conditions. 1.6. Applies knowledge of soil-water interactions to optimize irrigation systems, ensuring efficient water use and minimizing runoff or erosion risks in agricultural land. 1.7. Demonstrates the ability to assess and address the impact of heavy machinery and equipment on soil structure, implementing solutions to reduce soil compaction and prevent degradation. 1.8. Utilizes laboratory and field testing methods, such as soil sampling, Atterberg limits, and triaxial testing, to evaluate soil conditions and inform engineering decisions in agricultural projects. 1.9. Incorporates sustainable soil management practices based on soil mechanics, promoting

	long-term soil fertility, water retention, and erosion control for sustainable agricultural productivity.
2. Learn techniques for improving soil structure and handling soil compaction in farming systems.	2.1. Demonstrates a thorough understanding of soil structure, including the importance of soil aggregation, pore space, and organic matter content for supporting healthy plant growth and water infiltration. 2.2. Applies techniques such as deep tillage, subsoiling, and aeration to alleviate soil compaction and improve root penetration, water movement, and nutrient uptake in compacted soils. 2.3. Utilizes cover cropping and crop rotation strategies to enhance soil structure by increasing organic matter, improving microbial activity, and preventing erosion. 2.4. Implements conservation tillage practices, such as no-till or reduced tillage, to minimize soil disturbance, preserve soil structure, and reduce the risk of compaction. 2.5. Applies organic and inorganic soil amendments, such as compost, biochar, and gypsum, to improve soil aggregation, enhance nutrient cycling, and reduce compaction in heavy soils. 2.6. Integrates the use of controlled traffic farming (CTF) systems to limit compaction by restricting heavy machinery to designated paths, preserving soil structure in the rest of the field. 2.7. Uses modern soil testing methods to monitor compaction levels and soil health, guiding targeted interventions and adjustments in farming practices to optimize soil conditions. 2.8. Implements proper drainage systems, including the use of tile drains or surface drainage, to prevent waterlogging and the subsequent risk of soil compaction in poorly-drained areas. 2.9. Collaborates with agronomists and soil scientists to develop site-specific strategies for improving soil structure and managing compaction, ensuring practices are tailored to different soil types and farming systems.

AGE0001-31 Climate-Smart Agriculture

The aim of this study unit is to provide students with a comprehensive understanding of climate-smart agriculture and its role in addressing the challenges posed by climate change. It focuses on equipping students with knowledge of adaptive and mitigation strategies to enhance climate resilience, reduce greenhouse gas emissions, and promote sustainable agricultural practices, ensuring food security and environmental sustainability.

Learning Outcome:	Assessment Criteria:
1. Understand how agriculture can adapt to and mitigate climate change.	1.1. Demonstrates a comprehensive understanding of the impact of climate change on agricultural systems, including changing weather patterns, temperature fluctuations, droughts, floods, and shifts in pest and disease dynamics. 1.2. Applies knowledge of climate-resilient agricultural practices, such as drought-resistant crops, agroforestry, and water-efficient irrigation, to reduce vulnerability to climate change. 1.3. Identifies and evaluates mitigation strategies in agriculture, such as carbon sequestration through soil management, agroecological practices, and the use of renewable energy sources in farming operations. 1.4. Analyzes the role of sustainable farming techniques, including crop diversification, conservation tillage, and cover cropping, in increasing farm resilience to extreme weather events and enhancing soil health. 1.5. Understands the importance of reducing greenhouse gas emissions from agriculture by optimizing fertilizer use, improving livestock management, and adopting low-carbon technologies. 1.6. Utilizes climate models and data to assess potential impacts of climate change on crop yields, water availability, and farming systems, helping farmers plan and adapt accordingly. 1.7. Promotes the adoption of precision agriculture technologies, including weather forecasting, remote sensing, and soil monitoring, to enable better resource management and reduce the environmental footprint of farming. 1.8. Recognizes the importance of policy and international frameworks, such as carbon pricing, subsidies for sustainable practices, and climate adaptation funding, in supporting climate-resilient agriculture.

	1.9. Engages with farmers, researchers, and policymakers to implement adaptation strategies and develop long-term, climate-smart agricultural plans that enhance productivity while mitigating climate risks.
2. Learn strategies for building climate resilience in agricultural systems.	2.1. Demonstrates a clear understanding of the concept of climate resilience in agriculture, including the ability to adapt to climate variability, minimize vulnerability, and recover from climate-related shocks. 2.2. Identifies and applies climate-resilient farming practices, such as drought-tolerant crops, agroforestry, and intercropping, to improve farm productivity and sustainability under changing climate conditions. 2.3. Understands the role of soil health management in building resilience, including techniques such as organic farming, cover cropping, reduced tillage, and mulching to enhance soil structure, water retention, and fertility. 2.4. Implements efficient water management strategies, such as rainwater harvesting, drip irrigation, and water-efficient crop varieties, to ensure reliable water supply in the face of climate-induced droughts or water scarcity. 2.5. Develops and applies crop diversification strategies to reduce the risk of crop failure due to extreme weather events, pests, or diseases, enhancing farm income stability and ecosystem resilience. 2.6. Integrates the use of climate-smart technologies, such as weather forecasting, remote sensing, and precision agriculture, to improve decision-making and optimize resource use under fluctuating climate conditions. 2.7. Analyzes and applies risk management tools, such as crop insurance, financial reserves, and diversification, to buffer farms from climate-related financial losses and uncertainties. 2.8. Engages with stakeholders, including farmers, researchers, and policymakers, to promote the development and adoption of climate adaptation strategies, fostering community-level resilience through knowledge sharing and

	collaboration. 2.9. Continuously monitors and evaluates climate resilience strategies, adjusting practices based on new scientific data, emerging climate risks, and farmer feedback to ensure long-term viability of agricultural systems.

AGE0001-32 Renewable Energy Systems for Farms

The aim of this study unit is to equip students with the knowledge and skills to design and evaluate renewable energy systems, such as solar, wind, and biomass, tailored for agricultural applications. It focuses on fostering an understanding of the feasibility, efficiency, and sustainability of integrating renewable energy solutions into farming operations, promoting energy independence and environmental stewardship in agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Design renewable energy systems (solar, wind, biomass) for use in agricultural operations.	1.1. Demonstrates a comprehensive understanding of renewable energy technologies, including solar, wind, and biomass, and their potential applications in agricultural operations for energy generation and efficiency. 1.2. Applies knowledge of energy needs in agricultural settings to design customized renewable energy systems that address specific farm requirements, such as irrigation, heating, cooling, and mechanization. 1.3. Designs and sizes solar power systems, including photovoltaic panels, inverters, and battery storage, to meet the energy demands of agricultural operations, ensuring optimal performance and cost-effectiveness. 1.4. Evaluates the feasibility of wind energy systems for farms, considering local wind patterns, turbine capacity, and energy storage solutions to generate electricity for farm operations. 1.5. Applies principles of biomass energy production, including the selection and processing of organic materials (e.g., crop residues, animal waste), to design systems for bioenergy generation such as biogas, biofuels, or biomass boilers. 1.6. Integrates energy storage solutions, such as batteries or thermal storage, into renewable energy systems to ensure a continuous, reliable energy supply, particularly during non-sunny or non-windy periods. 1.7. Analyzes the economic and environmental benefits of renewable energy systems, conducting cost-benefit analysis to assess initial investment, operational savings, and long-term sustainability for farm businesses. 1.8. Designs hybrid renewable energy systems, combining solar, wind, and/or biomass to provide a balanced, stable energy supply while

	minimizing dependency on fossil fuels and grid electricity. 1.9. Considers the environmental and regulatory implications of renewable energy installations, ensuring compliance with local zoning laws, environmental impact assessments, and industry standards for renewable energy systems.
2. Assess the feasibility and sustainability of renewable energy on farms.	2.1. Demonstrates the ability to conduct a comprehensive feasibility assessment of renewable energy systems (solar, wind, biomass) for agricultural applications, considering energy needs, geographic location, and environmental factors. 2.2. Analyzes farm energy consumption patterns to determine the appropriate size, type, and configuration of renewable energy systems (e.g., solar arrays, wind turbines, biomass digesters) that would provide optimal energy production and meet operational demands. 2.3. Assesses the financial feasibility of renewable energy projects by conducting cost-benefit analyses, evaluating initial capital costs, ongoing operational expenses, and potential savings from reduced energy bills or increased efficiency. 2.4. Evaluates the technical feasibility of renewable energy integration, including grid connection, energy storage solutions, and the compatibility of renewable systems with existing farm infrastructure and equipment. 2.5. Conducts an environmental impact assessment to evaluate how renewable energy systems affect local ecosystems, water resources, and soil health, ensuring that installations align with sustainable farming practices. 2.6. Considers long-term sustainability by assessing the durability and maintenance requirements of renewable energy systems, ensuring their reliability, efficiency, and cost-effectiveness over time. 2.7. Analyzes the potential for energy independence and resilience, evaluating how renewable energy systems can mitigate risks

	related to energy price fluctuations, supply disruptions, or external dependencies. 2.8. Assesses regulatory and policy implications, ensuring that renewable energy projects comply with local, regional, and national regulations, including zoning, permitting, and environmental guidelines. 2.9. Engages with stakeholders (e.g., farm operators, energy consultants, and local authorities) to gather input and align renewable energy projects with the farm's economic, environmental, and operational goals.

AGE0001-33 Post-Harvest Technology

The aim of this study unit is to provide students with a comprehensive understanding of the principles and practices involved in post-harvest handling, storage, and processing of agricultural produce. It focuses on equipping students with the knowledge and techniques to minimize post-harvest losses, maintain product quality, and enhance the value of harvested crops, contributing to sustainable agricultural systems and food security.

Learning Outcome:	Assessment Criteria:
1. Understand the principles of post-harvest handling, storage, and processing.	1.1. Demonstrates a clear understanding of the principles of post-harvest handling, focusing on techniques to minimize losses, preserve quality, and maintain the nutritional value of harvested crops. 1.2. Understands the physiological changes that occur in crops post-harvest, including respiration, ripening, and senescence, and applies this knowledge to optimize storage conditions and extend shelf life. 1.3. Applies best practices in harvesting, handling, and transporting crops to prevent mechanical damage, contamination, and spoilage, ensuring the preservation of quality from field to storage. 1.4. Demonstrates knowledge of various storage methods, including temperature control (e.g., refrigeration, cooling), humidity control, and ventilation, tailored to different types of crops (e.g., grains, fruits, vegetables). 1.5. Understands the role of packaging materials and techniques in protecting crops during storage and transportation, maintaining their quality, and preventing physical damage or pest infestation. 1.6. Evaluates the principles of processing agricultural products to improve shelf life, add value, and ensure food safety while preserving nutrients and flavor. 1.7. Demonstrates knowledge of food safety standards and regulations, including HACCP (Hazard Analysis and Critical Control Points), to ensure safe and hygienic handling, storage, and processing practices. 1.8. Identifies and implements methods for reducing post-harvest losses, including integrated pest management (IPM) strategies, proper sanitation, and the use of natural preservatives.

	1.9. Understands the role of technological innovations, such as automated sorting, drying systems, and climate-controlled storage, in improving the efficiency and sustainability of post-harvest operations.
2. Learn techniques to minimize losses and preserve the quality of harvested crops.	2.1. Demonstrates a thorough understanding of the factors that contribute to post-harvest losses, including mechanical damage, dehydration, microbial contamination, and improper handling. 2.2. Applies knowledge of proper harvesting techniques to reduce crop damage, ensuring minimal physical injury and contamination during harvesting processes. 2.3. Implements appropriate pre-storage treatments, such as cleaning, sorting, and grading, to enhance crop quality and minimize the risk of spoilage during storage and transportation. 2.4. Demonstrates the ability to select and maintain optimal storage conditions for different crop types, extending shelf life and maintaining nutritional value. 2.5. Understands and applies appropriate packaging techniques and materials to protect crops from physical damage, contamination, and environmental stress during storage and transportation. 2.6. Utilizes preservation methods, such as controlled atmosphere storage, refrigeration, and drying, to minimize spoilage, maintain texture and flavor, and reduce waste. 2.7. Implements integrated pest management (IPM) strategies and sanitation practices to prevent pest infestations and microbial growth during post-harvest handling. 2.8. Analyzes the impact of handling practices, such as sorting and transportation, on crop quality, ensuring minimal exposure to factors that could lead to bruising, rot, or degradation. 2.9. Evaluates and applies technological innovations, such as automated sorting, advanced packaging systems, and climate-controlled storage, to enhance post-harvest quality preservation and reduce losses.

AGE0001-34 Automation in Agriculture

The aim of this study unit is to provide students with an in-depth understanding of the role of automation and robotics in modern agriculture. It focuses on exploring how automated systems enhance efficiency, precision, and sustainability in farming operations such as planting, harvesting, and processing. Through this unit, students will gain insights into cutting-edge technologies and their applications in addressing the challenges of contemporary agricultural practices.

Learning Outcome:	Assessment Criteria:
1. Learn about the role of automation and robotics in farming.	1.1. Demonstrates a solid understanding of the principles of automation and robotics in agriculture, including the various types of technologies and their applications across different farming operations. 1.2. Explains the role of automated machinery in reducing labor costs, increasing efficiency, and improving the precision of agricultural tasks such as planting, harvesting, irrigation, and crop monitoring. 1.3. Analyzes the integration of robotics in farming, including autonomous tractors, drones, and robotic harvesters, and evaluates their impact on farm productivity, cost-effectiveness, and sustainability. 1.4. Understands the use of precision farming tools, such as GPS-guided equipment and sensor-based systems, to enhance crop management, optimize inputs, and minimize waste. 1.5. Demonstrates the ability to evaluate the potential benefits and challenges of adopting automation and robotics, considering factors such as capital investment, return on investment (ROI), and the technical skills required for operation. 1.6. Assesses the role of artificial intelligence (AI) and machine learning in improving farm automation systems, such as through predictive analytics, crop health monitoring, and yield forecasting. 1.7. Explores the impact of automation on labor dynamics in agriculture, including workforce displacement and the potential for upskilling and training opportunities for farm workers. 1.8. Examines the environmental implications of robotic and automated systems, including energy efficiency, reduced pesticide use, and

	the potential for precision water management. 1.9. Investigates the scalability and adaptability of automation and robotics in different agricultural settings, including small-scale and large-scale farms, and identifies strategies for overcoming barriers to adoption.
2. Understand how automation can improve efficiency in planting, harvesting, and processing.	2.1. Demonstrates a comprehensive understanding of how automation technologies, such as autonomous tractors, robotic planters, and harvesters, contribute to improving operational efficiency in planting, harvesting, and processing. 2.2. Analyzes the role of automated planting systems in optimizing seed placement, depth, and spacing, ensuring uniform crop emergence, reduced seed waste, and improved overall yield. 2.3. Understands how automated irrigation systems, integrated with weather forecasting and soil moisture sensors, can optimize water usage during planting, enhancing crop establishment and minimizing water waste. 2.4. Explains the advantages of robotic harvesters in reducing labor costs, increasing harvest precision, and minimizing crop damage during the harvesting process, leading to higher-quality produce and reduced post-harvest losses. 2.5. Evaluates the use of automated sorting, grading, and packaging systems in post-harvest processing, enhancing efficiency, consistency, and quality control while reducing human error and operational costs. 2.6. Assesses the integration of sensor-based technologies and AI in automated systems for real-time monitoring and decision-making, such as determining optimal harvest timing, soil conditions, and crop health. 2.7. Understands how automation can streamline supply chain processes, including harvesting, processing, and transportation, improving logistical efficiency and reducing time-to-market for perishable products. 2.8. Analyzes the potential for data-driven insights from automated systems to inform decision-

	making on planting schedules, crop management, and processing operations, ultimately increasing resource efficiency and maximizing profitability. 2.9. Evaluates the environmental benefits of automation in reducing input waste (e.g., water, fertilizers, pesticides) and improving energy efficiency in planting, harvesting, and processing activities.

AGE0001-35 Research Methods in Agriculture Engineering

The aim of this study unit is to equip students with the essential skills and methodologies required to conduct rigorous research in agricultural engineering. It focuses on fostering a comprehensive understanding of experimental design, data collection, and analysis techniques while enhancing the ability to effectively communicate research findings. This unit prepares students to address complex agricultural challenges through evidence-based approaches and innovative problem-solving.

Learning Outcome:	Assessment Criteria:
1. Develop skills in conducting research in agricultural engineering.	1.1. Demonstrates a solid understanding of research methodologies, including experimental design, data collection, analysis, and interpretation, as applied to agricultural engineering problems and innovations. 1.2. Develops proficiency in using relevant research tools and software (e.g., CAD, MATLAB, statistical analysis programs) for designing and conducting experiments, simulations, and modeling in agricultural systems. 1.3. Identifies critical research questions in agricultural engineering, such as improving machinery design, enhancing crop production systems, optimizing resource management, and developing sustainable agricultural practices. 1.4. Conducts literature reviews to evaluate existing research, understand current trends, identify gaps in knowledge, and establish a foundation for original research projects in agricultural engineering. 1.5. Designs, implements, and evaluates research projects that address specific agricultural engineering challenges, ensuring research outcomes are relevant, practical, and aligned with industry needs. 1.6. Analyzes data using appropriate statistical methods, ensuring the accuracy, reliability, and validity of results in the context of agricultural engineering applications. 1.7. Develops and tests hypotheses related to agricultural engineering innovations, using controlled experiments and real-world data to draw actionable conclusions. 1.8. Communicates research findings effectively through written reports, research papers, and presentations, ensuring that results are accessible to both academic audiences and industry stakeholders. 1.9. Collaborates with agricultural engineers, farmers,

	and other professionals to identify practical solutions to real-world problems, ensuring research has practical, on-the-ground applications.
2. Learn about experimental design, data analysis, and presenting research findings.	2.1. Demonstrates a solid understanding of experimental design principles, including hypothesis formulation, variable identification, and control group establishment to ensure valid and reliable research outcomes. 2.2. Applies appropriate sampling methods to ensure representative data collection, minimizing bias and ensuring the accuracy and generalizability of experimental results. 2.3. Develops skills in selecting and utilizing various experimental techniques, such as randomized controlled trials, field experiments, and laboratory testing, to address specific research questions in agricultural engineering. 2.4. Implements proper data collection methods, ensuring consistency, accuracy, and repeatability across experiments, with attention to factors such as measurement precision and instrumentation calibration. 2.5. Utilizes advanced data analysis tools and software (e.g., statistical packages such as SPSS, R, or Python) to process and interpret experimental data, applying relevant statistical tests to validate hypotheses. 2.6. Interprets research results critically, drawing evidence-based conclusions and identifying trends, patterns, and correlations that provide insights into agricultural engineering applications. 2.7. Communicates research findings effectively through well-structured written reports, research papers, and visual aids (e.g., charts, graphs), ensuring clarity and accessibility for both academic and industry audiences. 2.8. Develops oral presentation skills, presenting research findings confidently to stakeholders, including peers, faculty, industry professionals, and policymakers, using appropriate language and visual tools. 2.9. Applies the principles of scientific communication, including clarity, transparency, and adherence to ethical standards, to ensure research is communicated responsibly and effectively.

AGE0001-36 Final Project in Agricultural Engineering

The aim of this study unit is to empower students to integrate and apply the theoretical and practical knowledge gained throughout their academic journey in agricultural engineering. It focuses on enabling students to design, develop, and implement a comprehensive project that addresses real-world challenges in the field. Through this unit, students will enhance their problem-solving, innovation, and research skills, while demonstrating technical proficiency and critical thinking.

Learning Outcome:	Assessment Criteria:
1. Apply knowledge from previous years to design and implement an agricultural engineering project.	1.1. Integrates theoretical knowledge from previous coursework in agricultural engineering, including principles of crop management, machinery design, soil mechanics, irrigation systems, and renewable energy, to develop a well-structured agricultural engineering project. 1.2. Demonstrates the ability to conduct a comprehensive needs assessment, identifying key challenges and opportunities within the agricultural sector, and translates these into practical project objectives. 1.3. Applies sound engineering principles to design innovative solutions, utilizing appropriate technologies, tools, and methodologies to address identified agricultural problems or enhance productivity. 1.4. Develops a clear, actionable project plan that includes detailed timelines, resource allocation, and milestone tracking, ensuring efficient execution and adherence to project scope and budget constraints. 1.5. Conducts a feasibility analysis, assessing technical, economic, environmental, and regulatory factors to ensure the project's sustainability, scalability, and alignment with industry standards. 1.6. Demonstrates proficiency in utilizing relevant design and simulation software (e.g., CAD, MATLAB, GIS) to create and optimize models for the proposed project, ensuring accuracy and technical integrity. 1.7. Applies principles of project management, including risk assessment, problem-solving, and team coordination, to ensure the successful implementation of the project from conceptualization to execution. 1.8. Evaluates project outcomes through data

	collection and performance analysis, applying critical thinking to assess efficiency, effectiveness, and overall impact, and making necessary adjustments for continuous improvement. 1.9. Effectively communicates project progress and results to stakeholders through professional reports, technical documentation, and presentations, ensuring clarity and transparency in conveying complex technical details.
2. Demonstrate problem-solving, innovation, and research skills in solving a real-world agricultural engineering challenge.	2.1. Demonstrates the ability to identify and clearly define a real-world agricultural engineering problem, considering the technical, economic, environmental, and social factors that impact the issue. 2.2. Applies critical thinking and analytical skills to break down complex agricultural engineering problems into manageable components, prioritizing key factors and formulating effective solutions. 2.3. Utilizes innovative approaches and cutting-edge technologies (e.g., precision farming, renewable energy, automated systems) to develop novel solutions that address the identified agricultural challenge in an efficient and sustainable manner. 2.4. Conducts thorough research to gather relevant data, review existing literature, and evaluate current best practices, ensuring the proposed solution is informed by up-to-date knowledge and industry standards. 2.5. Designs and tests prototypes or models to validate potential solutions, using data-driven decision-making to refine and optimize engineering designs and approaches. 2.6. Demonstrates strong problem-solving skills by identifying and addressing obstacles that arise during the project, adjusting strategies as needed to ensure project success. 2.7. Evaluates the feasibility and impact of proposed solutions, considering technical, financial, environmental, and operational constraints, ensuring the solution's practicality and sustainability.

	2.8. Engages in continuous learning throughout the problem-solving process, seeking expert opinions, collaborating with industry professionals, and incorporating new insights into the solution development. 2.9. Communicates the problem-solving process, research findings, and proposed solutions clearly and effectively to stakeholders through technical reports, presentations, and recommendations, ensuring the solution is understood and actionable.

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