Course Code	Skill Enhancement Courses (SEC)						Marks			Pre-requisite
241AE007	**Course Name**	**Level**	**L**	**T**	**P**	**C**	**CIE**	**SEE**	**Total**	
	1. Skill Enhancement (students can opt any two given modules)	FC	0	0	8	8	50	50	100	-
	a) Operation & maintenance of farm machinery.		0	0	4	4	50	50	100	-
	b) Repair and maintenance of tractors and power tillers.		0	0	4	4	50	50	100	-
	c) Management of agricultural machinery custom hiring and maintenance facilities.		0	0	4	4	50	50	100	-
	d) Valorization of agri-biomass and organic waste.		0	0	4	4	50	50	100	-
	e) Energy audit, energy conservation and energy efficiency.		0	0	4	4	50	50	100	-
	f) Installation and maintenance of micro-irrigation systems.		0	0	4	4	50	50	100	-
	g) Application of remote sensing and GIS for agricultural water management.		0	0	4	4	50	50	100	-
	h) Installation and maintenance of roof top rainwater harvesting systems.		0	0	4	4	50	50	100	-
	i) Agro processing methods, equipment operation and maintenance.		0	0	4	4	50	50	100	-

	j) Food grain goes down and warehouse management.		0	0	4	4	50	50	100	-
	k) Post-harvest value chain management including logistics.		0	0	4	4	50	50	100	-
	l) Operation and maintenance of drones used for agricultural applications		0	0	4	4	50	50	100	-
	m)Machine vision, sensors and sensors architecture		0	0	4	4	50	50	100	-
	n) Geophysical survey and investigations for groundwater exploration and installation of tube well/ bore well		0	0	4	4	50	50	100	-
	o) Construction, management and maintenance of protected cultivation structures		0	0	4	4	50	50	100	-
	p) Agro processing methods, equipment operation and maintenance		0	0	4	4	50	50	100	-
	Total		0	0	8	8				

SKILL ENHANCEMENT

Semester:II	L	T	P	C
Course Code: 241AE007	0	0	8	8

Course Schedule

1. After two to three days common orientation on different skill enhancement modules.
2. Each student can take two modules. The selection of the module(s) will be entirely on the student's choice.
3. The credit hours for each module have been kept as 0+4.

Indicative Modules

1. Operation & maintenance of farm machinery.
2. Repair and maintenance of tractors and power tillers.
3. Management of agricultural machinery custom hiring and maintenance facilities.
4. Valorisation of agri-biomass and organic waste.
5. Energy audit, energy conservation and energy efficiency.
6. Installation and maintenance of micro-irrigation systems.
7. Application of remote sensing and GIS for agricultural water management.
8. Installation and maintenance of roof top rainwater harvesting systems.
9. Agro processing methods, equipment operation and maintenance.
10. Food grain godown and warehouse management.
11. Post-harvest value chain management including logistics.
12. Operation and maintenance of drones used for agricultural applications.
13. Machine vision, sensors and sensors architecture.
14. Geophysical survey and investigations for groundwater exploration and installation of tube well/ bore well.
15. Construction, management and maintenance of protected cultivation structures.
16. Agro processing methods, equipment operation and maintenance.

Operation & Maintenance of Farm Machinery

Week 1: Introduction to Farm Machinery
Topics Covered:

Overview of common farm machinery.
Importance of proper operation and maintenance.
Safety measures and precautions.

Week 2: Tractor Basics and Maintenance
Topics Covered:

Types of tractors and their uses.
Engine components and functions.
Routine maintenance: oil changes, filter replacements.

Week 3: Tillage Equipment
Topics Covered:

Types of tillage equipment: plows, harrows, cultivators.
Operational techniques.
Maintenance: blade sharpening, component checks.

Week 4: Planting Equipment
Topics Covered:

Seed drills, planters, and transplanters.
Calibration and adjustment for different crops.
Routine maintenance: seed metering systems, lubrications.

Week 5: Irrigation Systems
Topics Covered:

Types of irrigation systems: drip, sprinkler, pivot.
Installation and operational techniques.
Maintenance: cleaning nozzles, checking pumps and filters.

Week 6: Crop Protection Equipment
Topics Covered:

Sprayers: types and applications.
Calibration of sprayers for pesticide and herbicide application.
Maintenance: nozzle checks, pump maintenance.

Week 7: Harvesting Equipment
Topics Covered:

Types of harvesters: combines, forage harvesters.
Operational settings for different crops.
Routine maintenance: checking belts, knives, and cleaning systems.

Week 8: Post-Harvest Equipment
Topics Covered:

Grain handling and storage systems.
Maintenance of silos, dryers, and elevators.
Ensuring quality and preventing spoilage.

Week 9: Hay and Forage Equipment
Topics Covered:

Mowers, balers, and rakes.
Operational techniques for different forage crops.
Routine maintenance: belt tension, blade sharpening.

Week 10: Precision Farming Technology
Topics Covered:

Introduction to GPS and GIS in farming.
Use of drones and sensors.
Maintenance of electronic equipment.

Week 11: Troubleshooting Common Issues
Topics Covered:

Identifying and diagnosing common problems in machinery.
Basic repair techniques.

Preventive maintenance strategies.

Week 12: Practical Session and Review
Topics Covered:
Hands-on practice with different machinery.
Review of key concepts.
Q&A and final discussion.

Repair and Maintenance of Tractors and Power Tillers

Week 1: Introduction to Tractors and Power Tillers
Topics Covered:
Overview of different types of tractors and power tillers.
Importance of proper maintenance and repair.
Safety precautions and guidelines.

Week 2: Engine Systems
Topics Covered:
Components of diesel and gasoline engines.
Basic engine operation principles.
Common engine issues and troubleshooting.

Week 3: Fuel Systems
Topics Covered:
Types of fuel systems: carbureted, fuel injection.
Maintenance of fuel filters, pumps, and injectors.
Diagnosing and resolving fuel system problems.

Week 4: Lubrication Systems
Topics Covered:
Importance of proper lubrication.
Types of lubricants and their applications.
Maintenance procedures for lubrication systems.

Week 5: Cooling Systems
Topics Covered:
Components of cooling systems: radiators, pumps, thermostats.
Maintenance of cooling systems.
Troubleshooting overheating and other cooling issues.

Week 6: Electrical Systems
Topics Covered:
Basic electrical components: battery, alternator, starter motor.
Diagnosing electrical problems.
Maintenance of wiring and connections.

Week 7: Transmission Systems
Topics Covered:
Types of transmissions: manual, automatic, hydrostatic.
Maintenance of clutch, gears, and drive belts.
Troubleshooting transmission issues.

Week 8: Hydraulic Systems
Topics Covered:
Principles of hydraulic systems.
Maintenance of hydraulic pumps, cylinders, and hoses.
Diagnosing hydraulic system problems.

Week 9: Steering and Brake Systems
Topics Covered:
Types of steering systems: manual, power.
Maintenance of steering components.
Brake system components and maintenance.

Week 10: Tires and Tracks
Topics Covered:
Types of tires and tracks used in tractors and power tillers.
Maintenance of tires: pressure, alignment, tread.
Track maintenance and adjustment.

Week 11: Preventive Maintenance
Topics Covered:
Developing a preventive maintenance schedule.
Regular checks and services.
Record-keeping and documentation.

Week 12: Practical Session and Review
Topics Covered:
Topics Covered:
Hands-on practice with repairing and maintaining tractors and power tillers.
Review of key concepts.
Q&A and final discussion.

Management of Agricultural Machinery Custom Hiring and Maintenance Facilities

Week 1: Introduction to Custom Hiring of Agricultural Machinery
Topics Covered:
Overview of custom hiring services in agriculture.
Benefits and challenges of custom hiring.
Key considerations for setting up a custom hiring center.

Week 2: Types of Agricultural Machinery for Custom Hiring
Topics Covered:

Commonly hired machinery: tractors, tillers, harvesters, sprayers.
Criteria for selecting machinery for custom hiring.
Understanding the demand for different types of machinery.

Week 3: Business Models and Planning
Topics Covered:

Different business models for custom hiring centers.
Financial planning and budgeting.
Developing a business plan.

Week 4: Facility Management
Topics Covered:

Setting up a custom hiring facility: location, infrastructure, layout.
Essential tools and equipment for a maintenance workshop.
Safety measures and facility management best practices.

Week 5: Machinery Procurement and Inventory Management
Topics Covered:

Strategies for procuring machinery: new vs. Used.
Inventory management techniques.
Tracking usage and maintenance schedules.

Week 6: Maintenance Planning and Scheduling
Topics Covered:

Developing a maintenance schedule for hired machinery.
Preventive vs. corrective maintenance.
Record-keeping and documentation.

Week 7: Operations Management
Topics Covered:

Daily operations of a custom hiring center.
Booking and scheduling machinery rentals.
Customer relationship management.

Week 8: Financial Management
Topics Covered:

Pricing strategies for custom hiring services.
Cost control and budgeting.
Financial record-keeping and reporting.

Week 9: Marketing and Outreach
Topics Covered:

Marketing strategies for promoting custom hiring services.

Building partnerships with farmers and agricultural organizations.
Utilizing digital platforms and social media.

Week 10: Legal and Regulatory Aspects
Topics Covered:
Understanding legal requirements and regulations.
Contracts and agreements for machinery rental.
Insurance and liability management.

Week 11: Staff Training and Management
Topics Covered:
Recruiting and training staff for the custom hiring center.
Roles and responsibilities of staff members.
Performance evaluation and management.

Week 12: Practical Session and Review
Topics Covered:
Hands-on practice with managing bookings, maintenance, and customer interactions.
Review of key concepts.
Q&A and final discussion.

Valorization of Agri-Biomass and Organic Waste

Week 1: Introduction to Agri-Biomass and Organic Waste
Topics Covered:
Overview of agri-biomass and organic waste.
Types and sources of biomass and organic waste.
Importance of waste valorization in agriculture.

Week 2: Principles of Biomass Conversion
Topics Covered:
Introduction to biomass conversion processes.
Physical, chemical, and biological conversion methods.
Overview of bioproducts and bioenergy.

Week 3: Composting
Topics Covered:
Principles and benefits of composting.
Composting techniques and methods.
Managing composting processes: temperature, moisture, aeration.
Week 4: Anaerobic Digestion
Topics Covered:
Fundamentals of anaerobic digestion.
Biogas production and utilization.
Designing and managing anaerobic digesters.

Week 5: Biochar Production
Topics Covered:
Introduction to biochar and its benefits.
Methods of biochar production: pyrolysis, gasification.
Applications of biochar in agriculture.

Week 6: Biomass to Biofuels
Topics Covered:
Types of biofuels: bioethanol, biodiesel, biogas.
Conversion technologies for biofuel production.
Sustainability and economic aspects of biofuels.

Week 7: Value-Added Products from Agri-Waste
Topics Covered:
Production of value-added products: organic fertilizers, soil amendments.
Extraction of high-value compounds: antioxidants, bioactive compounds.
Case studies and examples.

Week 8: Environmental and Economic Benefits
Topics Covered:
Environmental impact of biomass valorization.
Economic benefits and challenges.
Life cycle assessment and cost-benefit analysis.

Week 9: Policy and Regulatory Framework
Topics Covered:
National and international policies on biomass valorization.
Regulations and standards for biomass processing and bio-products.
Incentives and funding opportunities.

Week 10: Technology and Innovation
Topics Covered:
Emerging technologies in biomass valorization.
Innovations in waste processing and management.
Role of technology in enhancing efficiency and sustainability.

Week 11: Practical Applications and Case Studies
Topics Covered:
Case studies of successful biomass valorization projects.
Lessons learned and best practices.
Field visit or guest lecture from industry experts.

Week 12: Project Presentation and Review
Topics Covered:
Student presentations on valorization projects.

Review of key concepts.
Q&A and final discussion.

Energy Audit, Energy Conservation, and Energy Efficiency

Week 1: Introduction to Energy Audit
Topics Covered:
Definition and importance of energy audits.
Types of energy audits: preliminary and detailed.
Energy audit process and methodology.

Week 2: Energy Consumption Analysis
Topics Covered:
Understanding energy consumption patterns.
Data collection techniques.
Tools and instruments for energy auditing.

Week 3: Energy Conservation Principles
Topics Covered:
Fundamentals of energy conservation.
Key areas for energy conservation in industrial, commercial, and residential settings.
Energy conservation measures and strategies.

Week 4: Energy Efficiency Concepts
Topics Covered:
Definition and importance of energy efficiency.
Energy efficiency indicators and metrics.
Benefits of improving energy efficiency.

Week 5: Energy Management Systems
Topics Covered:
Components of an energy management system (EnMS).
ISO 50001 standard for energy management.
Implementing an energy management program.

Week 6: Energy Efficient Technologies
Topics Covered:
Overview of energy-efficient technologies in various sectors.
Lighting: LED, CFL, and smart lighting systems.
HVAC systems: energy-efficient heating, ventilation, and air conditioning.

Week 7: Industrial Energy Efficiency
Topics Covered:
Energy efficiency in industrial processes.
Efficient motor systems, boilers, and steam systems.
Waste heat recovery and cogeneration.

Week 8: Building Energy Efficiency
Topics Covered:
Building envelope: insulation, windows, and sealing.
Energy-efficient appliances and equipment.
Building automation and control systems.

Week 9: Renewable Energy Integration
Topics Covered:
Role of renewable energy in energy conservation.
Solar, wind, and biomass energy systems.
Integrating renewable energy into existing systems.

Week 10: Energy Policy and Regulations
Topics Covered:
National and international energy policies.
Energy conservation regulations and standards.
Incentives and programs for energy efficiency and conservation.

Week 11: Case Studies and Best Practices
Topics Covered:
Analysis of successful energy audit and conservation projects.
Lessons learned and best practices.
Guest lecture or field visit to an energy-efficient facility.

Week 12: Practical Session and Review
Topics Covered:
Hands-on practice with energy auditing tools and techniques.
Student presentations on energy audit projects.
Review of key concepts, Q&A, and final discussion.

Installation and Maintenance of Micro-Irrigation Systems

Week 1: Introduction to Micro-Irrigation Systems
Topics Covered:
Overview and importance of micro-irrigation.
Types and benefits of micro-irrigation systems.
Basic components and terminology.

Week 2: Design of Micro-Irrigation Systems
Topics Covered:
Principles of system design.

Week 3: Planning of Micro-Irrigation Systems
Topics Covered:
Calculating water requirements.
Layout planning and system mapping.

Week 4: Components of Micro-Irrigation Systems
Topics Covered:

Detailed study of system components.
Functionality of filters, pumps, pipes, and valves.
Selection criteria for different components.

Week 5: Installation Techniques
Topics Covered:

Step-by-step installation process.
Safety protocols and best practices.
Field setup and initial testing.

Week 6: Filtration and Water Treatment
Topics Covered:

Importance of filtration in micro-irrigation
Types of filters: screen, disk, sand
Maintenance of filtration systems

Week 7: Maintenance Practices
Topics Covered:

Regular maintenance routines.
Troubleshooting common issues.
Systematic record-keeping and scheduling.

Week 8: Water Management and Efficiency
Topics Covered:

Strategies for efficient water use.
Monitoring and controlling water distribution.
Impact of water management on crop yield.

Week 9: Troubleshooting
Topics Covered:

Identifying common system problems.
Troubleshooting techniques.

Week 10: Problem Solving
Topics Covered:

Preventative measures
Finding solutions to the problems

Week 11: Advanced Topics
Topics Covered:

Advanced technologies (automation, IoT integration).

Week 12: Future Trends
Topics Covered:

Future trends in micro-irrigation.
Sustainable agricultural practices.

Application of Remote Sensing and GIS for Agricultural Water Management

Week 1: Introduction to Remote Sensing and GIS
- Overview of remote sensing and GIS technologies
- Importance in agricultural water management
- History and evolution of remote sensing and GIS in agriculture

Week 2: Fundamentals of Remote Sensing
- Principles of remote sensing
- Types of remote sensing (optical, thermal, radar)
- Key remote sensing satellites and sensors

Week 3: Basics of Geographic Information Systems (GIS)
- Introduction to GIS concepts and components
- Spatial data types and formats
- GIS software and tools (e.g., ArcGIS, QGIS)

Week 4: Data Acquisition and Processing
- Sources of remote sensing data
- Data acquisition techniques
- Preprocessing steps (georeferencing, atmospheric correction, etc.)

Week 5: Remote Sensing for Soil Moisture Monitoring
- Techniques for measuring soil moisture using remote sensing
- Key indices (e.g., NDVI, NDWI)
- Case studies and applications

Week 6: Crop Water Requirement Estimation
- Remote sensing methods for estimating crop water requirements
- Evapotranspiration (ET) models
- Application of remote sensing data in ET estimation

Week 7: GIS for Agricultural Water Management
- Mapping and analyzing spatial variability in fields
- GIS-based decision support systems
- Integrating GIS with other data sources for water management

Week 8: Irrigation Scheduling and Management
- Using remote sensing and GIS for precision irrigation
- Creating irrigation schedules based on spatial data
- Case studies on effective irrigation management

Week 9: Drought Monitoring and Assessment
- Remote sensing techniques for drought monitoring
- Drought indices and their applications
- GIS for drought impact assessment and management

Week 10: Flood Monitoring and Management

Remote sensing for flood detection and mapping
Integrating GIS for flood risk assessment
Case studies on flood management in agriculture

Week 11: Climate Change and Water Resources

Impact of climate change on agricultural water resources
Using remote sensing and GIS to study climate change effects
Adaptive strategies for water management under changing climates

Week 12: Advanced Topics and Future Trends

Emerging technologies in remote sensing and GIS
Machine learning and AI applications in agricultural water management
Future trends and research directions in the field.

Installation and Maintenance of Roof Top Rainwater Harvesting Systems

Week 1: Introduction to Rainwater Harvesting
Topics Covered:

Basics and importance of rainwater harvesting.
Historical context and modern applications.
Overview of roof top rainwater harvesting systems.

Week 2: Components of Rainwater Harvesting
Topics Covered:

Key components of a roof top rainwater harvesting system (catchment area, conveyance, filtration, storage).
Types of storage tanks.

Week 3: Design Principles of Rainwater Harvesting System
Topics Covered:

Design principles and considerations.
Placement of Storage Tanks

Week 4: Calculating Water Demand and Supply
Topics Covered:

Estimating water demand for various purposes.
Calculating potential water supply from rainfall data.
Balancing supply and demand.

Week 5: Installation Techniques
Topics Covered:

Step-by-step installation process.
Tools and materials required.
Safety protocols and best practices.

Week 6: Filtration
Topics Covered:
Importance of water quality in rainwater harvesting.
Types of filtration systems and their maintenance.

Week 7: Water Quality Maintenance
Topics Covered:
Water quality testing and treatment options.

Week 8: Maintenance Practices
Topics Covered:
Routine maintenance tasks and schedules.
Troubleshooting common issues.
Long-term system care and upgrades.

Week 9: Legal Considerations of Rainwater Harvesting System
Topics Covered:
Local regulations and codes for rainwater harvesting.

Week 10: Environmental Considerations of Rainwater Harvesting System
Topics Covered:
Environmental impacts and benefits.
Sustainable practices and certifications.

Week 11: Advanced Topics
Topics Covered:
Innovations in rainwater harvesting technology.
Integrating rainwater harvesting with other sustainable practices.

Week 12: Future Trends
Topics Covered:
Future trends and research directions.

Agro Processing Methods, Equipment Operation And Maintenance

Week 1: Introduction to Agro Processing
Topics Covered:
Overview of agro processing and its importance
Role of agro processing in food preservation and value addition
Discussion on various agro processing methods

Week 2: Basics of Equipment Operation
Topics Covered:
Introduction to different types of processing equipment
Safety measures in equipment operation
Hands-on demonstration of equipment operation

Week 3: Cleaning and Sorting Techniques

Topics Covered:

Importance of cleaning and sorting in agro processing
Different cleaning and sorting techniques
Equipment used for cleaning and sorting

Week 4: Drying Methods and Equipment
Topics Covered:

Importance of drying in agro processing
Various drying methods (sun drying, mechanical drying, etc.)
Equipment used for drying and their operation

Week 5: Milling and Grinding Processes
Topics Covered:

Introduction to milling and grinding
Types of mills and grinders used in agro processing
Demonstration of milling and grinding equipment

Week 6: Crushing and Pressing Techniques
Topics Covered:

Overview of crushing and pressing in agro processing
Types of crushers and presses
Operation and maintenance of crushing and pressing equipment

Week 7: Extraction Processes
Topics Covered:

Different extraction methods (solvent extraction, cold pressing, etc.)
Equipment used for extraction
Hands-on demonstration of extraction equipment (if feasible)

Week 8: Fermentation and Preservation
Topics Covered:

Role of fermentation in agro processing
Preservation techniques (canning, freezing, etc.)
Equipment for fermentation and preservation

Week 9: Packaging and Storage
Topics Covered:

Importance of proper packaging and storage
Types of packaging materials
Equipment used for packaging and storage

Week 10: Quality Control in Agro Processing

Importance of quality control in agro processing
Methods for quality assessment
Equipment used for quality control

Week 11: Maintenance of Processing Equipment
Topics Covered:
- Importance of equipment maintenance
- Regular maintenance procedures
- Troubleshooting common issues

Week 12: Future Trends in Agro Processing
Topics Covered:
- Emerging technologies in agro processing
- Sustainable practices in agro processing
- Discussion on future challenges and opportunities

Food Grain Godown and Warehouse Management

Week 1: Introduction to Food Grain Warehousing
Topics Covered:
- Importance of food grain storage
- Overview of the food grain supply chain
- Types of food grain godowns and warehouses

Week 2: Principles of Food Grain Storage
Topics Covered:
- Factors influencing food grain storage
- Techniques for maintaining food grain quality
- Methods to minimize losses during storage

Week 3: Warehouse Layout and Design
Topics Covered:
- Principles of warehouse layout design
- Optimization of storage space
- Considerations for efficient material handling

Week 4: Inventory Management
Topics Covered:
- Importance of inventory management in food grain warehouses
- Inventory control techniques
- Best practices for managing inventory accuracy

Week 5: Handling Equipment and Machinery
Topics Covered:
- Types of handling equipment used in food grain warehouses
- Safety considerations in equipment operation
- Maintenance of handling machinery

Week 6: Quality Assurance and Control
Topics Covered:

Importance of quality assurance in food grain storage
Quality control measures and standards
Monitoring and evaluation of grain quality

Week 7: Pest Management
Topics Covered:
Common pests affecting food grains
Integrated pest management techniques
Prevention and control measures

Week 8: Environmental Factors and Safety Regulations
Topics Covered:
Impact of environmental factors on food grain storage
Compliance with safety regulations and standards
Measures to mitigate environmental risks

Week 9: Technology in Warehouse Management
Topics Covered:
Role of technology in modern warehouse management
Automated systems for inventory tracking and management
Integration of technology for efficiency improvement

Week 10: Risk Management and Insurance
Topics Covered:
Understanding risks associated with food grain storage
Importance of insurance coverage for warehouses
Strategies for risk mitigation and loss prevention

Week 11: Case Studies and Best Practices
Topics Covered:
Analysis of successful food grain warehouse management practices
Case studies highlighting challenges and solutions
Learning from industry best practices

Week 12: Future Trends and Innovations
Topics Covered:
Emerging trends in food grain warehousing
Anticipated challenges and opportunities
Strategies for adapting to future changes and advancements

Post-Harvest Value Chain Management Including Logistics

Week 1: Introduction to Post-Harvest Value Chain Management
Topics Covered:
Overview of post-harvest processes

Importance of post-harvest management in enhancing food security
Key components of the post-harvest value chain

Week 2: Post-Harvest Losses and Their Causes
Topics Covered:
Understanding post-harvest losses
Identification of causes of post-harvest losses
Quantification and assessment methods for losses

Week 3: Post-Harvest Technologies and Innovations
Topics Covered:
Overview of post-harvest technologies
Innovations in harvesting, handling, and storage
Role of technology in reducing post-harvest losses

Week 4: Quality Management in Post-Harvest Handling
Topics Covered:
Importance of maintaining quality in post-harvest handling
Factors affecting post-harvest quality
Techniques for quality assessment and assurance

Week 5: Packaging and Storage Techniques
Topics Covered:
Importance of proper packaging in post-harvest management
Types of packaging materials and methods
Storage techniques to preserve quality and reduce losses

Week 6: Post-Harvest Handling Practices for Specific Crops
Topics Covered:
Crop-specific post-harvest handling practices
Challenges and best practices for handling different types of crops
Case studies on successful crop-specific handling techniques

Week 7: Transportation and Logistics in the Post-Harvest Value Chain
Topics Covered:
Importance of transportation and logistics in the post-harvest value chain
Challenges and considerations in post-harvest transportation
Strategies for efficient and cost-effective logistics management

Week 8: Cold Chain Management
Topics Covered:
Overview of the cold chain and its importance in post-harvest management
Components of the cold chain
Best practices and technologies for cold chain management

Week 9: Market Access and Distribution

Topics Covered:

Importance of market access in post-harvest management
Distribution channels and market linkages
Strategies for enhancing market access for smallholder farmers

Week 10: Value Addition and Processing
Topics Covered:

Role of value addition in post-harvest management
Techniques for value addition and processing
Value-added products and their market potential

Week 11: Sustainability and Environmental Considerations
Topics Covered:

Environmental impacts of post-harvest activities
Sustainable practices in post-harvest management
Strategies for reducing environmental footprint

Week 12: Future Trends and Challenges
Topics Covered:

Emerging trends in post-harvest value chain management
Anticipated challenges and opportunities
Strategies for advancing post-harvest management practices

Operation and Maintenance of Drones used for Agricultural Applications

Week 1: Introduction to Drones in Agriculture
Topics Covered:

Overview of drone technology and its evolution in agriculture.
Types of drones used in agriculture (fixed-wing, rotary-wing, hybrids).
Applications of drones in crop monitoring, spraying, and mapping.

Week 2: Drone Regulations and Safety
Topics Covered:

Understanding drone regulations (global and local laws).
Licensing and certification requirements for agricultural drone operators.
Safety protocols and risk management in drone operations.

Week 3: Drone Components and System Architecture
Topics Covered:

Detailed overview of drone components (frames, motors, propellers, etc.).
Sensors and cameras used in agricultural drones.
Power systems and batteries: types, maintenance, and best practices.

Week 4: Basic Drone Operation and Flight Mechanics
Topics Covered:
Principles of flight and drone control.
Hands-on training: Basic flight maneuvers.
Introduction to flight planning and GPS-based navigation.

Week 5: Advanced Drone Operation Techniques
Topics Covered:
Autonomous flight modes and programming.
Waypoint navigation and mission planning.
Hands-on training: Advanced flight techniques and troubleshooting.

Week 6: Payloads and Data Collection
Topics Covered:
Understanding different types of payloads (cameras, sprayers, sensors).
Data collection methods for agricultural applications (NDVI, multispectral imaging).
Hands-on training: Installing and using payloads.

Week 7: Image Processing and Data Analysis
Topics Covered:
Introduction to image processing software for agricultural drones.
Techniques for analyzing drone-captured data.
Hands-on training: Basic image processing and analysis.

Week 8: Maintenance of Drones
Topics Covered:
Routine maintenance: Pre-flight and post-flight checks.
Troubleshooting common issues (motor failures, GPS errors).
Hands-on training: Performing basic repairs and maintenance.

Week 9: Battery Management and Power Systems
Topics Covered:
Understanding battery types and specifications for drones.
Best practices for battery charging, storage, and disposal.
Hands-on training: Battery maintenance and replacement.

Week 10: Calibration and Sensor Maintenance
Topics Covered:
Importance of calibration for accurate data collection.
Steps for calibrating sensors and cameras.
Hands-on training: Sensor maintenance and calibration.

Week 11: Drone Software and Firmware Updates
Topics Covered:
Overview of drone control software and firmware.
Importance of keeping software and firmware up to date.
Hands-on training: Performing software and firmware updates.

Week 12: Final Project and Review
Topics Covered:
Review of key concepts and skills learned.
Student presentations of their final projects.
Course wrap-up and discussion on future trends in drone technology for agriculture.

Machine Vision, Sensors, and Sensors Architecture

Week 1: Introduction to Machine Vision and Sensor Systems
Topics Covered:
Overview of machine vision systems
Importance and applications of sensors in machine vision
Introduction to sensor architecture
Week 2: Image Acquisition and Sensor Types
Topics Covered:
Principles of image formation
Types of image sensors: CCD vs. CMOS
Introduction to non-optical sensors: LIDAR, RADAR, Ultrasonic
Week 3: Sensor Characteristics and Performance
Topics Covered:
Key sensor characteristics: resolution, sensitivity, dynamic range, SNR
Calibration and error analysis in sensors
Noise and its impact on sensor performance
Week 4: Image Processing Fundamentals
Topics Covered:
Introduction to image processing techniques: filtering, edge detection, thresholding
Image preprocessing for machine vision
Role of sensors in enhancing image quality
Week 5: 3D Vision and Depth Sensing
Topics Covered:
Basics of stereo vision and depth estimation
Structured light and time-of-flight (ToF) sensors
Applications of 3D sensing in machine vision
Week 6: Sensor Fusion and Multi-Sensor Systems
Topics Covered:
Concepts of sensor fusion
Combining data from multiple sensors for improved accuracy
Algorithms for sensor fusion: Kalman Filter, Bayesian Networks

Week 7: Embedded Systems and Real-Time Processing
Topics Covered:
Architecture of embedded systems in machine vision
Real-time processing constraints
Hardware acceleration techniques (FPGA, GPUs)
Week 8: Machine Learning in Machine Vision
Topics Covered:
Role of machine learning in sensor-based vision systems
Introduction to convolutional neural networks (CNNs)
Training models with sensor data
Week 9: Advanced Vision Sensors
Topics Covered:
Hyperspectral and multispectral imaging sensors
Thermal imaging and its applications
Emerging sensor technologies: quantum sensors, neuromorphic sensors
Week 10: Sensor Network Architecture
Topics Covered:
Architecture of distributed sensor networks
Communication protocols for sensor networks
Power management and optimization in sensor networks
Week 11: Case Studies and Applications
Topics Covered:
Case studies on machine vision in industrial automation, robotics, automotive (e.g., autonomous vehicles)
Discussion on challenges and future trends in sensor technology and machine vision
Week 12: Project Presentations and Course Review
Topics Covered:
Review of key concepts learned throughout the course
Discussion on potential future developments in the field

Geophysical Survey and Investigations for Groundwater Exploration and Installation of Tube Well/Bore Well

Week 1: Introduction to Groundwater Systems
Topics Covered:
Overview of groundwater systems and their importance.
Key features and characteristics of groundwater systems.
Introduction to groundwater exploration techniques.

Week 2: Geophysical Survey Methods
Topics Covered:
Study of different types of geophysical surveys for groundwater exploration.
Overview of resistivity meter components.
Introduction to Wenner-Schlumberger arrangement.
Comparison of various geophysical survey techniques.

Week 3: Geophysical Survey Process
Topics Covered:

Conducting geophysical surveys in the field.
Data collection techniques during geophysical surveys.
Analysis and interpretation of surveyed data.

Week 4: Well Logging Techniques
Topics Covered:

Introduction to well logging and its importance in groundwater exploration.
Different types of well logs and their applications.
Preparation and analysis of commonly used well logs.

Week 5: Types of Wells
Topics Covered:

Study of different types of wells, including tube wells and bore wells.
Understanding the components and structure of tube wells/bore wells.

Week 6: Drilling Methods and Equipment
Topics Covered:

Overview of different drilling methods used for well installation.
Study of various drilling equipment and their applications.
Selection criteria for drilling methods based on geological conditions.

Week 7: Installation of Well Assembly
Topics Covered:

Process of installing well assemblies, including casing and screens.
Types of casing and screen materials used in tube wells/bore wells.
Introduction to gravel packing and its significance in well installation.

Week 8: Well Development Process
Topics Covered:

Study of the well development process to enhance well efficiency.
Techniques used in well development.
Importance of well development in ensuring long-term groundwater supply.

Week 9: Sanitary Protection of Wells
Topics Covered:

Understanding the need for sanitary protection of tube wells/bore wells.
Methods and best practices for ensuring sanitary protection.
Legal and environmental considerations in well installation.

Week 10: Case Studies and Field Applications
Topics Covered:

Analysis of successful groundwater exploration and well installation projects.
Lessons learned from real-world case studies.
Guest lectures or field visits to observe geophysical surveys and well installations.

Week 11: Practical Session on Geophysical Surveys
Topics Covered:

Hands-on practice with resistivity meters and other geophysical survey tools.
Conducting a geophysical survey in the field.
Data analysis and interpretation exercises.

Week 12: Practical Session on Well Installation
Topics Covered:

Hands-on practice with well installation techniques.
Student presentations on groundwater exploration and well installation projects.
Review of key concepts, Q&A, and final discussion.

Construction, Management and Maintenance of Protected Cultivation Structures

Week 1: Introduction to Protected Cultivation
Topics Covered:

Enlist advantages of protected cultivation.
Enlist factors affecting protected cultivation.
Enlist and identify different crops suitable for protected cultivation.

Week 2: Types of Protected Structure and its Components
Topics Covered:

Differentiate greenhouse shade house and low tunnels.
Demonstration of utility of mist house.
Identify the cladding material used for greenhouse erection.

Week 3: Types of Protected Structure and its Components
Topics Covered:

Enlist factors affecting selection of greenhouse design.
Draw a typical greenhouse and label the parts.
Collect figures of different components of greenhouse.

Week 4: Preparation of Media and Container for Commercial Cultivation in Greenhouse
Topics Covered:

Identification of various types of media.
Differentiate soil and soil less cultivation in green house.
Differentiation of chemical and physical methods of soil sterilization.

Week 5: Preparation of Media and Container for Commercial Cultivation in Greenhouse
Topics Covered:

Demonstration of raised beds preparation.
Demonstration of filling of pots/ containers.
Identification of containers.
Enlist different constituents of growing media.

Week 6: Crop Management in Protected Cultivation

Topics Covered:

Demonstration of measuring pH, TDS and EC in water for irrigation.
Identification of components of drip irrigation.

Week 7: Irrigation and Fertigation Systems
Topics Covered:

Enlist merits and demerits of micro-irrigation.
Identification of important water-soluble fertilizers used in protected cultivation.

Week 8: Irrigation and Fertigation Systems
Topics Covered:

Enlist advantages of foliar application.
Demonstration of fertigation procedure.
Identification of equipment used in fertigation.

Week 9: Greenhouse Operations
Topics Covered:

Enlist different greenhouse operations.
Enlist equipment used.
Demonstration of the regulation of temperature.
Enlist optimum temperature for important flower and vegetable crops.
Demonstration of the regulation process of light.

Week 10: Greenhouse Operations

Demonstration of how to regulate the humidity.
Enlist effect of high and low humidity.
Demonstration of the use of CO2 enrichment Procedure.
Demonstration of the use of ventilation in green house.

Week 11: Maintenance of Protected Cultivation Structures
Topics Covered:

Routine Maintenance:

- Cleaning and upkeep of structures
- Maintenance of environmental control systems

Pest and Disease Management:

- Common pests and diseases in protected cultivation
- Integrated Pest Management (IPM) strategies

Structural Repairs:

- Identifying wear and tear
- Repairing damages to the structure

Week 12: Economic Aspects of Protected Cultivation
Topics Covered:

Cost Analysis:

- Initial investment and operational costs
- ROI (Return on Investment)

Marketing and Sales:

- Market demand and pricing strategies
- Supply chain and distribution

Financial Planning:

- Budgeting and financial management
- Subsidies and government schemes

Agro Processing Methods, Equipment Operation and Maintenance

Week 1: Introduction to Agro Processing
Topics Covered:

Overview of agro processing and its importance
Role of agro processing in food preservation and value addition
Discussion on various agro processing methods

Week 2: Basics of Equipment Operation
Topics Covered:

Introduction to different types of processing equipment
Safety measures in equipment operation
Hands-on demonstration of equipment operation

Week 3: Cleaning and Sorting Techniques
Topics Covered:

Importance of cleaning and sorting in agro processing
Different cleaning and sorting techniques
Equipment used for cleaning and sorting

Week 4: Drying Methods and Equipment
Topics Covered:

Importance of drying in agro processing
Various drying methods (sun drying, mechanical drying, etc.)
Equipment used for drying and their operation

Week 5: Milling and Grinding Processes
Topics Covered:

Introduction to milling and grinding
Types of mills and grinders used in agro processing
Demonstration of milling and grinding equipment

Week 6: Crushing and Pressing Techniques
Topics Covered:

Overview of crushing and pressing in agro processing
Types of crushers and presses
Operation and maintenance of crushing and pressing equipment

Week 7: Extraction Processes
Topics Covered:
- Different extraction methods (solvent extraction, cold pressing, etc.)
- Equipment used for extraction
- Hands-on demonstration of extraction equipment (if feasible)

Week 8: Fermentation and Preservation
Topics Covered:
- Role of fermentation in agro processing
- Preservation techniques (canning, freezing, etc.)
- Equipment for fermentation and preservation

Week 9: Packaging and Storage
Topics Covered:
- Importance of proper packaging and storage
- Types of packaging materials
- Equipment used for packaging and storage

Week 10: Quality Control in Agro Processing
- Importance of quality control in agro processing
- Methods for quality assessment
- Equipment used for quality control

Week 11: Maintenance of Processing Equipment
Topics Covered:
- Importance of equipment maintenance
- Regular maintenance procedures
- Troubleshooting common issues

Week 12: Future Trends in Agro Processing
Topics Covered:
- Emerging technologies in agro processing
- Sustainable practices in agro processing
- Discussion on future challenges and opportunities