TAKSHASHILA UNIVERSITY

(Tamil Nadu State Private University)
ONGUR, TINDIVANAM TK, VILLUPURAM DT

FACULTY OF SCIENCES
SCHOOL OF AGRICULTURAL SCIENCES

Department of Agriculture

REGULATION 2024

CURRICULUM & SYLLABI

B.Sc. (Hons.) Agriculture

Semester – V

VISION AND MISSION OF UNIVERSITY

VISION:

To create change makers and world leaders similar to the ancient Takshashila University

MISSION:

The brightest minds and the best resources are used to nurture and develop the leaders of tomorrow, where they are encouraged to be eternally curious and ethically sound.

DEPARTMENT VISION AND MISSION

VISION:

Focusing on Agricultural research, teaching, and extension to use cutting-edge, sustainable technologies to satisfy human needs.

To become a globally recognized university dedicated to educating the next generation in both rural and urban areas about science-based agriculture.

MISSION:

M1:	Empower future generations through quality educational opportunities in agriculture with forefront farming technology to meet the needs of various stakeholders, including farmers, employers, industries, and society.
M2:	Enhance agricultural higher education to meet worldwide standards for advanced teaching, research, and extension.
M3:	Promote innovative technologies such as artificial intelligence, high-tech agriculture, digital agriculture, and sustainable farming to assure production and productivity.
M4:	Successfully transfer technologies from lab to farm land to assure food and water security, enhance farmers' revenues, and raise the standard of living.
M5:	Stimulating professional behavior and good ethical values to improve the leadership skills and social responsibilities.

PROGRAMME OUTCOMES (POs)

PO 1: Domain Knowledge: Apply fundamental knowledge from several agricultural disciplines to the fields of animal husbandry, agricultural extension, crop improvement, production, and protection, as well as agri-informatics.

PO 2: Problem analysis: To improve agricultural output, identify gaps by examining regular difficulties and challenges in farming.

PO 3: Formulate solution: Design and develop solutions to complicated and specialized agricultura l challenges, with an emphasis on cultural, socioeconomic, and environmental considerations.

PO 4: Conduct surveys and investigations: Evaluate and evaluate the available agricultural inform ation in order to provide sustainable solutions by using research-based knowledge and methods.

PO 5: Use of Contemporary Concepts and Tools: Create, select, and implement suitable methods, materials, and present-day tools to forecast agricultural outcome.

PO 6: Social Role: Determine logic and background information to evaluate and advance environmental safety, livelihood security, and nutrition.

PO 7: Environment and Sustainability: Recognize the effects of regional and global environmental problems and take appropriate action to produce agricultural products in a sustainable manner.

PO 8: Ethics: Put ethical concepts into practice and follow obligations and standards in the field.

PO 9: Teamwork: Contribute well as a leader or an individual in a variety of multidisciplinary, cross-cultural teams.

PO 10: Efficient communication: Understand and compose succinct scientific reports, deliver persuasive speeches, and interact with stakeholders in an efficient manner.

PO 11: Finance and project management: Able to exhibit scientific understanding in their roles as financial managers and entrepreneurs.

PO 12: Life-long learning: Make an initiative to pursue self-sustaining, continuous learning in order to stay updated with emerging technology and maintain your professional proficiency in agriculture.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Industry Leadership

Demonstrate advanced managerial competency and domain expertise to lead teams, drive strategy, and deliver measurable results in dynamic business environments.

PEO2: Research and Development

Identify market opportunities, apply data-driven decision-making, and develop scalable solutions as entrepreneurs or intrapreneurs within established organizations

PEO3: Professional Ethics

Uphold rigorous ethical standards and corporate governance principles while making decisions that balance profitability with social and environmental responsibility

PEO4: Global Citizenship

Operate effectively in multicultural, international business contexts by leveraging global perspectives, cross-cultural intelligence, and awareness of global economic trends.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Domain Knowledge

Demonstrate an in-depth understanding of financial management, banking, investment, financial markets, financial technologies, and digital financial services to analyze complex financial problems and develop innovative solutions in dynamic business environments.

PSO2: Digital Finance and Technology Integration

Apply financial technologies, artificial intelligence, blockchain, data analytics, enterprise resource planning (ERP), digital payment systems, cloud computing, and emerging FinTech solutions to optimize financial operations, support data-driven decision-making, enhance customer experience, and manage financial risks.

PSO3: Professional Competency

Exhibit a high level of professional competence through financial analysis, strategic thinking, ethical decision-making, regulatory compliance, leadership, communication, teamwork, and lifelong learning, enabling successful careers in banking, financial services, FinTech organizations, consulting, entrepreneurship, and global financial ecosystems.

CURRICULUM

School : School of Agricultural Science **Batch** : 2024-2028

Program: B.Sc. (Hons.) Agriculture **Regulation** : R24

SEMESTER V

Sl. No.	Course code	Course title	Category	Credit hours	Maximum marks		
					CAM	ESM	Total
Program Core							
1.	U24AGT501	Intellectual Property Rights	PC	1 (1+0)	50	50	100
2.	U24AGB502	Protected Cultivation and Secondary Agriculture	PC	2 (1+1)	50	50	100
3.	U24AGB503	Pest of Crops and Stored Grain and their Management	PC	3 (2+1)	50	50	100
4.	U24AGP504	Practical Crop Production – I (*Kharif crops*)	PC	2 (0+2)	100	-	100
5.	U24AGB505	Crop Improvement – I (*Kharif crops*)	PC	2 (1+1)	50	50	100
6.	U24AGB506	Manures, Fertilizers and Soil Fertility Management	PC	3 (2+1)	50	50	100
7.	U24AGB507	Diseases of Field and Horticultural Crops and their Management – I	PC	3 (2+1)	50	50	100
8.	U24AGB508	Rainfed Agriculture & Watershed Management	PC	2 (1+1)	50	50	100
9.	U24AGB509	Production Technology for Ornamental Crops, MAP and Landscaping	PC	2 (1+1)	50	50	100
Generic Elective							
10.		Generic Elective - III	GE	1 (0+1)	100	-	100
Discipline Elective							
11.	U24AGB511	System Simulation and Agro-advisory	DSE	3 (2+1)	50	50	100
	U24AGB512	Agribusiness Management					
	U24AGB513	Biopesticides & Biofertilizers					
	U24AGB514	Micro Propagation Technologies					
University Mandatory Course							
12.	U24UMP591	Takshashila Innovative Learning - V	TIL	1 (0+1)	100	-	100
13.	U24UMP593	Green Credit – V	GC	1 (0+1)	100	-	100
Total				**26 (13+13)**	**850**	**450**	**1300**

*PC – Program Core
*SEC – Skill Enhancement Course
*DSE – Discipline Elective
*GE – Generic Elective
*TIL – Takshashila Innovative Learning
*GC – Green Credit

(BOS Chairman)

U24AGT501	Intellectual Property Rights	(1+0)

COURSE OBJECTIVES:

- To understand the basic concept of Intellectual Property and how global bodies like WTO, TRIPS, and international treaties protect it.
- To learn about the various categories of IP (Patents, Copyrights, Trademarks, GIs) and the specific laws governing them in India.
- To understand the Indian Patents Act 1970, the criteria for patentability, and the step-by-step process of filing and defending a patent.
- To study the legal systems (UPOV & PPV&FR Act) that protect new plant varieties and safeguard the rights of farmers and traditional knowledge holders.
- To acquire knowledge about the Biological Diversity Act and international treaties that regulate access to genetic resources and ensure fair benefit sharing.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	To understand different types of IP and explain how international frameworks regulate global property rights.
CO2 :	To understand various creative and industrial works and their correct legal protection under Indian law.
CO3 :	To evaluate if an invention can be patented and outline the process for drafting, filing, and searching patents.
CO4 :	To apply and register plant varieties and protect the legal rights of breeders, researchers, farmers, and traditional communities.
CO5 :	To apply biodiversity compliance rules to configure research collaborations and handle benefit-sharing agreements legally.

UNIT I : Introduction to Intellectual Property Rights	**3 Hrs.**
Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPS and WIPO, Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.	

UNIT II : Types of Intellectual Property and IPR Legislation in India	**3 Hrs.**
Types of IP and legislation covering IPR in India: Patents, copyrights, trademarks, industrial design, geographical indication, integrated circuits and trade secrets.	

UNIT III : Patent Law, Patent Systems, and Patent Protection	**3 Hrs.**
Patents Act 1970, Patent systems in India, patentability, process and product patent, filing of patent, patent specifications, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, patent search and patent database.	

UNIT IV : Protection of Plant Varieties, Plant Breeders' Rights, and Traditional Knowledge	**4 Hrs.**
Origin, history, including a brief introduction to UPOV for protection of plant varieties, protection	

of plant varieties under UPOV and PPV & FR Act of India, Plant Breeders' Rights, registration of plant varieties under PPV & FR Act 2001, breeders, researchers and farmers' rights - Traditional knowledge - meaning and rights of TK holders.

UNIT V : Biodiversity, Genetic Resources, and Access & Benefit Sharing	**3 Hrs.**
Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002, and its salient features, and access and benefit-sharing.	

Lecture Schedule

1. Meaning, concepts and historical developments of Intellectual Property Rights.
2. Introduction to GATT, WTO, TRIPS and WIPO - role and importance.
3. Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.
4. Types of IP and legislation covering IPR in India.
5. Patents, copyrights, trademarks, industrial design.
6. Geographical indication and its importance, integrated circuits, trade secrets.
7. Patents Act, 1970, Patent systems in India, patentability, process and product patent, filing of patent.
8. Patent specifications, patent claims, patent opposition and revocation, infringement.
   Mid-Semester Examination.
9. Compulsory licensing, Patent Cooperation Treaty, patent search and patent database.
10. Origin, history, including a brief introduction to UPOV.
11. Protection of plant varieties under UPOV and PPV & FR Act of India.
12. Plant Breeders' rights, registration of plant varieties under PPV & FR Act 2001, breeders, researchers and farmers' rights.
13. Traditional knowledge - meaning and rights of TK holders and IPR.
14. Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).
15. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.
16. Research collaborations in agriculture and the role of IPR in protecting public institute inventions.

Total Hours: 16

TEXT BOOKS:	
1.	Ahuja, V. K. (2017). Law relating to intellectual property rights (3rd ed.). LexisNexis.
2.	Wadehra, B. L. (2016). Law relating to patents, trademarks, copyright, designs and geographical indications (5th ed.). Universal Law Publishing.
3.	Goel, D., & Prashar, S. (2015). IPR, biosafety and bioethics. Pearson Education India.
4.	Encyclopedia of Intellectual Property Rights. Anmol Publications Pvt. Ltd.
5.	Antons, C. (Ed.). (2011). Traditional knowledge, traditional cultural expressions and intellectual property law in the Asia-Pacific region. Kluwer Law International.

REFERENCE BOOKS :	
1.	Vinod V. Sople, 2014, Managing intellectual Property: The Strategic imperative. PHI Learning Private Limited, N. Delhi
2.	Keith, E. Maskus, 2000, Intellectual Property Rights in the Global Economy, Institute for

	International Economics.
3.	Ganguli, P. 2001.Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
4.	Sridevan Prabha. 2015. Intellectual Property in the Ancient Indian Texts. In: Diversity in Intellectual Property.pp.232-246. Publ: Cambridge University Press.
5.	Indian Acts- Patents Act 1970 and amendments; Design Act, 2000; Trademarks Act 1999; Copyrights Act,1957; Layout design Act 2000; PPV and FR Act,2001, and rules 2003; National Bio Diversity Act

WEB REFERENCES:	
1	https://www.wipo.int/edocs/pubdocs/en/wipo_pub_946.pdf
2	https://pmc.ncbi.nlm.nih.gov/articles/PMC3217699/
3	https://ageconsearch.umn.edu/record/308549/files/Registration_of_Plant_Varieties_by_Farmers.pdf
4	https://www.mdpi.com/2079-9276/6/1/11
5	https://iiss.res.in/downloads/Rti/2018/Section%204(1)(b)(v)-6.pdf

U24AGB502	Protected Cultivation and Secondary Agriculture	(1+1)

COURSE OBJECTIVES:

• To understand the concepts, importance, scope, advantages, and limitations of protected cultivation and greenhouse technology.
• To gain knowledge on the planning, design, construction, and environmental control of greenhouses.
• To learn greenhouse applications, irrigation systems, economic feasibility, and engineering properties of agricultural materials.
• To acquire knowledge of engineering properties of food materials and principles of drying and dehydration used in post-harvest technology.
• To know xthe design, operation, and selection of dryers and material handling equipment used in agricultural processing.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the concept, need, advantages, limitations, and present status of protected cultivation and describe different types of greenhouses and plant responses to greenhouse environments.
CO2 :	Illustrate the principles of greenhouse planning, design criteria, environmental control systems, greenhouse equipment, and construction materials.
CO3 :	Describe greenhouse irrigation systems, heating and drying technologies, cost economics, and evaluate the physical and aerodynamic properties of agricultural produce relevant to post-harvest engineering.
CO4 :	Apply the principles of thermal properties, moisture determination, drying characteristics, equilibrium moisture concepts, and different drying methods in post-harvest processing.
CO5 :	Select appropriate commercial drying systems and material handling equipment based on engineering principles for efficient agricultural produce processing, storage, and transportation.
CO6 :	Demonstrate practical skills in operating, evaluating, and maintaining greenhouse, drying, and material handling equipment through laboratory experiments and field visits.

UNIT I : Introduction to Protected Cultivation and Green houses	**4 Hrs.**
Protected cultivation – need, advantages and limitations – present status. Green house technology – Introduction – Types of greenhouses- Plant response to greenhouse environment.	

UNIT II : Design of Greenhouses	**3 Hrs.**
Planning and design of greenhouses - Design criteria of green house for cooling and heating purposes - Green house equipment - Materials for construction of greenhouses.	

UNIT III : Applications of Greenhouses and Engineering Properties of Food Material	**3 Hrs.**
Irrigation systems used in greenhouses-Typical applications - Passive solar greenhouse - Hot air greenhouse heating systems - Greenhouse drying - Cost estimation and economic analysis. Physical	

properties- size-shape, Aero-hydro dynamic properties.

UNIT IV : Engineering Properties Drying and Dehydration of Food Materials	3 Hrs.

Thermal properties- specific heat- thermal conductivity- thermal diffusivity, and their application in PHT equipment design and operation-Drying and dehydration, Moisture determination-direct method and indirect method of moisture determination, drying rate curves- constant rate period, CMC- Falling rate period, EMC, Drying methods- contact type dryers- convective type dryer- radiation dryer.

UNIT V - Drying and Dehydration and Material Handling	3Hrs.

Commercial grain dryer -deep bed dryer-flat bed dryer- tray dryer-fluidized bed dryer. - Recirculatory dryer- solar dryer-Introduction- selection of material handling machines, Belt conveyor-belt conveyor idlers- idler spacing- belt material- belt tension, Bucket conveyor- head Section-Boot section-elevator legs- elevator belts- bucket drive mechanism. Screw conveyor- Details -various shapes screw trough- capacity – horse power, pneumatic conveyor – advantages and limitations.

Lecture Schedule

1. Introduction to protected cultivation – need, advantages and limitations and present status – protected cultivation for horticultural crops.
2. Green house technology – Definition, History and evolution – Advantages and limitations
3. Types of greenhouses – based on shape, cost, utility and cladding materials.
4. Plant response to greenhouse environment – Sunlight, Temperature, Relative Humidity, Carbon dioxide enrichment – Soil / media.
5. Planning and design of greenhouses – Criteria for site selection – orientation – structural design - Design criteria of greenhouse for cooling and heating purposes.
6. Equipment and components of a Greenhouse – Summer cooling and winter cooling, natural ventilation and forced ventilation.
7. Materials for construction of greenhouses – Wood, iron, glass, polyethylene film.
8. Irrigation systems in greenhouses - Rules of watering, hand watering, perimeter watering, overhead sprinklers, boom watering and drip irrigation.

Mid Semester Examination

9. Typical applications of greenhouses – passive solar greenhouse, hot air greenhouse heating system and green house drying- Cost estimation and economic analysis.
10. Physical properties – size- shape- sphericity- density- specific gravity, Aero-hydrodynamic properties – Terminal velocity- drag coefficient.
11. Thermal properties- specific heat- thermal conductivity- thermal diffusivity, Application of Engineering properties of cereals, pulses and oilseeds in PHT equipment design and operation.

12. Moisture measurement, direct method and indirect method of moisture measurements, Drying and dehydration, Drying theory, drying rate curves- constant rate period, CMC- Falling rate period , EMC.
13. Various drying method, contact type dryers- convective type dryer- radiation dryer.
14. Commercial grain dryer- deep bed dryer-flat bed dryer- tray dryer-fluidized bed dryer, recirculatory dryer- solar dryer.
15. Material handling equipment-introduction, screw conveyor working principle, and selection.
16. Bucket elevator- head section-Boot section-elevator legs- elevator belts- bucket drive. mechanism-Screw conveyor and pneumatic conveyor working principle and selection.

Practical Schedule

1. Study of different types of greenhouses based on shape, etc.
2. Measurement of weather data in greenhouses.
3. Computing the rate of air exchange in an active summer and winter cooling systems.
4. Experiment on determination of shape and size of the cereal grains.
5. Experiment on determination of bulk density and porosity of biomaterials.
6. Determination of Moisture content of various grains by direct method.
7. Determination of Moisture content of various grains by indirect method.
8. Experiment on determination of terminal velocity of different grains.
9. Performance evaluation of available screen cleaner.
10. Performance evaluation of fluidized bed dryer.
11. Performance evaluation of tray dryer.
12. Determination of Capacity of a belt conveyor and its performance evaluation.
13. Determination of Capacity of a bucket conveyor and its performance evaluation.
14. Field visit to greenhouse.
15. Visit to Horticulture Research Station, Udhagamandalam.
16. Visit to Modern rice mill.

Final Practical Examination.

Total Hours: 48

TEXT BOOKS :	
1.	Singh, B., 2014. *Protected Cultivation of Horticultural Crops.* Kalyani Publishers, Ludhiana.
2.	Tiwari, G.N., 2003. *Greenhouse Technology for Controlled Environment.* Narosa Publishing House, New Delhi.
3.	Sahay, K.M. and Singh, K.K., 2018. *Unit Operations of Agricultural Processing.* Vikas Publishing House Pvt. Ltd., New Delhi.
4.	Chakraverty, A., Mujumdar, A.S., Raghavan, G.S.V. and Ramaswamy, H.S., 2014. *Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea and Spices.* CRC Press, Boca Raton.
5.	Mohanraj, M. and Chandrasekar, P., 2016. *Protected Cultivation and Precision Farming.* New India Publishing Agency, New Delhi.

REFERENCE BOOKS :	
1.	Jain, R.K. and Rao, S.S., 2017. Post Harvest Technology of Fruits and Vegetables. CBS Publishers & Distributors Pvt. Ltd., New Delhi.
2.	Thompson, J.F., Mitchell, F.G., Rumsey, T.R., Kasmire, R.F. and Crisosto, C.H., 2008. Commercial Cooling of Fruits, Vegetables and Flowers. University of California, Davis.
3.	Sirohi, N.P.S. and Behera, T.K., 2017. Protected Cultivation of Vegetable Crops. New India Publishing Agency, New Delhi.
4.	Pantastico, E.B., 1975. Postharvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. AVI Publishing Company, Westport, Connecticut.
5.	Sharma, V.K., 2012. Protected Cultivation and Precision Farming. Agrotech Publishing Academy, Udaipur.

WEB REFERENCES :	
1.	**https://www.scribd.com/document/806056143/APE-311-Theory-Notes**
2.	https://rvsagri.ac.in/modules/academics/timetable/APE%20311.pdf
3.	https://eternaluniversity.edu.in/docs/ProtectedCultivationandSecondaryAgriculture.pdf
4.	**https://www.agricorn.in/p/protected-cultivation.html**
5.	https://rlbcau.ac.in/wp-content/uploads/2024/10/AAE-332-Protected-Cultivation-Secondary-Agriculture-min.pdf

U24AGB503	Pest of Crops and Stored Grain and Their Management	(2+1)

COURSE OBJECTIVES:

- To understand the distribution, biology, ecology and economic importance of insect and non-insect pests of agricultural and horticultural crops.
- To identify major pests based on their morphology, damage symptoms and field characteristics in different cropping systems.
- To explain the life cycle, bionomics and nature of damage caused by economically important crop pests.
- To develop appropriate pest management strategies based on Integrated Pest Management (IPM) principles for field, horticultural, plantation, medicinal and stored products.
- To evaluate the management of vertebrate pests, locusts and emerging pest problems for sustainable crop protection.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Identify economically important insect, non-insect and vertebrate pests associated with major agricultural and horticultural crops.
CO2 :	Describe the distribution, biology, life cycle and damage symptoms of important crop pests.
CO3 :	Diagnose pest infestations based on characteristic field symptoms and pest incidence.
CO4 :	Recommend suitable Integrated Pest Management (IPM) practices for economically important crop pests.
CO5 :	Apply scientific knowledge for effective management of stored-product pests, vertebrate pests and locusts in sustainable agriculture.
CO6 :	Identify major crop pests based on their life stages and damage symptoms for effective pest diagnosis and management.

UNIT I : Pests of Field Crops: Cereals, Millets, Pulses	**5 Hrs.**
Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, tenai, redgram, green gram, black gram, bengal gram, cowpea.	

UNIT II : Pests of Oilseeds, Commercial Crops, Green Manure and Forage Crops	**6 Hrs.**
Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean and mustard. cotton and sugarcane, green manures (Sunnhemp, Sesbania, Daincha, Glyricidia), forage crops (Lucerne and Subabul)	

UNIT III: Pests of Vegetable and Major Fruit Crops	**7 Hrs.**
Distribution, bionomics, symptoms of damage and management strategies of insect and non insect	

pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus, Crucifers, Cucurbits, Mango, Citrus, Banana, Guava, Grapevine, Sapota, Pomegranate, Papaya, Aonla

UNIT IV: Pests of Fruit, Plantation, Tuber, Spice and Medicinal Crops	**7 Hrs.**
Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Apple, Pine apple, Custard apple and Jack, Potato, Sweet potato, Tapioca, Yam, Colocasia, Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind	

UNIT V: Pests of Ornamental, Medicinal and Stored Products, and Vertebrate Pests	**7 Hrs.**
Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Glory lily, Coleus, Stonebreaker, Aswagantha, Senna, Periwinkle and Lawn - Distribution, bionomics, symptoms of damage and management strategies of pests of and stored products - Rodents and birds of agricultural importance and their management - Locusts and their management.	

Lecture schedule:

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Rice – Sucking pests.
2. Rice – Borers and defoliators.
3. Maize, sorghum and cumbu.
4. Wheat, ragi and tenai.
5. Redgram, bengalgram, blackgram, greengram and cowpea.
6. Groundnut, gingelly and sunflower.
7. Castor, soybean, safflower, jatropha and mustard.
8. Cotton – Sucking pests.
9. Cotton – Bollworms, borers and defoliators.
10. Sugarcane.
11. Green manures and forage crops - sunnhemp, sesbania, daincha, lucerne, subabul and glyricidia.
12. Brinjal, bhendi and tomato.
13. Chillies, onion, garlic, moringa and amaranthus.
14. Crucifers, Cucurbits.
15. Mango.
16. Citrus and banana.

Mid Semester Examination.

17. Guava, grapevine and sapota.
18. Pomegranate, papaya and aonla.
19. Apple, pine apple, custard apple and jack.
20. Potato, sweet potato, tapioca.
21. Coconut and arecanut.
22. Tea and coffee.
23. Cashew, cocoa and betelvine.
24. Ginger, turmeric and coriander.
25. Cardamom, pepper, curry leaf and tamarind.
26. Rose, jasmine, crossandra, chrysanthemum, tuberose.
27. Cut flowers Glory lily, coleus, stone breaker, aswagantha,
28. Senna, periwinkle and lawn.
29. Role of physical, biological, mechanical and chemical factors in deterioration of grain by Stored product pests.
30. Stored product pests and their management.
31. Locusts and their management.
32. Rodents and birds of agricultural importance and their management.

Practical schedule:

Identification of symptoms of damage and life stages of

1. Pests of rice.
2. Pests of maize, sorghum, cumbu, ragi and tenai.
3. Pests of pulses.
4. Pests of groundnut, gingelly sunflower and castor.
5. Pests of cotton.
6. Pests of sugarcane.
7. Pests of brinjal, bhendi and tomato.
8. Pests of chillies, onion, garlic, moringa and amaranthus.
9. Pests of crucifers and cucurbits.
10. Pests of mango, citrus, sapota, banana, grapevine and guava.
11. Pests of pomegranate, aonla, papaya, jack, pine apple, custard apple, ber and apple.
12. Pests of potato, sweet potato and tapioca.
13. Pests of coconut, cashew, cocoa, betelvine, coffee and tea.
14. Pests of turmeric, ginger, coriander, cardamom, pepper and curry leaf.
15. Pests of rose, jasmine, crossandra, chrysanthemum and tuberose.
16. Pests of stored products.

Final Practical Examination.

Total Hours: 64

	TEXT BOOKS :
1.	David, B.V. & Ramamurthy, V.V. (2022). Elements of Economic Entomology (9th Ed.). Brillion Publishing, New Delhi.
2.	Pedigo, L.P. & Rice, M.E. (2014). Entomology and Pest Management (6th Ed.). Waveland Press, USA.
3.	Dhaliwal, G.S., Jindal, V. & Dhawan, A.K. (2020). Insect Pest Problems and Crop Losses: Changing Trends. Kalyani Publishers, Ludhiana.
4.	Atwal, A.S. & Dhaliwal, G.S. (2016). Agricultural Pests of South Asia and Their Management. Kalyani Publishers, Ludhiana.
5.	Nair, M.R.G.K. (2019). Insects and Mites of Crops in India. ICAR, New Delhi.

	REFERENCE BOOKS :
1.	Hill, D.S. (2012). Agricultural Insect Pests of the Tropics and Their Control (2nd Ed.). Cambridge University Press.
2.	Metcalf, R.L. & Luckmann, W.H. (2017). Introduction to Insect Pest Management (4th Ed.). Wiley India.
3.	Dent, D. & Binks, R. (2020). Insect Pest Management (3rd Ed.). CABI Publishing.
4.	Norris, R.F., Caswell-Chen, E.P. & Kogan, M. (2003). Concepts in Integrated Pest Management. Pearson Education.
5.	Gullan, P.J. & Cranston, P.S. (2023). The Insects: An Outline of Entomology (6th Ed.). Wiley-Blackwell.

	WEB REFERENCES :
1.	Indian Council of Agricultural Research (ICAR) – https://icar.org.in
2.	National Centre for Integrated Pest Management (NCIPM) – https://ncipm.icar.gov.in
3.	Central Integrated Pest Management Centre (CIPMC), Directorate of Plant Protection – https://ppqs.gov.in
4.	CABI Crop Protection Compendium – https://www.cabi.org
5.	FAO – Integrated Pest Management – https://www.fao.org

U24AGP504	Practical Crop Production – I (*Kharif Crops*)	(0+2)

COURSE OBJECTIVES:

•	To acquire knowledge on enhancing agricultural productivity throughout the Kharif season.
•	To know about season and varieties which was grown in the Kharif season.
•	To gain hands on experience on all aspects of crop production.
•	To learn and identify the pest and disease of crop.
•	To understand about the preparation of balance sheet which includes cost of cultivation.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Students execute practical methods for increasing crop yield during the Kharif season
CO2 :	Apply their theoretical knowledge to actual circumstances.
CO3 :	Examine scientific crop production technologies to make it profitable cropping season.
CO4 :	Identify different pest and diseases of the crops in the growing season.
CO5 :	Evaluate about the cost of cultivation including profit and loss.

Practical Schedule

1. Study of rice ecosystems, climate and weather.
2. Study of seasons and varieties of Rice in Tamil Nadu.
3. Selection of nursery area and preparation of nursery in the rice field.
4. Application of manures and fertilizer to nursery.
5. Acquiring skill and knowledge in seed treatment and its methods.
6. Practicing seed soaking and incubation, nursery sowing and management.
7. Study of wetland and Practicing of puddling operations.
8. Study and Practice of main field preparation.
9. Practicing of field preparatory operations - sectioning of field bunds, plastering and leveling.
10. To Study and Practicing of basal application of fertilizers.
11. Practicing transplanting techniques in lowland rice.
12. To study about different package of practices of rice.
13. Acquiring skill in gap filling and thinning.
14. Estimation of plant population in rice.
15. To study about various nutrients and its management in rice.
16. To study about irrigation in real field condition.

Mid semester Examination

17. To calculate fertilizer requirement in rice.
18. Study of weeds and weed management in rice.
19. To calculate the weed control efficiency & weed index in rice.
20. Study and practice of green and green leaf manuring.
21. Study about different bio-fertilizer application in rice.
22. Study and practicing top dressing techniques in rice.

23. Observation of insect pests and their management in rice.
24. Observation of diseases and their management in rice.
25. Recording growth and other related characters of rice.
26. Estimation of yield and yield parameters in rice.
27. To study about harvesting and threshing in rice.
28. To study about drying & winnowing in rice.
29. To study about storage and its methods.
30. To study about marketing of produce.
31. To calculate the economics of crop production on per hectare basis.
32. To study about preparation cost of cultivation.

Total Hours: 64

TEXT BOOKS :	
1.	Rajendra Prasad, "Text Book on Field Crop Production". Indian Council of Agrl. Research, New Delhi, 2004
2.	Reddy,S. R, "Agronomy of field crops". Kalyani publishers, New Delhi, 2012.
3.	Annadurai K and B Chandrasekaran, "A Text Book of Rice Science". ScientificPublishers, New Delhi, 2009.
4.	Surajit K. De Datta, "Principles and Practices of rice production". A wiley-interscience publication, New York, 1933.

REFERENCE BOOKS :	
1.	Ramesh Dutt Sharma, "Story of Rice", National Book Trust, India, 2003.
2.	Vivek, R.K. Naresh, P.K. Singh, Rajendra Kumar and M. Sharath Chandra, "Practical Manual on Field Crop Production". Akinik Publications, New Delhi, 2020.
3.	ICAR, "Hand book of Agriculture". Indian Council of Agriculture, New Delhi, 2015.
4.	TNAU, "Crop Production Guide". Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore, 2020.

WEB REFERENCES :	
1.	https://agrimoon.com/wp-content/uploads/Practical-Crop-Production.pdf
2.	https://bieap.apcfss.in/Uploads/Materials/I_CP_&_M.pdf
3.	https://rvsagri.ac.in/modules/academics/timetable/AGR%20301.pdf
4.	https://resources.peopleinneed.net/documents/1365-handbook-for-practical-agriculture.pdf
5.	https://agritech.tnau.ac.in/

U24AGB505	Crop Improvement – I (*Kharif crops*)	(1+1)

COURSE OBJECTIVES:

- To know the origin, distribution, genetic resources, floral biology, breeding objectives and conventional and modern breeding techniques and recommended varieties and hybrids in Kharif Cereal crops.
- To know the origin, distribution, genetic resources, floral biology, breeding objectives and conventional and modern breeding techniques and recommended varieties and hybrids in Kharif Pulses.
- To know the origin, distribution, genetic resources, floral biology, breeding objectives and conventional and modern breeding techniques and recommended varieties and hybrids in Kharif Oilseeds and Fibre crops
- To know the origin, distribution, genetic resources, floral biology, breeding objectives and conventional and modern breeding techniques and recommended varieties and hybrids in Kharif Fodder crops, Vegetables and Cash crops
- To enlighten the students about hybrid seed production technologies, ideotype breeding concepts, and climate-resilient programmes for crop improvement.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the evolution history, floral nature, breeding principles and modern breeding methods in developing newer crop varieties and hybrids of Kharif cereals
CO2 :	Explain the evolution history, floral nature, breeding principles and modern breeding methods in developing newer crop varieties and hybrids of Kharif pulses
CO3 :	Explain the evolution history, floral nature, breeding principles and modern breeding methods in developing newer crop varieties and hybrids of Kharif oilseed and fibre crops
CO4 :	Explain the evolution history, floral nature, breeding principles and modern breeding methods in developing newer crop varieties and hybrids of Kharif fodder crops, vegetables and cash crops
CO5 :	Demonstrate hybrid seed production techniques in various kharif crops and plan ideotype breeding and climate- resilient variety development.
CO6 :	Handling of germplasm, undertake maintenance breeding, accomplish emasculation and hybridization, estimate heterosis, carry out quality hybrid seed production, evaluate quality characters and select donor parents for crop improvement programmes.

UNIT I:	**3 Hrs.**
Centers of origin, distribution of species, wild relatives in different Floral biology, study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in Rice, Maize, Sorghum and Bajra	

UNIT II:	3 Hrs.
Centers of origin, distribution of species, wild relatives in different Floral biology, study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in Urd, Mung, Cowpea, Pigeon pea	

UNIT III:	4 Hrs.
Centers of origin, distribution of species, wild relatives in different Floral biology, study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in Soybean, Sesame, Groundnut, Cotton and Jute	

UNIT IV:	3 Hrs.
Centers of origin, distribution of species, wild relatives in different Floral biology, study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in Fodder Maize, Fodder sorghum and Cumbu Napier, Brinjal, Bhendi, Cucurbitaceae and Castor	

UNIT V:	3 Hrs.
Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea, etc. Ideotype concept and climate resilient crop varieties for future.	

Lecture Schedule

1. Crop improvement aspects in Rice as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
2. Crop improvement aspects in Maize as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production, Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
3. Crop improvement aspects in Sorghum and Bajra as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
4. Crop improvement aspects in Urd, Mung bean as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)

5. Crop improvement aspects in Cowpea as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
6. Crop improvement aspects in Pegion Pea as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
7. Crop improvement aspects in Soybean as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
8. Crop improvement aspects in Sesame as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)

Mid Semester Examination

9. Crop improvement aspects in Groundnut as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
10. Crop improvement aspects in Cotton and Jute as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
11. Crop improvement aspects in Fodder crops- Fodder Maize, Fodder Sorghum and Cumbu Napier as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
12. Crop improvement aspects in Brinjal, Bhendi, as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
13. Crop improvement aspects in Cucurbitaceae and Castor as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
14. Hybrid Seed production technology in self-pollinated, cross pollinated and vegetatively propagated crops- Maize, Rice, Sorghum, Pearl millet and Pigeonpea.
15. Ideotype concept
16. Climate resilient crop varieties for future.

Practical Schedule

1. Emasculation and hybridization techniques in Rice, Maize
2. Emasculation and hybridization techniques in Sorghum, Pearl millet and Ragi
3. Emasculation and hybridization techniques in Pigeonpea, Urdbean, Mungbean and Cowpea

4. Emasculation and hybridization techniques in, Soybean, Sesame.
5. Emasculation and hybridization techniques in and Groundnut, Cotton and Tobacco.
6. Emasculation and hybridization techniques in and Brinjal, Bhendi and Cucurbitaceae
7. Maintenance breeding of different kharif crops
8. Handling of germplasm and segregating populations by different methods like Pedigree method
9. Handling of germplasm and segregating populations by different methods like Bulk and single seed decent methods
10. Study of field techniques for seed production and hybrid seeds production in Kharif crops
11. Estimation of heterosis, inbreeding depression and heritability
12. Layout of field experiments
13. Study of quality characters
14. Donor parents for different characters
15. Visit to seed production plots
16. Visit to AICRP plots of different field crops

Final Practical Examination.

Total Hours: 48

TEXT BOOKS :	
1.	Chopra, V. L. "Breeding field crops – I". Oxford IBH,2001.
2.	Yadava, Devendra Kumar, Harsh Kumar Dikshit, Gyan Prakash Mishra, and Shailesh Tripathi, eds. "Fundamentals of field crop breeding", Berlin: Springer, 2022.
3.	Gupta, S. K. "Plant Breeding – Theory and Techniques", Agrobios,2008.
4.	Singh, C. B. and Khare, D. "Genetic Improvement of Field Crops", Scientific publishers,2017.
5.	Yadav Rajendra Kumar. "Practical Manual on Crop Improvement – I (Kharif crops)", S.K. Kataria & Sons, 2022.
6.	Sleper, D. A. and Poehlman, J. M. "Breeding Field Crops", Springer Science & Business Media,2013.

REFERENCE BOOKS :	
1.	Ram, H, H. "Vegetable Breeding – Principles and Practices", Kalyani Publishers,2006.
2.	Singh, D, P. "Genetics and Breeding of Pulse Crops", Kalyani Publishers,1991.

WEB REFERENCES :	
1.	https://icar-crri.in/wp-content/uploads/2025/11/CRRIs-varieties-1968-2024.pdf
2.	http://icar-crri.in/major-achievements/
3.	http://books.irri.org/annual-report/AR2025_content.pdf
5.	https://www.icrisat.org/research/overview
7.	https://agritech.tnau.ac.in/crop_improvement/crop_imprv_emasculation.html

U24AGB506	Manures, Fertilizers and Soil Fertility Management	(2+1)

COURSE OBJECTIVES:

- To understand the classification and importance of organic manure/ nutrient sources.
- To explain the classification, composition, properties, and efficient use of chemical fertilizers.
- To examine the principles of soil fertility and plant nutrition, nutrient transport mechanisms, and the chemistry of macro and micronutrients in soil.
- To evaluate soil fertility through soil testing, plant analysis, critical nutrient levels.
- To apply appropriate fertilizer recommendation approaches and nutrient management practices.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	List out the essential nutrients
CO2 :	Explain the nutrient transformations in soil
CO3 :	Outline the importance and properties of fertilizers
CO4 :	Acquire knowledge on manures and their importance
CO5 :	Evaluating the soil health for management
CO6:	Demonstrate skills in soil, plant, and manure nutrient analysis, interpret soil test results, and recommend site-specific fertilizers for sustainable nutrient management.

UNIT I: Organic Nutrient Sources	**7 Hrs.**
Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures – Green manuring and green leaf manuring. Integrated nutrient management – Carbon sequestration – Carbon trading - Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic fertilizer.	

UNIT II: Fertilizers and Soil Amendments	**6 Hrs.**
Potassic fertilizers, secondary & micronutrient fertilizers – Mixed/ Complex/customized/designer fertilizers, water soluble and liquid fertilizers, nano fertilizers & Soil amendments – Fertilizer Storage and Fertilizer Control Order.	

UNIT III: Soil Fertility and Essential Plant Nutrients	7 Hrs.
History of soil fertility and plant nutrition – Criteria of essentiality – Role, deficiency and toxicity symptoms of essential plant nutrients – Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants – Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.	

UNIT IV: Soil Testing and Fertility Assessment	6 Hrs.
Soil fertility Evaluation-Soil testing, Critical levels of different nutrients in soil – Forms of nutrients in soil, plant analysis, and rapid plant tissue tests – Indicator plants.	

UNIT V: Fertilizer Application and Nutrient Use Efficiency	6 Hrs.
Methods of fertilizer recommendations to crops – Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions	

Lecture Schedule

1. Organic Manures-Importance, Definition, classification, properties and sources – Fortified organics.
2. Methods of preparation of bulky and concentrated manures – Composting techniques – Aerobic and anaerobic (Bangalore & Coimbatore method) enriched FYM and vermicompost.
3. Composting of organic waste – Sugarcane trash and coir waste. Green manuring and green leaf.
4. Soil carbon sequestration and carbon trading.
5. Fertilizers – Definition, classification of N, P and K fertilizers.
6. N fertilizers – Urea, ammonium sulphate, ammonium nitrate, CAN, properties and their reactions in soil.
7. P fertilizers – Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil.
8. K fertilizers – MOP and SOP – properties and reactions in soil.
9. Secondary nutrient fertilizers and micronutrient fertilizers.
10. Complex fertilizers – definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes.
11. Mixed fertilizers – definition, preparation and compatibility. Customized/designer fertilizers, water soluble, liquid fertilizers and Nano fertilizers.
12. Micro nutrient mixtures and chelated micronutrients. Soil amendments.
13. Fertilizer Storage and Fertilizer Control Order.

14. History of soil fertility, productivity plant nutrition and criteria of essentiality. Functions, deficiency and toxicity symptoms of N, P and K.
15. Functions, deficiency and toxicity symptoms of Secondary, micronutrient and beneficial elements.
16. Mechanisms of nutrient transport to plants.

Mid Semester Examination.

17. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen and phosphorous in soil.
18. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil.
19. Sources, forms, mobility, transformation, fixation, losses and availability of calcium, magnesium and sulphur in soil.
20. Sources, forms, mobility, transformation, fixation, losses and availability of micronutrients in soil.
21. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law and Bray's nutrient mobility concept. Approaches – Deficiency symptoms, tissue analysis, biological tests and chemical tests.
22. Techniques/ methods of soil fertility evaluation: Crop logging, critical level, DRIS, Isotopic nutrient availability techniques.
23. Fertilizer application: Soil and foliar application.
24. Fertigation – Definition – Types of fertigation and scheduling.
25. Fertilizer application- specific methods – Seed coating, pelletization, seedling dipping – Nutriseed pack.
26. Nutrient management concepts – 4 R Concept-Agronomic approach.
27. Inductive (STCR), SSNM
28. Nutrient management concepts -Deductive, INM, IPNS. Tools – DSSIFER and VDK.
29. Nitrogen use efficiency – Slow Release N fertilizers – Significance and enhancement techniques.
30. Nutrient use efficiency of P, K and micronutrients and their enhancement techniques.
31. Nutrient management for dry land and rainfed agriculture.
32. Long term effect of fertilization on soil health – PME and LTFE. RTNM.

Practical Schedule

1.Analytical instruments: Principles, calibration and applications – Colorimetry and Spectrophotometry.

2. Flame photometry and Atomic absorption spectroscopy.
3. Estimation of available N in soil.
4. Estimation of available P (Olsen P and Bray P) in soil
5. Estimation of available K in soil.

6. Estimation of available sulphur in soil by turbidimetry.

7. Estimation of available Ca and Mg in soils.

8. Estimation of DTPA extractable micronutrients in soil.

8. Estimation of N content in plant.

9. Estimation of P content in plant.

10. Estimation of K content in plant.

11. Estimation of S content in plant.

12. Estimation of N content in manure.

13. Estimation of P content in manure.

14. Estimation of K content in manure.

15. Colloquium on establishment of soil testing laboratories – Fertilizer calculations – Soil test based fertilizer prescription.

16. Visit to STL and FTL / Fertilizer manufacturing or mixing unit.

Final Practical Examination.

Total Hours: 64

References:

TEXT BOOKS:	
1.	John L. Havlin, James D. Beaton, Samuel L. Tisdale and Werner L. Nelson. 2011. Soil Fertility and Fertilizers- An Introduction to Nutrient Management. PHL Learning Pvt. Ltd. , New Delhi.
2.	Gupta, P. K. 2012. A Handbook of Soil, Fertilizer and Manure. Agrobios (India), Jodhpur.
3.	Michael, A. M. 2009. Irrigation Theory and Practice. Second Edition. Vikas Publishing House Pvt. Ltd., New Delhi.
4.	Ramesh Chandra and S. K. Singh. 2009. Fundamental and Management of soil quality. Westville Publishing House, New Delhi.

REFERENCE BOOKS:	
1.	Epstein, E. and Bloom, A.J. (2005). Mineral Nutrition of Plants: Principles and perspectives (2nd ed.). Sunderland, MA: Sinauer Associates. pp.1 - 380.
2.	Jackson, M.L. (2012). Soil chemical analysis: Advanced course, Scientific Publisher.
3.	John, L. H., Beaton J.D, Tisdale S.L and Nelson W.L. (2016). Soil Fertility and Fertilizers - An Introduction to Nutrient Management. (2nd ed.). New Delhi: PHL Learning Pvt. Ltd. pp.

	1 - 433.
4.	Tan K.H. (2018). Principles of Soil Chemistry, Special Indian edition (4th ed.). Taylor & Francis.
5.	Mengel, K and Kirkby, E.A. (2001). Principles of Plant Nutrition (5th ed.), Springer. pp. 1 - 849.

WEB REFERENCES:	
1.	https://www.usda.gov/
2.	https://www.springer.com/gp/environmental-sciences/soil-science
3.	https://www.soils.org.uk/students
4.	https://youtu.be/zrjL5J_U1iE
5.	https://youtu.be/OcEuG-NzmqQ

U24AGB507	Diseases of Field and Horticultural Crops and their Management -I	(2+1)

COURSE OBJECTIVES:

- To impart knowledge on the etiology, symptoms, disease cycle, epidemiology, and management of major diseases affecting cereals, millets, pulses, oilseeds, cash crops, fruits, vegetables, plantation, and medicinal crops.
- To develop the ability to identify important crop diseases based on characteristic symptoms and causal organisms.
- To understand the principles of integrated disease management (IDM) for sustainable crop protection.
- To familiarize students with post-harvest diseases of fruits and vegetables and diseases of stored grains.
- To enhance decision-making skills for diagnosing crop diseases and recommending suitable management practices under field conditions.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Identify the major diseases of cereals, millets, pulses, and oilseed crops based on symptoms and causal organisms.
CO2 :	Explain the etiology, disease cycle, epidemiology, and integrated management practices of diseases affecting cash crops and fruit crops.
CO3 :	Diagnose important diseases of vegetable crops, including post-harvest diseases of fruits and vegetables, and recommend suitable management measures.
CO4 :	Describe the major diseases of plantation and medicinal crops and formulate effective integrated disease management strategies.
CO5 :	Apply the knowledge of plant disease diagnosis and integrated disease management to minimize crop losses and promote sustainable agricultural production.
CO6:	Evaluate the economic importance of major crop diseases and recommend appropriate preventive and integrated disease management strategies to improve crop productivity and quality.

Unit I : Diseases of cereals and millets	**5 Hrs.**
Cereals: Rice and maize - Millets: Sorghum, pearl millet, finger millet and small millets.	

Unit II: Diseases of pulses and oilseeds	**6 Hrs.**
Pulses: Pigeon pea, urd bean, mung bean, cowpea, soyabean - Oilseeds: Ground nut, castor and sesame - Diseases of stored grains	

Unit III: Diseases of cash crops and fruit crops	**6 Hrs.**
Cash crops: Tobacco, jute and mulberry - Fruit crops: Banana, guava, sapota, papaya, pomegran pineapple, jack fruit, aonla and ber.	

Unit IV: Diseases of vegetables crops	6 Hrs.
Vegetable crops: Tomato, brinjal, okra, crucifers, beans, sweet potato, carrot and beetroot - Post harvest diseases of fruits and vegetables.	

Unit V: Diseases of plantation and medicinal crops	9 Hrs.
Plantation crops: Coconut, arecanut, oilpalm, vanilla, tea, coffee, rubber and cocoa -Medicinal crops: Gloriosa, coleus, stevia and aloe.	

Lecture Schedule

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of rice
2. Diseases of maize
3. Diseases of sorghum
4. Diseases of pearl millet and finger millet
5. Diseases of small millets
6. Diseases of pigeonpea
7. Diseases of urdbean, mungbean and cowpea
8. Diseases of soybean
9. Diseases of groundnut
10. Diseases of sesame and castor
11. Diseases of stored grains and their management
12. Diseases of tobacco
13. Diseases of jute and mulberry
14. Diseases of banana
15. Diseases of guava, papaya and sapota
16. Diseases of pomegranate and pineapple

Mid Semester Examination

17. Diseases of jack fruit, ber and aonla
18. Diseases of crucifers
19. Diseases of tomato
20. Diseases of brinjal
21. Diseases of okra
22. Diseases of sweet potato and beans
23. Diseases of carrot and beetroot
24. Diseases of coconut
25. Diseases of arecanut and oilpalm

26. Diseases of vanilla
27. Diseases of tea
28. Diseases of coffee
29. Diseases of rubber
30. Diseases of cocoa
31. Diseases of gloriosa, coleus, stevia and aloe
32. Post-harvest diseases of fruits and vegetables

Practical schedule

Study of symptoms and host-parasite relationship of:

1. Diseases of rice
2. Diseases of maize and sorghum
3. Diseases of pearl millet, finger millet and small millets
4. Diseases of pigeonpea, urdbean, mungbean, soybean and cowpea
5. Diseases of groundnut, sesame and castor
6. Diseases of tobacco, jute and mulberry
7. Diseases of banana, papaya, pomegranate
8. Diseases of guava, sapota, pineapple, jack fruit, ber and aonla
9. Diseases of crucifers
10. Field visit/ exposure visit to fruits, vegetables and plantation crops
11. Diseases of tomato, brinjal and okra
12. Diseases of sweet potato, beans, carrot and beetroot
13. Diseases of coconut, arecanut, oilpalm and vanilla
14. Diseases of tea and coffee
15. Diseases of rubber and cocoa
16. Diseases of gloriosa, coleus, stevia and aloe

Final Practical Examination.

Total Hours: 64

TEXT BOOKS :	
1.	Mehrotra R S and Aggarwal A, "Plant Pathology"(3rd Edition), McGraw Hill Education (India) Pvt. Ltd., 2017.
2.	Rangaswami G and Mahadevan A, "Diseases of Crop Plants in India "(4th Edition), PHI Learning Pvt. Ltd., New Delhi, 2008.
3.	Gupta V K and Paul Y S, "Diseases of Field Crops and Their Management" Scientific Publishers, Jodhpur, 2002.

REFERENCE BOOKS :	
1.	Mukhopadhyay A N, "Diseases of Crop Plants", New India Publishing Agency, New Delhi, 2015.
2.	Nene Y L and Thapliyal P N, "*Fungicides in Plant Disease Control*" (3rd Edition), Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2013.

WEB REFERENCES	
1.	https://icar.org.in
2.	https://cpcri.icar.gov.in
3.	https://www.apsnet.org

U24AGB508	Rainfed Agriculture & Watershed Management	(1+1)

COURSE OBJECTIVES:

- To understand the concepts, significance, scope, problems, prospects, and agro-climatic characteristics of rainfed agriculture in India.
- To acquire knowledge of drought types, crop responses and adaptation mechanisms to moisture stress, and appropriate drought management strategies.
- To understand soil erosion processes and apply suitable agronomic, mechanical, and in-situ soil and water conservation measures.
- To gain knowledge of water harvesting techniques, efficient water utilization, rainfed crop management, contingent crop planning, and mid-season corrections.
- To comprehend the principles of watershed management and utilize non-monetary inputs and low-cost technologies for sustainable crop production in rainfed areas.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Describe the principles, importance, features, constraints, opportunities, and prevailing soil and climatic conditions of rainfed agriculture in India.
CO2 :	Assess the impact of drought and moisture stress on crop growth and identify suitable crop adaptation mechanisms and drought management practices.
CO3 :	Implement suitable agronomic, mechanical, and in-situ moisture conservation practices for efficient soil and water management in rainfed areas.
CO4 :	Evaluate water harvesting techniques, efficient water utilization practices, and contingent crop planning strategies for managing aberrant weather conditions.
CO5 :	Formulate effective watershed management approaches incorporating development principles, non-monetary inputs, and low-cost technologies for sustainable crop production in rainfed areas.
CO6	Design integrated watershed management strategies incorporating appropriate development principles, non-monetary inputs, and low-cost technologies for sustainable crop production and resource conservation in rainfed regions.

UNIT I : Rainfed agriculture	**3 Hrs.**
Rainfed agriculture - introduction and definition -Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India -History of rainfed agriculture and watersheds in India. Problems and prospects of rainfed agriculture in India - Soil and climatic conditions prevalent in rainfed areas.	

UNIT II : Drought	**3 Hrs.**
Drought - types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Management strategies for drought.	

UNIT III : Soil and water conservation	**3 Hrs.**

Soil erosion - definition - losses due to erosion - types of water and wind erosion - factors affecting erosion - Agronomic measures, mechanical measures and *In-situ* moisture conservation measures of soil and water conservation

UNIT IV: Water harvesting	**3 Hrs.**
Water harvesting - importance and its techniques - Water harvesting structures – Storage and recycling - Efficient utilization of water through soil and crop management practices Management of crops in rainfed areas - Contingent crop planning for aberrant weather conditions - mid season correction.	

UNIT V - Watershed, its management and Non-monetary inputs	**4 Hrs.**
Watershed - concept - objectives - principles and components of watershed development programme - factors affecting watershed management. Non-monetary inputs and low cost technologies for crop production.	

Lecture Schedule

1. Rainfed agriculture - introduction and definition -Dry farming and rainfed farming: Characteristics. Significance and scope of dry farming in India
2. History of rainfed agriculture and watersheds in India.
3. Problems and prospects of rainfed agriculture in India - climate - rainfall pattern - distribution - variabilities of rainfall
4. Soil and climatic conditions prevalent in rainfed areas.
5. Drought – definition - types of drought - effect of water deficits on physio-morphological characteristics of the plants- mechanism of crop adaptation under drought
6. Management strategies for drought - measures to reduce evapotranspiration – weeding, use of mulches, anti-transparent, windbreaks and shelterbelts
7. Soil erosion - definition - losses due to erosion - types of water and wind erosion – nature and extent of wind and water erosion - factors affecting erosion – universal soil loss equation
8. Agronomic measures of soil and water conservation - choice of crop - crop geometry - tillage - contour cultivation - strip cropping - cover cropping - mulching – cropping systems and weed control

Mid Semester Examination.

9. Mechanical measures of soil and water conservation - gully control - bench terraces – contour contour bunds - graded bunds
10. *In-situ* moisture conservation measures - bund forming - bunding, ridge and furrow system - conservation furrows - inter plot water harvesting, mulching - Broad Bed and Furrow (BBF) and leveling.
11. Water harvesting - importance and its techniques

12. Water harvesting structures – Storage and recycling
13. Efficient utilization of water through soil and crop management practices – Management of crops in rainfed areas
14. Contingent crop planning for aberrant weather conditions - mid season correction.
15. Watershed: concept - objectives - principles and components of watershed development programme - factors affecting watershed management.
16. Non-monetary inputs and low cost technologies for crop production.

Practical schedule:

1. Climate classification.
2. Rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
3. Cropping pattern of different rainfed areas of India
4. Mapping of rainfed areas in India.
5. Interpretation of meteorological data for rainfall variability.
6. Scheduling of supplemental irrigation based on crop ET demand.
7. Critical analysis of rainfall and calculation of wet spells,dry spells and length of growing period.
8. Calculation of effective rainfall.
9. Drought management technologies in dryland agriculture
10. Soil & moisture conservation measures.
11. Water harvesting structures
12. Characterization and delineation of model watershed
13. Cropping and farming systems in drylands.
14. Mechanization in dryland farming.
15. Alternate land use system
16. Visit to watershed / rainfed research station.

Final Practical Examination

Total Hours: 48

TEXT BOOKS :	
1.	V. V. Dhruva Narayana, G. Sastry and U. S. Patnaik, "Watershed Management", ICAR, New Delhi, 1990.
2.	R. P. C. Morgan, "Soil Erosion and Conservation", Blackwell Publishing, Oxford, 2005.
3.	S. Jeevananda Reddy, "Dryland Agriculture in India: An Agro-Climatological and Agro-Meteorological Perspective", B. S. Publications, Hyderabad, 2002.
4.	K. Govindan and V. Thirumurugan, "Principles and Practices of Dryland Agriculture", Kalyani Publishers, New Delhi, 2012.
5.	R. Suresh, "Watershed Hydrology", Standard Publishers Distributors, New Delhi, 2012.

REFERENCE BOOKS :	
1.	S. R. Reddy and G. Prabhakara Reddy, "Dryland Agriculture", Kalyani Publishers, 2015.
2.	I. Arnon, "Crop Production in Dry Regions (Vol. I)", Leonard Hill Publishing Company, London, 1972.
3.	S. Jeevananda Reddy, "Dryland Agriculture in India: An Agro-Climatological and Agro-Meteorological Perspective", B. S. Publications, 2002.
4.	K. Govindan and V. Thirumurugan, "Principles and Practices of Dryland Agriculture", Kalyani Publishers, 2012.
5.	P. Rangaswamy, "Dry Farming Technology in India", Agricole Publishing Academy, New Delhi, 1990.

WEB REFERENCES :	
1.	**www.agritech.tnau.ac.in**
2.	**www.icar.gov.in**
3.	**www.cazri.res.in**
4.	**www.agriwelfare.gov.in**
5.	**www.imd.gov.in**

U24AGB509	Production Technology for Ornamental Crops, MAP and Landscaping	(1+1)

COURSE OBJECTIVES:

- To understand the basics of ornamental crops, landscaping and rose cultivation.
- To learn the production technology of major protected cut flowers such as gerbera, carnation, lilium and orchids.
- To acquire knowledge on the cultivation and postharvest management of open field cut flowers.
- To study the production technology of loose flowers and important medicinal plants.
- To develop practical skills in the cultivation, processing and value addition of aromatic plants and essential oil crops.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Remember the importance of ornamental crops, landscaping principles and rose cultivation.
CO2 :	Understand the cultivation practices of protected cut flowers.
CO3 :	Apply the production and postharvest management techniques of open field cut flowers.
CO4 :	Apply the production and postharvest management techniques of open field cut flowers.
CO5 :	Apply processing and value addition techniques for aromatic plants and ornamental produce.
CO6 :	Evaluate commercial production practices through field visits to floriculture and medicinal plant enterprises.

UNIT I : Scope, Principles of Landscaping and Protected Cultivation of Rose	**3 Hrs.**
Importance and scope of ornamental crops and landscaping, principles of landscaping, landscape uses of trees, shrubs and climbers, and production technology of rose under protected cultivation, including propagation, cultivation, harvesting and postharvest management.	

UNIT II : Protected Cultivation of Cut Flowers Gerbera, Carnation, Lilium & Orchids	**3 Hrs.**
Production technology of gerbera, carnation, lilium and orchids under protected cultivation, including varieties, propagation, cultivation practices, use of growth regulators, physiological disorders, harvesting, postharvest management and yield.	

UNIT III : Open Field Cultivation of Cut Flower Gladiolus, Tuberose & Chrysanthemu	**3 Hrs.**
Production technology of gladiolus, tuberose and chrysanthemum under open field conditions, including varieties, propagation, cultivation practices, use of growth regulators, physiological disorders, harvesting, postharvest management and yield.	

UNIT IV : Production technology of Loose Flowers and Medicinal Plants	**3 Hrs.**
Production technology of loose flowers including marigold and jasmine under open field conditions, and cultivation of medicinal plants such as asparagus, aloe, costus, periwinkle and isabgol, covering propagation, cultivation practices, harvesting and yield.	

UNIT V : Production technology of Aromatic Plants, Processing and Value Addition	4 Hrs.
Importance of aromatic plants and the essential oil industry, production technology of mint, ocimum, lemongrass, citronella, palmarosa, rosemary, geranium and vetiver, and processing and value addition of ornamental, medicinal and aromatic plants, including dry flower making and essential oil extraction methods.	

Lecture Schedule

1. Importance and scope of ornamental crops and landscaping - Landscape uses of trees, shrubs and climbers.
2. Principles of landscaping - Initial approach – Axis – Focal Point – Mass effect – Unity – Space – Divisional Lines – Proportion and Scale – Texture – Time and Light – Tone and Colour – Mobility – Rhythm – Balance – Contract – Harmony- Vista –Style.
3. Production technology of cut flowers under protected conditions - Rose – Introduction- origin and distribution - Classification- Species and varieties - Climate and soil requirements - Propagation – Rootstocks - Stock scion compatibility - Land preparation – planting - Manures and fertilizers - Cultural operations (pruning- pinching and mulching) harvesting - Post harvest management - Yield and rose by products.
4. Gerbera – Introduction - Origin and distribution – Classification - Species and varieties, Climate and soil requirements – Propagation - Land preparation – Planting - Manures and fertilizers - Cultural operations – Defoliation - Soil loosening- Shading- use of growth regulators - Physiological disorders – Harvesting - Post harvest management and yield.
5. Carnation – Introduction - Origin and distribution- Classification - Species and varieties - Climate and soil requirements - Propagation - Land preparation- Planting - Manures and fertilizers - Cultural operations- (Pinching and disbudding) use of growth regulators - Physiological disorders - Harvesting - Post harvest management and yield.
6. Lilium and Orchids - Introduction- Origin and distribution- Classification- Species and varieties- Climate and soil requirements- Propagation- Land preparation-Planting- Manures and fertilizers- Cultural operations - Use of growth regulators- Physiological disorders- Harvesting- Post harvest management and yield.
7. Production technology of cut flowers under open conditions - Gladiolus - Introduction - Origin and distribution - Classification of varieties - Species and varieties - Climate and soil requirements - Propagation - Land preparation – Planting - Manures and fertilizers - Cultural operations - Use of growth regulators- Physiological disorders – Harvesting - Post harvest management and yield.
8. Production technology of cut flowers under open conditions - Tuberose- Introduction - Origin and distribution - Classification of varieties - Species and varieties - Climate and soil requirements - Propagation - Land preparation – Planting - Manures and fertilizers - Cultural operations - Use of growth regulators- Physiological disorders – Harvesting - Post harvest management and yield.

   Mid Semester Examination.
9. Chrysanthemum – Introduction - Origin and distribution – Classification - Species and varieties - Climate and soil requirements – Propagation - Land preparation - Planting, Manures and fertilizers - Cultural operations - Pinching and disbudding - Use of growth regulators- Harvesting - Post harvest management and yield.
10. Loose flowers - Marigold and Jasmine under open conditions – Introduction – Origin and distribution - Species and varieties - F1 hybrids - Climate and soil requirements - Propagation- Land preparation – Planting - Manures and fertilizers - Cultural operations- Pinching and disbudding - Use of growth regulators – Harvesting - Postharvest management and yield.

11. Medicinal plants – Scope and Importance – Production technology of Asparagus, Aloe, Costus - Botanical name – Family - Origin - Economic part - Introduction – Climate – Soil - Varieties – Propagation – Planting - Manuring - Irrigation -Intercultural operations - Harvesting - Yield.
12. Periwinkle, Isabgol -Botanical name – Family - Origin - Economic part -Introduction – Climate – Soil – Varieties – Propagation – Planting - Manuring – Irrigation – Intercultural operations - Harvesting - Yield.
13. Aromatic plants – Importance – Essential oil industry in India – Properties of essential oils – Production technology of Mint and Ocimum - Botanical name –Family - Origin - Economic part - Introduction – Climate – Soil - Varieties –Propagation – Planting - Manuring - Irrigation - Intercultural operations -Harvesting - Yield.
14. Lemongrass, Citronella, Palmarosa - Botanical name – Family - Origin – Economic part- Introduction – Climate – Soil - Varieties – Propagation – Planting - Manuring- Irrigation - Intercultural operations - Harvesting - Yield.
15. Rosemary, Geranium and Vettiver - Botanical name – Family - Origin - Economic part - Introduction – Climate – Soil - Varieties – Propagation – Planting - Manuring - Irrigation - Intercultural operations - Harvesting - Yield.
16. Processing and value addition in ornamental crops and medicinal and aromatic plants produce – Dry flower making - Extraction methods of essential oils.

Practical Schedule

1. Identification of ornamental plants.
2. Identification of Medicinal and Aromatic Plants.
3. Nursery bed preparation and flower seed sowing.
4. Training and pruning of roses.
5. Planning and layout of ornamental garden.
6. Bed preparation and planting of Medicinal and Aromatic Plants.
7. Protected structures – Care and maintenance.
8. Intercultural operations in flowers crops.
9. Intercultural operations in Medicinal and Aromatic plants.
10. Harvesting and post-harvest handling of cut and loose flowers.
11. Floral preservatives to prolong vase-life of cut flowers.
12. Drying / dehydration techniques for flower drying.
13. Processing of Medicinal and Aromatic Plants.
14. Extraction of essential oils.
15. Visit to commercial flower unit.
16. Visit to commercial medicinal and aromatic plants unit.

Final Practical Examination.

Total Hours: 48

TEXT BOOKS :	
1.	Bose, T.K, "Floriculture and Landscaping", Naya Prakash, Kolkatta, 1999.
2.	Randhawa, G.S. and Mukhopadhyaya, A, "Floriculture in India", Allied Publishers Pvt. Ltd., New Delhi, 1994.
3.	Chattopadhyay, S.K, "Commercial Floriculture", Gene-Tech Books, New Delhi, 2007.
4.	Srivastava, H.C, "Medicinal and Aromatic Plants", ICAR, New Delhi, 2014.
5.	Bose, T.K. and Yadav, L.P, "Commercial Flowers", Naya Prakash, Kolkatta, 1992.

REFERENCE BOOKS :	
1.	Singh, A.K., "Flower Crops: Cultivation and Management", New India Publishing Agency, New Delhi, 2006.
2.	Kumar, N., "Introduction to Horticulture", Rajalakshmi Publications, Nagercoil, 2014.
3.	Peter, K.V. (Ed.), "Ornamental Horticulture", New India Publishing Agency, New Delhi, 2008.
4.	Panda, H., "Cultivation and Utilization of Aromatic Plants", Asia Pacific Business Press Inc., New Delhi, 2005.
5.	Bhattacharjee, S.K., "Advances in Ornamental Horticulture (Vols. I–VI)", Pointer Publishers, Jaipur, 2006.

WEB REFERENCES :	
1.	https://nptel.ac.in/courses/117101056
2.	https://www.icar.org.in
3.	https://ebook.icar.org.in
4.	https://www.iari.res.in
5.	https://www.nhb.gov.in

U24AGB511	System Simulation and Agro-advisory	(2+1)

COURSE OBJECTIVES:

• To understand the systems approach in agriculture and the concepts, principles, and components of crop simulation models.
• To acquire knowledge of crop growth modelling, model calibration, validation, verification, and sensitivity analysis for evaluating crop responses to weather variables.
• To learn about simulation techniques to estimate crop productivity under potential, water-limited, and nutrient-limited conditions using soil water and nutrient balance concepts.
• To gain awareness on weather forecasting methods, forecast verification, and the role of Indigenous Technical Knowledge (ITK) in agricultural weather prediction.
• To study about competency in preparing weather-based agro-advisory bulletins using crop simulation models and disseminating advisories for informed farm decision-making.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the systems approach in agriculture, Soil–Plant–Atmosphere Continuum (SPAC), and the principles, types, and data requirements of crop simulation models.
CO2 :	Evaluate crop responses to weather parameters using crop growth models and perform model calibration, validation, verification, and sensitivity analysis.
CO3 :	Apply crop simulation techniques to estimate potential and attainable crop yields under varying water and nutrient availability using soil water and nutrient balance models.
CO4 :	Interpret weather forecasts, assess their accuracy through forecast verification, and integrate Indigenous Technical Knowledge (ITK) into agricultural weather advisory services.
CO5 :	Prepare and disseminate scientifically sound agro-advisory bulletins based on weather forecasts and crop simulation models to support climate-smart and sustainable agricultural decision-making.
CO6 :	Demonstrate proficiency in collecting and interpreting agrometeorological data, preparing crop weather calendars and agro-advisory bulletins, applying statistical and crop simulation models and evaluating weather-based advisories through institutional exposure and farmer feedback for effective agricultural decision-making.

UNIT I: System & Models	**7 Hrs.**
System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.	

UNIT II: Validation of models	**6 Hrs.**
Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis - Model evaluation techniques - Applications of crop simulation in agriculture.	

UNIT III: Modelling techniques	6 Hrs.
Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions - components of soil water and nutrients balance - Yield forecasting using simulation models.	

UNIT IV: Weather forecasting and verification	6 Hrs.

Weather forecasting, types, methods, tools and techniques, forecast verification; Value added weather forecast - ITK for weather forecast and its validity.

UNIT V: Simulation and Agromet Advisory Bulletins	7 Hrs.
Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast - Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.	

Lecture Schedule:

1. System – definition – concepts.
2. Models- definition - scope.
3. Soil-plant-atmospheric continuum
4. Model- System boundaries – inputs
5. Crop models, concepts and techniques
6. Types of crop models – Abstract models and Simulation Models.
7. Input and output data requirements, relational diagrams.
8. Evaluation of crop responses to weather elements;
9. Elementary crop growth models
10. Calibration, validation, verification
11. Sensitivity analysis of models.
12. Model evaluation techniques.
13. Applications of crop simulation in agriculture.
14. Potential and achievable crop production
15. Concept and modelling techniques for estimation of yields
16. Crop production in moisture and nutrients limited conditions

Mid Semester Exam

17. Components of soil water balance.
18. Components of nutrients balance.
19. Yield forecasting using simulation models.
20. Weather forecasting- definitions- scope
21. Techniques of weather forecasting and forecast verification

22. Value added weather forecast.
23. Now casting and its application.
24. National Centre for Medium Range Weather Forecasting (NCMRWF)
25. Agro Meteorological Field Units (AMFU) and forecasting.
26. Gramin Krishi Mausam Sewa (GKMS) - role in weather forecasting
27. District Agromet field Units (DAMU) - role in weather forecasting.
28. ITK for weather forecast and its validity
29. Preparation of agro-advisory bulletin based on weather forecast.
30. Use of crop simulation model for preparation of Agro-advisory
31. Dissemination of weather forecasting and its mode.
32. Crop-Weather Calendars and IMD and its role in weather forecasting.

Practical Schedule

1. Visit to Agro meteorological Observatory.
2. Preparation of crop weather calendars.
3. Preparation of agro-advisories based on weather forecast using various approaches
4. Synoptic charts
5. Working with statistical and simulation models for crop growth
6. Potential & achievable production, Yield forecasting
7. Insect & disease forecasting models.
8. Simulation with limitations of water and nutrient management options.
9. Sensitivity analysis of varying weather and crop management practices.
10. Use of statistical approaches in data analysis and
11. Preparation of historical, past and present meteorological data for medium range weather forecast.
12. Feedback from farmers about the agro advisory.
13. Visit to GKMS centre / AIR, Karaikal
14. Visit to IMD, DWRS, Karaikal
15. Visit to RMC, Chennai
16. Field visits to agro advisory unit.

Final Practical Examination

Total Hours: 64

TEXT BOOKS :	
1.	Gopalaswamy, N, "Agricultural Meteorology", Rawat publications, Jaipur, 1994.
2.	Reddy, S.R, "Introduction to Agriculture and Agro meteorology". Kalyani Publishers, New Delhi, 2014.
3.	Patra, A.K, "Principles and applications of Agricultural Meteorology", New India Publishing

	Agency, New Delhi, 2016.

REFERENCE BOOKS :	
1.	Mavi, H.S, "Introduction to Agro meteorology", oxford and IBH Publishing Co., New Delhi, 1996.
2.	Rao, G.S.L.H.V, "Agricultural Meteorology", Kerala Agricultural University Press, Thrissur, 2005.

WEB REFERENCES :	
1.	https://atarijodhpur.res.in/Agro%20Advisory%20Services.pdf
2.	https://horizonepublishing.com/index.php/PST/article/view/7357
3.	https://horizonepublishing.com/index.php/PST/article/view/7357
4.	https://mausam.imd.gov.in/index_en.php
5.	https://nwp.imd.gov.in/gfsproducts_cycle00_mausam.php

U24AGB512	Agribusiness Management	(2+1)

COURSE OBJECTIVES:

- To introduce the transition, components, value chain linkages, and environmental analysis (SWOT/PEST) of modern agribusiness systems.
- To explain fundamental management levels, legal forms of business organization, and the core planning and organizing functions.
- To cover human resource planning, workplace motivation theories, operational facilities management, and inventory control models.
- To train students in interpreting financial statements and implementing targeted marketing strategies, pricing policies, and consumer behavior analysis.
- To detail the agricultural project cycle, discounted/undiscounted appraisal techniques, and the procedural frameworks for establishing agro-based industries.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Analyze agri-value chains and evaluate macro/micro environments to map structural stakeholders across agribusiness sectors.
CO2 :	Apply Management by Objectives (MBO) and design organizational structures with clear departmentation, delegation, and planning steps.
CO3 :	Evaluate and execute staffing processes, schedule operations under quality standards (HACCP/TQM), and calculate optimal inventory using the Economic Order Quantity (EOQ) model.
CO4 :	Evaluate corporate financial health via balance sheets and construct strategic marketing mixes (4Ps) mapped to the Product Life Cycle.
CO5:	Analyze the commercial, policy-compliant project reports using financial metrics like Payback Period, BCR, NPW, and IRR.
CO6 :	Formulate bankable agricultural project proposals using discounted and undiscounted financial evaluation techniques, supported by field appraisals of input-output market dynamics, cooperative systems, price trends, and institutional financing mechanisms.

UNIT I : Agribusiness and Management	**7 Hrs.**
Agribusiness – Definition – Nature and Scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems - Structure of Agribusiness (input, farm and product sectors) - Agribusiness Management - Distinctive featuresof Agribusiness - Importance of Agribusiness in the Indian Economy and New Agricultural Policy – Agri-value chain: Understanding primary and support activities and their linkages - Business environment – PEST and SWOT analysis.	

UNIT II : Management Functions	**6 Hrs.**
Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management - Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited – Cooperatives - Management functions: Roles and activities, organizational culture - Planning – Definition – Types of plans (Purpose or Mission, Goals or	

Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget) - Steps in planning and implementation – Characteristics of a Sound plan. Objectives – MBO. Organizing – Principles of Organizing – Conceptof Departmentation-Delegation- Centralization–Decentralization.

UNIT III : Functional areas of management	**6 Hrs.**

Staffing – Concept – Human Resource Planning – Process, Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques - Functional areas: Operations, Human Resources, Finance and Marketing – Meaning and scope - Operations management: meaning – physical facilities – implementing the plan - Inventory control: meaning – inventory model – EOQ.

UNIT IV : Financial management	**6 Hrs.**

Financial statements and their importance – Balance sheet, Network analysis and Cash flow analysis - Marketing management agreement: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies - Consumer behavior analysis: Product Life Cycle (PLC) - Sales and distribution management - Pricing policy, various pricing methods.

UNIT V : Preparation of bankable project	**7 Hrs.**

Project management: Definition – classification of agricultural projects – Project cycle: Identification, Formulation, Appraisal, Implementation, Monitoring and Evaluation - Project appraisal and evaluation of bankable projects – Pay Back Period, BCR, NPW and IRR. Agro-basedindustries – importance and need – Types of agro-based industries – institutional arrangements - Procedure to set up agro-based industries, constraints in establishing agro-basedindustries - Laws and policies related to agri-business in India.

Lecture Schedule

1. Agribusiness – Nature and scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.
2. Agribusiness – definition - Structure of Agribusiness (input, farm and product sectors).
3. Agribusiness Management - Distinctive features of Agribusiness.
4. Importance ofAgribusiness in the Indian Economy – New Agricultural Policy.
5. Agri-supply chain management and agri-value chain management – Forward and Backward linkages.
6. Business environment – analyzing the demographic, economic, socio-cultural, natural, technological and political-legal environment.
7. Business environment – PEST and SWOT analysis.
8. Management – Definition and Importance – Management functions. Management –Roles, Skills, Levels, Activities and organizational culture.
9. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and PublicLimited - Cooperatives.
10. Management functions: Planning – Definition – Types of plans (Purpose or Mission, Goals

orObjectives, Strategies, Policies, Procedures, Rules, Programmes, Budget).

11. Steps in planning – Characteristics of a Sound plan. Objectives – MBO
12. Organizing – Principles of Organizing – Organisation structure – Formal and Informal Organisation.
13. Concept of Departmentation- Span of control – Authority and Responsibility – Concept andMeaning. Delegation- Centralization – Decentralization
14. Staffing – Concept – Human Resource Planning – Process.
15. Directing – Concept – Principles – Techniques -ordering, leading, supervision.
16. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques

Mid-Semester Examination.

17. Functional areas of management: Operations management: meaning – operating system – physical facilities – implementing the plan.
18. Scheduling the work – controlling production in terms of quantity and quality – ISO standards – HACCP – TQM.
19. Inventory – meaning – types – inventory costs – inventory management – EOQ.
20. Financial management – financial statements – importance and need – Balance sheet, Net worth analysis and cash flow analysis.
21. Marketing management: meaning, definition – market segmentation, targeting and positioning.
22. 4Ps of marketing mix and marketing strategies.
23. Consumer buying behavior – factors influencing buying behavior – Buying decision process.
24. Sales and distribution management.
25. Pricing policy- pricing method – pricing at various stages of marketing.
26. Project – meaning, definition – classification of agricultural projects.
27. Project cycle – Identification, formulation, appraisal, implementation, monitoring and evaluation.
28. Project appraisal and evaluation techniques – undiscounted and discounted measures.
29. Agro-based industries – importance and need – types of agro-based industries institutional arrangements for financing agro-based industries.
30. Procedure to set up agro-based industries – constraints in establishing agro-based industries.
31. Business plan – components of a business plan.
32. Preparation of project reports for agricultural and allied sector activities, and the laws and policies governing agribusiness in India

Practical schedule

1. Study of agro-input markets: Seeds, fertilizers and pesticides.
2. Visit to output markets – Regulated market/Uzhavar sandhai.
3. Visit to output markets – Shandies/flower market.
4. Visit to an agro-processing unit to study retail trade, commodity trading and value addition.
5. Visit to Cooperatives to know their role in agricultural development.
6. Visit to Lead Bank/RRBs.
7. Visit to the NABARD district office.
8. A case study of agro-based industries – preparation and presentation of project report.
9. Exercise on project evaluation techniques – Undiscounted measures.
10. Exercise on project evaluation techniques – Discounted measures.
11. Preparation of bankable project – I.
12. Preparation of bankable project – II.
13. Group presentation of projects – I.
14. Group presentation of projects – II.
15. Trend and growth rate in prices of agro-inputs.
16. Trend and growth rate in prices of agricultural commodities.

Final Practical examination

Total Hours: 64

TEXT BOOKS:	
1.	Singh, S., & Asokan, S. R. (2019). Agribusiness management in India. Oxford & IBH Publishing.
2.	Koontz, H., & Weihrich, H. (2015). Essentials of management: An international, innovation, and leadership perspective (10th ed.). McGraw-Hill Education.
3.	Kotler, P., Keller, K. L., Koshy, A., & Jha, M. (2013). Marketing management: A South Asian perspective (14th ed.). Pearson Education.
4.	Chase, R. B., Shankar, R., & Jacobs, F. R. (2018). Operations and supply chain management (15th ed.). McGraw-Hill Education.
5.	andra, P. (2019). Projects: Planning, analysis, selection, financing, implementation, and review (9th ed.). McGraw-Hill Education.

REFERENCE BOOKS:	
1.	Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, `Production and Operations Management - Manufacturing and service, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2.	Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 5th Edition, 2008.
3.	Philip Kotler and Kevin L.K., Marketing Management, Pearson India Education Services Pvt Ltd, 2016.

4.	Chandra Prasanna. 2000. Financial Management - Theory and Practice. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5.	R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.

WEB REFERENCES:	
1.	Agribusiness Management Textbook - NIBM eHub
2.	TNAU Agritech Portal Home & TNAU Institutional Research Repository
3.	Farmer's Handbook on Basic Agriculture - MANAGE
4.	Principles of Agricultural Economics Lecture Series
5.	Basic Principles of Agriculture & Economics Module

U24AGB513	Biopesticides & Biofertilizers	(2+1)

COURSE OBJECTIVES:

- Understand the concepts, classification, and importance of biopesticides and biofertilizers.
- Learn the isolation, production, and quality control of microbial biopesticides and biofertilizers.
- Study the role of beneficial microorganisms in sustainable crop production.
- Understand formulation, application methods, and quality standards of bio-inputs.
- Develop practical skills in laboratory techniques and production of biopesticides and biofertilizers.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the concepts and importance of biopesticides and biofertilizers.
CO2 :	Describe the production and formulation of bio-inputs.
CO3 :	Identify important biopesticides, biofertilizers, and botanicals.
CO4 :	Apply isolation, mass production, and application techniques.
CO5:	Evaluate the quality and effectiveness of bio-inputs.
CO6 :	Demonstrate laboratory skills in biopesticide and biofertilizer production.

UNIT I : History and Development of Bio pesticides	**7 Hrs.**
History and concept of biopesticides, importance-scope and potential of biopesticides, -Definition, concept and classification of biopesticides viz., entomopathogens, Botanical pesticides. Botanicals and their uses.	

UNIT II : Mass Production of Biopesticides	**6 Hrs.**
Mass production technology of biopesticides (Trichoderma, Pseudomonas Bacillus, Metarhizium etc., - virulence-pathogenicity and symptoms of entomopathogens - biocontrol of nematodes- uses of biopesticides- method of application of biopesticides. Quality control and limitations in production.	

UNIT III : Importance of Biofertilizers	**7 Hrs.**
Biofertilizer -Introduction, scope, concept and development. Characteristic features of bacterial biofertilizers, Azospirillum, Azotobacter, Azolla, Pseudomonas, Rhizobium and Frankia -Fungal biofertilizers-current scenario-list of cyanobacterial biofertilizers- Anabaena, Nostoc- AM mycorrhiza and ectomycorrhiza.	

UNIT IV : Mass Production of Biofertilizers	**6 Hrs.**
Phosphate solubilizing biofertilizer - Mechanism of phosphate solubilization and phosphate mobilization, K solubilizer, Zinc solubilizer. Production technology - strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.	

UNIT V : Formulations and Delivery System of Biofertilizers	**6 Hrs.**
Formulation– types– carrier based and liquid inoculants. Equipment's–tangential flow filtration (TFF) – centrifugation - freeze drying - Application technologies- dosage, method and time of application of biofertilizers for different crops - FCO specifications and quality control of biofertilizers - Liquid bio inoculant preservatives.	

Lecture Schedule

1. History and concept of biopesticides
2. Importance of biopesticides
3. Classification of biopesticides.
4. Botanical pesticides and their uses.
5. Mass production technology of biopesticides
6. Virulence and Pathogenicity of biopesticides
7. Symptoms of entomopathogens
8. Biocontrol of nematodes.
9. Microbial management of pests.
10. Mode of entry and mode of action biopesticides.Uses of biopesticides
11. Method of application of biopesticides.
12. Quality control of biopesticides
13. Limitations in biopesticides production.
14. Introduction to biofertilizer.
15. Scope and development of biofertilizers
16. Bacterial biofertilizers.

Mid Semester Examination

17. Current scenario of biofertilizers
18. Algal biofertilizers.
19. Fungal biofertilizers
20. Phosphate solubilizing biofertilizers.
21. Potassium and zinc releasing biofertilizers and their mechanism
22. Production technology of biofertilizers.
23. Strain selection, Sterilization, growth media and fermentation.
24. Formulations in biofertilizers
25. Techniques in carrier and liquid based biofertilizers.
26. Equipment's in biofertilizer production.
27. Equipment'stangential flow filtration (TFF) centrifugation-freeze drying.
28. Method of application of biofertilizers.
29. Dosageand time of application of biofertilizers for different crops.
30. FCO specifications of biofertilizers
31. Quality control of biofertilizers.
32. Preparation of biofertilizers projects

Practical schedule

1. Isolation and purification of *Trichoderma sp.*
2. Isolation and purification of *Pseudomonas* and *Bacillus sp.*
3. Isolation and purification of *Beauveria bassiana.*
4. Isolation and purification of Metarhizium
5. Identification of important botanicals.
6. Field visit to explore naturally infected cadavers.
7. Identification of entomopathogenic entities in field condition.
8. Quality control of biopesticides.
9. Isolation and purification of *Azospirillum,*
10. Isolation and purification of *Azotobacter,*
11. Isolation and purification of *Rhizobium,*
12. Isolation and purification of P-solubilizers.
13. Mass production of bacterial biofertilizers.
14. Isolation of AM fungi – wet sieving method.
15. Mass production of AM inoculants.
16. Visit to biopesticide and biofertilizer laboratory in nearby area.

Final Practical examination

Total Hours: 64

TEXT BOOKS:	
1.	Somani L.L. P, Shilkar& D. Shilpkar 2011. Biofertilizers Commercial Production Technology & Quality control. Agro Publishing Acadamy, Udaipur.
2.	DeshMukh, AM, R.M. Khobragade and P.P. Dixit 2007. Handbook of Biofertilizers and Biopesticides. Oxford Book Company, Jaipur, India.

REFERENCE BOOKS:	
1.	Acharya, K. Surjith Sen and Manjula Rai. 2019. Biofertilizers and Biopesticides Techno world.
2.	Chanda J. K. 2008. Biofertilizer Statistics 2006-07. Fertilizer Association of India, New Delhi.
3.	Gupta R.P., AnuKalia and Shammi Kapoor 2007. Bioinoculants a step towards Sustainable Agriculture, NIPA, New Delhi

WEB REFERENCES:	
1.	www.geocites.com
2.	www.insectariumvirtual.com
3.	www.nabard.org
4.	http://www.greenpeace.org
5.	www.hortsorb.com

U24AGB514	Micro Propagation Technologies	(2+1)

COURSE OBJECTIVES:

- Understand the principles and applications of plant tissue culture.
- Learn tissue culture media preparation, sterilization, and regeneration techniques.
- Study micropropagation methods for economically important crops.
- Develop practical skills in plant tissue culture and hardening techniques.
- Understand quality management and commercial applications of tissue culture.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the principles and applications of plant tissue culture.
CO2 :	Describe tissue culture media, sterilization, and regeneration methods.
CO3 :	Apply micropropagation techniques for different crop plants.
CO4 :	Demonstrate tissue culture laboratory techniques and culture maintenance.
CO5:	Explain hardening, quality management, and certification of tissue-cultured plants.
CO6 :	Develop project proposals for commercial tissue culture production and evaluate tissue culture enterprises.

UNIT I : Concept of *in vitro* culture and micro-propagation	**7 Hrs.**
Meaning and concept of in vitro culture and micro-propagation - Different concepts employed in micropropagation - Historical mile stones, advancement and future prospects of micropropagation; totipotency, dedifferentiation - Applications, advantages and limitations of tissue culture techniques - Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration - Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermolabile and disposal of remnants of culture - Laboratory organization, requirements, layout of small, medium and large scale Tissue culture laboratories.	

UNIT II : Components of the tissue culture media and stages	**6 Hrs.**
Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements, carbon source, hormones/ plant growth regulators, pH of the media, gelling agents - Different types of media. Preparation of media – Stocks and working media, preparation and storage. Plant regeneration pathways - Organogenesis and Somatic embryogenesis. Organo genesis - Purpose, methods and requirements for organogenesis, indirect and direct organogenesis. Somatic embryo genesis – Procedures and requirements for organogenesis, indirect and direct embryogenesis; Somatic and Gametic embryogenesis,	

UNIT III : Different Culture Methods	**7 Hrs.**
Haploid culture- Anther culture, pollen culture and Ovary culture- applications and limitations. Synthetic seed- Concepts, necessity, procedure and requirements for production of synthetic seeds. Artificial seed. Micro-propagation – Definition, methods, stages of micro-propagation and its	

significance. Axillary bud proliferation approach – Shoot tip and meristem culture. Factors affecting micropropagation-applications and limitations. Advancements and future prospects of in vitro culture – Techniques of single cell culture, suspension cultures. Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids). Production of secondary metabolites through cell culture techniques.

UNIT IV : Micropropagation techniques for different crops	**6 Hrs.**
Micropropagation-Definition, stages of micropropagation - Factors affecting micropropagation – applications and limitations. Micropropagation techniques in Banana, Neem, Bamboo, Casuarina, Sugarcane, Eucalyptus, Aloe vera, Phyllanthus, Gerbera, Coleus, Rose, Chrysanthemum and Orchids.	

UNIT V : Hardening certification and Quality management of TC plants.	**6 Hrs.**
Primary hardening of tissue cultured plants – requirements and layout of polyhouse. Secondary hardening of Tissue cultured plants- Requirements and layout of shade net provision. National certification and Quality management of TC plants - Genetic fidelity test and virus indexing in TC plants - Production of secondary metabolites through cell culture techniques. Public and private organizations involved in Plant Tissue culture in India - Preparation of Project proposal for establishing a commercial Tissue culture lab.	

Lecture Schedule

1. Meaning and concept of in vitro culture, micropropagation, totipotency, dedifferentiation. Different concepts employed in tissue culture. Scope of Plant Tissue culture.
2. Historical mile stones, advancement and future prospects of micropropagation; totipotency, dedifferentiation.
3. Different tissue culture techniques- applications, advantages and limitations.
4. Layout of Tissue culture, requirements and types- small, medium and large scale laboratories. Environmental requirements of Tissue culture unit.
5. Techniques of sterilization/asepsis for glass and metal ware, liquids both thermo stable and thermo labile, disposal of remnants of culture.
6. Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements.
7. Components of the tissue culture media- carbon source, hormones/ plant growth regulators, pH of the media, gelling agents.
8. Preparation of media – Stocks and working media, preparation and storage.
9. Genetic control of regeneration. Pathways of regeneration of plants and Regeneration methods- morphogenesis, organogenesis and embryogenesis.
10. Organogenesis-Purpose, methods and requirements for organogenesis, indirect and direct organogenesis.
11. Somatic embryogenesis and factors affecting somatic embryogenesis - Differences between gametic and somatic embryos.

12. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture. Applications and limitations.
13. Auxillary bud proliferation, shoot tip and meristem culture- application and limitations.
14. Anther culture, pollen culture and ovary culture- applications and limitations.
15. Production of virus free plants through Meristem tip culture.
16. Synthetic seeds and Artificial seed – Concept, necessity, procedure and requirements of synthetic seeds.

Mid Semester Examination

17. Micropropagation-Definition, stages of micropropagation - Factors affecting micropropagation –applications and limitations.
18. Micropropagation techniques in Banana and Neem
19. Micropropagation techniques Bamboo and Cassuarina
20. Micropropagation techniques in Sugarcane
21. Micropropagation techniques in Eucalyptus
22. Micropropagation techniques in Aloe vera and Phyllanthus
23. Micropropagation techniques in Gerbera and Coleus
24. Micropropagation techniques in Rose and Chrysanthemum
25. Micropropagation techniques in Orchids
26. Primary hardening of tissue cultured plants –requirements and layout of polyhouse.
27. Secondary hardening of Tissue cultured plants- requirements and layout of shade net provision.
28. National certification and Quality management of TC plants
29. Genetic fidelity test and virus indexing in TC plants.
30. Production of secondary metabolites through cell culture techniques.
31. Public and private organizations involved in Plant Tissue culture in India.
32. Preparation of Project proposal for establishing a commercial Tissue culture lab.

Practical schedule

1. Organization of tissue culture laboratory- small, medium and large scale laboratory layout.
2. Sterilization techniques used in tissue culture laboratory – Glass, plastic and metal ware.
3. Study and use of laminar flow unit for tissue culture.
4. Study and use of autoclaves for tissue culture.
5. Preparation of stock and working solutions of tissue culture media.
6. Sterilization techniques used in tissue culture laboratory media.
7. Filter Sterilization thermo labile compounds-Hormones and Vitamines and Aminoacids.
8. Preparation and inoculation of explants for direct organogenesis – Shoot tip, nodal

explants.

9. Preparation and inoculation of explants for callus production – Leaf, stem and root explants.
10. Determination of optimum concentration of hormones/ growth regulators for direct organogenesis – Shoots.
11. Determination of optimum concentration of hormones/ growth regulators for direct organogenesis – Roots.
12. Sub culturing for multiple shoots and calli produced in vitro.
13. Determination of optimum concentration of auxins to generate shoots from *in vitro* generated calli.
14. Preparation of synthetic seeds from somatic embryos and its storage.
15. Visit to commercial Tissue culture lab.
16. Visit to Accreditated Tissue Culture lab/NRC Banana, Trichy

Final Practical examination

Total Hours: 64

TEXT BOOKS:	
1.	R C Dubey, 1993, Text Book of Biotechnology: S. Chand Publishing, NewDelhi.
2.	B K Patnaik, 2014, Textbook of Biotechnology: Mc Graw Hill Education India, NewDelhi

REFERENCE BOOKS:	
1.	Gamborg, O.L. and Phillips, G.C. 1995. Plant Cell Tissue Organ Culture: Fundamental Methods. Springer, Berlin.
2.	Keshavachandran, R. and Peter, K.V. 2008. Pant Biotechnology: Methods in Tissue Cultureand Gene Transfer. Universities Press, Hyderabad. 224
3.	Smith, R.H., 2013. Plant Tissue Culture: Techniques and Experiments. 3rd ed. AcademicPress, San Diego, CA, USA.
4.	Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture, Theory and Practice. Elsevier,Netherlands.
5.	Bhojwani, S.S. and Dantu, P.K. 2013. Pant Tissue Culture: An Introductory Text. Springer,India, New Delhi.

WEB REFERENCES:	
1.	https://doi.org/10.1007/978-981-15-1906-2.
2.	http://www.agbiotechnet.com
3.	http://www.agbioworld.org
4.	http://www.agbiosafety.unl.edu/
5.	http://www.edugreen.teri.res.in/explore/bio/breed.html

U24UMP591	Takshashila Innovative Learning -V	(0+1)

Topic: Drones and IoT in Agricultural Learning

COURSE OBJECTIVES:

• Understand the fundamentals of drones and IoT in agriculture.
• Learn the applications of drones for crop monitoring and precision farming.
• Explore IoT-based smart farming technologies and sensor systems.
• Develop skills in collecting, analyzing, and interpreting agricultural data.
• Promote the adoption of digital technologies for sustainable agriculture.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1 :	Explain the concepts of drones and IoT in agriculture.
CO2 :	Demonstrate the use of drones for agricultural applications.
CO3 :	Apply IoT sensors for smart farm monitoring.
CO4 :	Analyze agricultural data for informed decision-making.
CO5 :	Evaluate the role of digital technologies in precision and sustainable agriculture.

COURSE STRUCTURE:

• Introduction to Drones and IoT in Agriculture
• Drone Components, Operation, and Agricultural Applications
• IoT Sensors, Smart Farming, and Data Collection
• Precision Agriculture and Data Analytics
• Hands-on Demonstration and Case Studies

WEEKLY PLAN:

Week	Topics
Week 1	Introduction to Drones, IoT, and Digital Agriculture
Week 2	Drone Components, Flight Principles, Regulations, and Safety
Week 3	Drone Applications in Crop Monitoring, Spraying, and Mapping
Week 4	IoT Fundamentals, Sensors, GPS, Weather Stations, and Smart Devices
Week 5	IoT-Based Smart Irrigation, Soil Moisture Monitoring, and Farm Automation
Week 6	Precision Agriculture, GIS, Remote Sensing, and Data Collection
Week 7	Hands-on Demonstration of Drones and IoT Devices, Case Studies
Week 8	Mini Project Presentation, Future Trends, and Course Assessmen

U24UMP593	Green credit -V	(0+1)

TERRACE GARDEN ESTABLISHMENT

COURSE OBJECTIVES

- To illustrate the methods and techniques for growing vegetables & their cultural activities in terrace conditions due to the absence of sufficient knowledge on terrace cultivation.
- To analyze the management practices associated with water, soil, pest etc.

COURSE OUTCOMES

After completion of the course, the students will be able to

CO1 – Gain knowledge in the popular methods used in terrace gardening and understand the benefits of growing our own food. **(K2)**

CO2 – Acquire the practices of safe, pesticide-free, healthy green and fresh fruits or vegetables via terrace gardening. **(K4)**

MODULE -1 INTRODUCTION

- Definition and importance of terrace gardening
- Types of terrace gardening
- Selection of site and layout
- Benefits of a terrace garden
- Basic tools and materials required

MODULE-2 MANAGEMENT PRACTICES

- Water management
- Soil management
- Pest management
- Plant maintenance
- Plant protection measures