TAKSHASHILA UNIVERSITY

(Tamil Nadu State Private University)

ONGUR, TINDIVANAM TK, VILLUPURAM DT

FACULTY OF SCIENCES

SCHOOL OF AGRICULTURAL SCIENCES

Department of Agriculture

REGULATION 2025NEP

CURRICULUM & SYLLABI

B.Sc. (Hons.) Agriculture

Semester – II

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** : 2026-2030

Program: B.Sc. (Hons.) Agriculture **Regulation** : R25

SEMESTER II							
Sl. No.	**Course code**	**Course title**	**Category**	**Credit hours**	**Maximum marks**		
					CAM	**ESM**	**Total**
Program Core							
1.	U25AG10B	Soil Fertility Management	PC	3 (2+1)	60	40	100
2.	U25AG11B	Fundamentals of Entomology	PC	3 (2+1)	60	40	100
3.	U25AG12B	Livestock and Poultry Management	PC	2 (1+1)	60	40	100
4.	U25AG13B	Fundamentals of Plant Pathology	PC	3 (2+1)	60	40	100
Ability Enhancement Course							
5.	U25AG14B	Personality Development	AEC	2 (1+1)	60	40	100
6.	U25AG15P U25AG16P	National Service Scheme - II / National Cadet Corps - II	AEC	1 (0+1)	100	-	100
7.	U25TA09P	**Illakiyangalil velanmaiyum ariviyal thamizh payanaakamum /**	AEC	1 (0+1)	100	-	100
	U25EN09P	**Development Education**					
Skill Enhancement Course							
8.	U25AG17P	Seed Production Technology	SEC	2 (0+2)	100	-	100
9.	U25AG18P	Post Harvest Processing Technology	SEC	2 (0+2)	100	-	100
Value Added Course							
10.	U25VA04T	Introduction to Indian Knowledge System*	VAC	1 (1+0)*	100	-	100
11.	U25VA12B	Environmental Studies and Disaster Management	VAC	3 (2+1)	60	40	100
Total				**22 (10+12)**	**860**	**240**	**1100**

PC – Program Core

SEC – Skill Enhancement Course

DSE – Discipline Elective

GE – Generic Elective

AEC – Ability Enhancement Course

MDC – Multi- Disciplinary Course

VAC – Value Added Course

UM – University Mandatory Course

* - Non Gradial course

(BOS Chairman)

U25AG10B	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

U25AG11B	Fundamentals of Entomology	(2+1)

COURSE OBJECTIVES:

• To understand the history, scope, importance, external morphology, and body organization of insects in relation to agriculture.
• To explain the anatomy and physiology of major organ systems in insects and their functional significance.
• To describe insect growth, development, reproduction, ecology, pest categorization, and the principles of pest surveillance and forecasting.
• To apply the principles of insect taxonomy, classification, and nomenclature for the identification of agriculturally important insect groups.
• To differentiate the distinguishing characteristics of economically important insect orders and families of Exopterygota and Endopterygota.

COURSE OUTCOMES:

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

CO1 :	Describe the significance of entomology, classify insects within Arthropoda, and explain the morphology and body organization of insects.
CO2 :	Illustrate the structure and functions of various organ systems and explain the physiological processes occurring in insects.
CO3 :	Explain insect reproduction, metamorphosis, diapause, ecology, pest categories, and the role of surveillance and forecasting in pest management.
CO4 :	Classify and identify agriculturally important insect orders and families using taxonomic principles and diagnostic characteristics.
CO5 :	Recognize and differentiate economically important insect families belonging to Exopterygota and Endopterygota based on their morphological features and agricultural importance.
CO6 :	Collect, preserve, identify, and classify agriculturally important insects based on their external morphology and taxonomic characters; perform basic insect dissections, estimate insect populations using standard sampling techniques, and demonstrate safe handling of insecticides and pesticide application equipment.

UNIT I : History, Importance and External Morphology	7 Hrs.
Entomology as a science - its importance in Agriculture, History of Entomology in India – Position of insects in the animal kingdom and their relationship with other classes of Arthropoda - Reasons for insect dominance - General organisation of insect body wall - structure and function, cuticular appendages, moulting - Body regions - insect head, thorax and abdomen, their structures and appendages.	

UNIT II : Insect Anatomy	8 Hrs.
Structure and functions of digestive – circulatory – excretory – respiratory – nervous - secretory (Endocrine) and reproductive systems in insects.	

UNIT III : Insect physiology, Ecology, Pest categories	7 Hrs.
Types of reproduction in insects - Metamorphosis and diapause in insects - Types of larvae and pupae - Major sensory organs - Introduction, ecology, environment and its components - Effect of abiotic factors and biotic factors - Categories of pests - Surveillance and forecasting.	

UNIT IV : Taxonomy of Exopterygota	5 Hrs.
Taxonomy, Classification and nomenclature of insects - Distinguishing characters of agriculturally important orders and families of Exopterygotes – Odonata - Orthoptera (Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae) - Dictyoptera (Blattidae, Mantidae) - Isoptera - Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae), and Thysanoptera.	

UNIT V - Taxonomy of Endopterygota	5 Hrs.
Distinguishing characters of agriculturally important families of Lepidoptera (Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae) - Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae) - Diptera (Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae) - Hymenoptera (Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae), and Neuroptera (Chrysopidae).	

Lecture Schedule

1. History of Entomology in India – classification of phylum arthropoda with classes - relationship with other members of Arthropoda.

2. Insect dominance - structural, morphological and physiological factors responsible for dominance.
3. Insect body wall - its structure and function, cuticular appendages.
4. Moulting process in insects.
5. Structure of insect head and its appendages.
6. Structure of insect thorax and its appendages.
7. Structure of insect abdomen and its appendages.
8. Digestive system - structure of alimentary canal and its modifications in certain groups. Digestive enzymes, digestion and absorption of nutrients.
9. Circulatory system in insects - haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions.
10. Excretory system in insects - malpighian tubules - accessory excretory organs and physiology of excretion
11. Respiratory system in insects - structure of trachea - tracheoles - types of respiratory system - types of spiracles - respiration in aquatic and endoparasitic insects.
12. Nervous system in insects - structure of neuron – types of nervous systems.
13. Conduction of nerve impulses - axonic and synaptic transmissions.
14. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
15. Male and female reproductive systems in insects – structure and modifications. Spermatogenesis and Oogenesis
16. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony, ovoviporous and parthenogenesis.

Mid Semester Examination

17. Metamorphosis and diapause in insects. Immature stages of insects
18. Structure of sense organs - types of sensilla - photoreceptors; chemoreceptors and mechanoreceptors
19. Definition of insect ecology and introduction to environment and its components
20. Effect of abiotic factors- temp, moist, humidity, RF, light and air on the population of insects
21. Effect of biotic factors- food competition, biotic potential and environmental resistance on the population of insects
22. Categories of pests, ETL, EIL, surveillance and forecasting
23. Taxonomy, importance, history and development of insects.
24. Classification and nomenclature of insects. Definition of biotype, sub species, species, genus, family and order
25. Distinguishing characters of Agricultural important orders and family of Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata

26. Isoptera: Termitidae; Thysanoptera: Thripidae
27. Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae
28. Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae
29. Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae
30. Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae
31. Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae
32. Neuroptera: Chrysopidae.

Practical schedule

1. Collection and preservation of insects including immature stages of insects
2. Observations on external features of grasshopper / blister beetle
3. Types of insect head and antennae
4. Types of mouth parts in insects
5. Types of insect legs and wings, Insect abdomen and its appendages
6. Types of immature stages of insects.
7. Dissection of digestive system in insect (Grasshopper)
8. Study of characters of Orders of Odonata, Dictyoptera (Mantidae, Blattidae) and Orthoptera (Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae)
9. Study of characters of Orders of Phasmida, Psocoptera, Dermaptera, Isoptera (Termitidae) and Thysanoptera (Thripidae)
10. Study of characters of Orders of Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae, Tingidae, Diaspididae, Kerridae, Membracidae, Miridae, Cicadidae)
11. Study of characters of Orders of Lepidoptera (Pieridae, Papiloinidae, Lycaenidae, Hesperiidae, Cochlidiidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Nymphalidae, Lymantriidae, Saturniidae, Bombycidae, Plutellidae)
12. Study of characters of Orders of Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Apionidae, Melolonthidae, Anobiidae, Bostrychidae, Meloidae, Buprestidae)
13. Study of characters of Orders of Hymenoptera (Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae, Sphecidae, Vespidae, Formicidae, Xylocopidae, Bethylidae, Agaonidae)
14. Study of characters of Orders of Diptera (Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae, Syrphidae) and Neuroptera (Chrysopidae, Myrmeleontidae, Ascalaphidae)
15. Insecticides and their formulations- Pesticide appliances and their maintenance

16. Sampling techniques for estimation of insect population and damage

Final Practical Examination.

Total Hours: 64

TEXT BOOKS :	
1.	Pedigo, L.P. & Rice, M.E. (2014). Entomology and Pest Management (6th ed.). Waveland Press.
2.	Chapman, R.F. (2013). The Insects: Structure and Function (5th ed.). Cambridge University Press.
3.	Gullan, P.J. & Cranston, P.S. (2014). The Insects: An Outline of Entomology (5th ed.). Wiley-Blackwell.
4.	Atwal, A.S. & Dhaliwal, G.S. (2015). Agricultural Pests of South Asia and Their Management. Kalyani Publishers.
5.	Vasantharaj David, B. & Ramamurthy, V.V. (2016). Elements of Economic Entomology (8th ed.). Brillion Publishing.

REFERENCE BOOKS :	
1.	Triplehorn, C.A. & Johnson, N.F. (2005). Borror and DeLong's Introduction to the Study of Insects (7th ed.). Brooks/Cole.
2.	Resh, V.H. & Cardé, R.T. (Eds.). (2009). Encyclopedia of Insects (2nd ed.). Academic Press.
3.	Hill, D.S. (2008). Pests of Crops in Warmer Climates and Their Control. Springer.
4.	Capinera, J.L. (Ed.). (2008). Encyclopedia of Entomology (2nd ed.). Springer.
5.	Dent, D. (2000). Insect Pest Management (2nd ed.). CABI Publishing.

WEB REFERENCES :	
1.	https://www.fao.org
2.	https://www.cabi.org
3.	https://ncipm.icar.gov.in
4.	https://entsoc.org/
5.	https://www.icipe.org/

U25AG12B	Livestock and Poultry Management	(1+1)

COURSE OBJECTIVES:

- Understand the importance of livestock and poultry in sustainable agriculture and the national economy.
- Acquire knowledge of breeding, housing, reproduction, and management of livestock and poultry.
- Explain animal nutrition, digestion, feed resources, and ration formulation.
- Develop practical skills in livestock and poultry production, feeding, and biosecurity.
- Apply disease prevention, vaccination, and health management practices for sustainable production.

COURSE OUTCOMES:

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

CO1 :	Explain the role of livestock and poultry in the agricultural economy and demonstrate scientific management practices for different classes of farm animals.
CO2 :	Identify important Indian and exotic breeds of livestock and poultry and apply appropriate breeding, housing and production management practices.
CO3 :	Explain the principles of digestion, nutrition, feed resources and formulate balanced rations for livestock and poultry.
CO4 :	Apply suitable feeding strategies, feed supplements and feed additives for improving livestock and poultry productivity.
CO5 :	Diagnose common livestock and poultry diseases and recommend appropriate preventive, biosecurity and health management measures.
CO6 :	Evaluate livestock and poultry production systems and prepare economically viable and sustainable farm management plans, incorporating animal welfare, environmental sustainability, and efficient resource utilization.

UNIT I : Role and Management of Livestock in the Economy	**4 Hrs.**
Importance of livestock in the national economy - Reproduction in farm animals and poultry - Housing principles and space requirements for livestock and poultry - Management of calves, growing heifers, and milch animals.	

UNIT II: Poultry and Livestock Breeds & Management	4 Hrs.
Management of sheep, goat, and swine - Incubation, hatching, and brooding in poultry - Management of growers and layers - Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine, and poultry.	

UNIT III: Nutrition and Digestion in Livestock and Poultry	3 Hrs.
Digestion in livestock and poultry - Classification of feedstuffs - Proximate principles of feed - Nutrients and their functions.	
UNIT IV: Feeding and Supplements for Livestock and Poultry	**3 Hrs.**
Feed ingredients for ration formulation - Feed supplements and feed additives - Feeding methods and strategies for livestock and poultry.	

UNIT V - Livestock and Poultry Diseases & Prevention	2 Hrs.
Introduction to livestock and poultry diseases - Prevention and control of diseases, including vaccination schedules - Common diseases affecting livestock and poultry and their management.	

Lecture Schedule

1. Introduction to Livestock and Poultry, Importance of livestock in the national economy and Contribution of livestock to agriculture and rural development.
2. Reproduction in Farm Animals and Poultry - Basics of animal reproduction and Breeding techniques and reproductive management.
3. Housing and Space Requirements - Principles of housing for different livestock species - Space management for cattle, buffalo, sheep, goats, swine, and poultry.
4. Management of Young and Milch Animals - Care and management of calves and growing heifers - Management of milch animals for optimal milk production.
5. Management of Sheep, Goat, and Swine - Feeding, breeding, and disease management in small ruminants - Swine farming practices.
6. Incubation, Hatching, and Brooding - Poultry incubation and hatching process - Brooding management for chicks.
7. Management of Growers and Layers - Feeding and management of broilers and layers - Productivity enhancement techniques.
8. Important Indian and Exotic Breeds - Cattle, buffalo, sheep, goat, swine, and poultry breeds - Characteristics and selection of breeds for farming.Improvement of Farm Animals and Poultry - Selective breeding and genetic improvement - Artificial insemination and embryo transfer.

Mid Semester Examination.

9. Digestion in Livestock and Poultry - Digestive system of ruminants and monogastric animals - Role of digestive enzymes and microbial fermentation.
10. Classification of Feedstuffs and Nutrient Functions - Types of feedstuffs (roughages, concentrates, etc.).
11. Nutrient functions and requirements for livestock and poultry.
12. Feed Ingredients for Ration Formulation - Common ingredients in livestock and poultry diets - Balancing rations for optimal growth and production.
13. Feed Supplements and Additives - Role of minerals, vitamins, and probiotics - Growth promoters and their effects.
14. Feeding Practices for Livestock and Poultry - Methods of feeding different species - Seasonal feeding strategies.
15. Introduction to Livestock and Poultry Diseases - Common bacterial, viral, and parasitic diseases - Symptoms and transmission of major diseases.
16. Disease Prevention and Control - Biosecurity measures and vaccination schedules - Disease control strategies and farm hygiene.

Practical Schedule

1. Identification of External Body Parts
2. Handling and Restraining of Livestock
3. Identification Methods for Farm Animals and Poultry
4. Breed Identification and Farm Visits
5. Judging of Cattle, Buffalo, and Poultry
6. Culling of Livestock and Poultry
7. Housing Planning and Layout Design
8. Ration Computation for Livestock
9. Formulation of Concentrate Mixtures
10. Clean Milk Production and Milking Methods
11. Hatchery Operations and Incubation Equipment
12. Management of Chicks, Growers, and Layers
13. Debeaking, Dusting, and Vaccination
14. Farm Records and Daily Routine Operations
15. Economic Analysis of Livestock and Poultry Production
16. Farm Hygiene and Biosecurity Measures.

Final Practical Examination.

Total Hours: 48

TEXT BOOKS:	
1.	ICAR (2002). Handbook of Animal Husbandry (4th ed). New Delhi: ICAR. 1549p.
2.	G.C. Banerjee (2013). A Text Book of Animal Husbandry (8th ed). New Delhi: Oxford and IBH Publishing Company Private Limited. 1079p.
3.	Lesson, S and Summers, J. D. (2001). A text book of Scott Nutrition of the chicken (4th ed). Canada: University books. 586p.
4.	Reddy, D. V. (2001). Principles of animal nutrition and feed technology (2nd ed). Oxford and New Delhi: IBH Publishing Company Private Limited. 425p.
5.	Sastry, N.S.R and Thomas, C.K. (2005). Livestock Production Management. (3rd ed). Ludhiana: Kalyani Publishers. 850p

REFERENCE BOOKS:	
1.	ICAR (2002). Handbook of Animal Husbandry (4th ed). New Delhi: ICAR. 1549p.
2.	G.C. Banerjee (2013). A Text Book of Animal Husbandry (8th ed). New Delhi: Oxford and IBH Publishing Company Private Limited. 1079p.
3.	Lesson, S and Summers, J. D. (2001). A text book of Scott Nutrition of the chicken (4th ed). Canada: University books. 586p.
4.	Reddy, D. V. (2001). Principles of animal nutrition and feed technology (2nd ed). Oxford and New Delhi: IBH Publishing Company Private Limited. 425p.
5.	Sastry, N.S.R and Thomas, C.K. (2005). Livestock Production Management. (3rd ed). Ludhiana: Kalyani Publishers. 850p

WEB REFERENCES:	
1.	https://www.drvet.in/p/e-books.html
2.	https://www.coursera.org/lecture/livestock-farming/1-3-farming-101-the-basics-of-livestock-production-wfhyL
3.	http://www.tanuvas.ac.in/e-learning/objectivities.html
4.	https://ecourses.icar.gov.in/

U25AG13B	Fundamentals of Plant Pathology	(2+1)

COURSE OBJECTIVES:

• To study the basic concepts of plant pathology, including the nature, causes, symptoms, and economic importance of plant diseases.
• To Identify and classify plant diseases based on causal organisms, symptoms, and disease development processes.
• To know the biology, morphology, reproduction, and characteristics of major plant pathogens such as fungi, bacteria, viruses, viroids, mollicutes, and protozoa.
• To Study the disease cycle, epidemiology, host–pathogen interactions, and environmental factors influencing disease development.
• To know the principles of plant disease management, including cultural, chemical, biological, host resistance, and integrated disease management (IDM) strategies for sustainable crop protection.

COURSE OUTCOMES:

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

CO1 :	Understand the concepts, terminology, causes, symptoms, and historical development of plant pathology and recognize the economic importance of plant diseases.
CO2 :	Remember the plant diseases based on causal organisms and symptoms, and describe the disease cycle, infection process, and epidemiology.
CO3 :	Identify the major groups of plant pathogens and explain their morphology, reproduction, classification, and role in causing plant diseases.
CO4 :	Remember the structure, replication, transmission, and management of plant viruses and viroids, and explain the disease triangle concept.
CO5 :	Analyze the plant disease management strategies by integrating cultural, chemical, host resistance, and integrated disease management (IDM) approaches for sustainable agriculture.
CO6:	Diagnose common plant diseases based on symptoms and causal organisms, and recommend suitable preventive and management measures for effective disease control.

Unit I: Introduction to Plant Pathology	06 Hrs.
Concept of Disease in Plants - Definition, economic importance, symptoms - Terms Used in Plant Pathology - Terminologies, key definitions - History of Plant Pathology - Contributions of scientists, special references to India - Causes of Plant Disease: Inanimate Factors - Abiotic factors (temperature, moisture, soil, etc.) - Causes of Plant Disease: Animate Factors - Biotic agents (fungi, bacteria, viruses, nematodes, etc.).	

Unit II: Classification of Plant Diseases	06 Hrs.
Classification of Plant Diseases - Based on pathogens and symptoms - Parasitism and Pathogenesis - Mechanisms, infection process, host-pathogen interaction - Development of Disease in Plants - Disease Cycle - Primary inoculum, infection chain, secondary inoculum and epidemiology.	

Unit III: Pathogen Groups	07 Hrs.
Disease Triangle Concept - Interactions between host, pathogen, and environment. Fungi: Morphology and Reproduction - Structure, reproduction (sexual/asexual) - Classification of Fungi - Major groups of plant pathogenic fungi - Bacteria: Morphology & Reproduction -Characteristics, bacterial reproduction - Other Pathogens: Mollicutes and Protozoa -Mycoplasma-like organisms, flagellates.	

Unit IV: Viruses and Viroids	06 Hrs.
Introduction to Plant Viruses – Structure and Characteristics -Replication and Multiplication of Plant Viruses -Plant Viroids – Characteristics and Importance - Virus Transmission by Insect Vectors - Mechanical, Seed, Pollen and Vegetative Transmission of Plant Viruses - Diagnosis and General Management of Viral Diseases.	

Unit V: Plant Disease Management	07 Hrs.
Principles of Plant Disease Management – Basic approaches. Chemical Control of Plant Diseases – Fungicides, bactericides - Host Resistance in Disease Management - Genetic resistance, breeding for resistance - Integrated Disease Management (IDM) - Concept & Importance - Combining methods for effective control - Fungal Disease Management – Example diseases like rust, smut - Cultural Methods in Disease Control - Crop rotation, sanitation, irrigation -Viral Disease Management -Example diseases like mosaic, leaf curl. Emerging Plant Pathogens and Future Threats - Climate change impact.	

Lecture Schedule

1.Introduction to Plant Pathology – Concept and Scope of Plant Diseases.

2.Definition, Economic Importance and Types of Plant Diseases.

3. Symptoms of Plant Diseases and Disease Terminologies.

4. History of Plant Pathology – Contributions of International Scientists.

5. History of Plant Pathology – Contributions of Indian Plant Pathologists.

6. Causes of Plant Diseases – Abiotic and Biotic Factors.

7. Classification of Plant Diseases Based on Pathogens.

8.Classification of Plant Diseases Based on Symptoms.

9. Parasitism, Pathogenicity and Host–Pathogen Interaction.

10. Infection Process and Mechanisms of Pathogenesis.

11. Disease Cycle – Primary Inoculum, Infection and Secondary Inoculum.

12. Epidemiology of Plant Diseases and Factors Influencing Disease Development.

13. Disease Triangle and Plant Disease Development.

14. Morphology and Structure of Plant Pathogenic Fungi.

15. Reproduction in Fungi – Sexual and Asexual Methods.

16. Classification of Plant Pathogenic Fungi.

Mid semester Examination

17. Morphology, Characteristics and Reproduction of Plant Pathogenic Bacteria.

18. Mollicutes (Phytoplasmas) and Their Importance in Plant Diseases.

19. Protozoa and Other Minor Plant Pathogens.

20. Introduction to Plant Viruses – Structure and Characteristics.

21. Replication and Multiplication of Plant Viruses.

22.Plant Viroids – Characteristics and Importance.

23. Virus Transmission by Insect Vectors.

24. Mechanical, Seed, Pollen and Vegetative Transmission of Plant Viruses.

25. Diagnosis and General Management of Viral Diseases.

26. Principles of Plant Disease Management.

27.Chemical Control of Plant Diseases – Fungicides and Bactericides.

28.Host Resistance and Breeding for Disease Resistance.

29. Integrated Disease Management (IDM) – Concept and Components.

30.Cultural Methods and Management of Fungal Diseases (Rusts and Smuts).

31. Management of Viral Diseases (Mosaic and Leaf Curl Diseases).

32. Emerging Plant Pathogens, Climate Change and Future Challenges in Plant Disease Management.

Practical schedule

1. Study of the Microscope.
2. Familiarization with Laboratory Materials and Equipment.
3. Study of Different Plant Disease Symptoms.
4. Microscopic Examination of Fungal Structures.
5. Simple Staining of Bacteria.
6. Gram Staining of Bacteria.
7. Microscopic Examination of Fungal Diseased Specimens.
8. Microscopic Examination of Bacterial Diseased Specimens.
9. Preparation of Culture.
10. Isolation of Fungal Pathogens from Diseased Plants.
11. Isolation of Bacterial Pathogens from Diseased Plants.
12. Isolation of Viral Pathogens from Diseased Plants.
13. Purification of Plant Pathogens.
14. Study of Plant Disease Diagnosis.
15. Characteristics and Formulation of Fungicides.
16. Methods of Application and Calculation of Fungicide Dosage.

Final Practical Examination.

Total Hours: 64

TEXT BOOKS :	
1.	Agrios G N, "Plant Pathology", 5th Edition Academic Press, New York, 2005.
2.	Vidhyasekaran P, "Principles of Plant Pathology", CBS Publishers and Distributers, New Delhi, 2010..
3.	Singh R S, "Introduction to Principles of Plant Pathology "(4th Edition), Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi., 2017.

REFERENCE BOOKS :	
1.	Chattopadhyay S B " Principles and Procedures of Plant Protection", Oxford Book Company, 2019.
2.	Schumann GL and D'Arcy C J, "Essential Plant Pathology" (2nd Edition), APS Press, 2010.
3.	Matthews, R.E.F., "Plant Virology" (4th Edition), Academic Press, (2012).

WEB REFERENCES	
1.	https://en.wikipedia.org/wiki/Fungus
2.	https://www.apsnet.org/edcenter/intropp/topics/Pages/Plant DiseaseDiagnosis.aspx

Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.

UNIT II: Individual Behaviour, Perception and Learning	**3 Hrs.**
Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution – Learning theories and principles of learning.	

UNIT III: Learning, Organizational behaviour, Training and Learning feedback	**3 Hrs.**
Learning and organizational behavior: Elements, Theories and Models of Organisational Behaviour - Learning and training: Types of Training; Learning vs Training and importance of Training -Learning feedback: functions and types of Feedback.	

UNIT IV: Attitude, Values, Intelligence and Motivation	**3 Hrs.**
Attitude and values - Intelligence: Types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behaviour, emotional intelligence.	

UNIT V: Motivation, Teamwork and Group Dynamics	**3 Hrs.**
Motivation: theories and principles - Teamwork: Meaning of Team and Teamwork, Team Development, Types of Team, Factors affecting Teamwork, Enhancing Teamwork, Qualities of an effective team player -Group Dynamics: Meaning, Types, Stages, Functions of Group Dynamics and Factors affecting Group Dynamics.	

Lecture Schedule

1. Personality: Definition, Nature of personality, theories of personality and its types.
2. The humanistic approach - Maslow's self-actualization theory, shaping of personality.
3. Determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours.
4. Personality and Organizational Behaviour: Meaning, Definitions, Types of Personality, Personality Traits, Factors influencing the personality; Personality and Organizational Behaviour.
5. Foundations of individual behavior and factors influencing individual behavior, Models of individual behaviour.
6. Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution, Errors of Perception.

U25AG14B	Personality Development	(1+1)

COURSE OBJECTIVES:

• To understand personality theories and determinants and their influence on organizational behavior.
• To learn the individual behavior, perception and attribution in organizational contexts.
• To know the learning theories, attitudes and values to enhance individual and organizational effectiveness.
• To understand intelligence, emotional intelligence and motivation theories for improving workplace performance.
• To gain knowledge in teamwork and group dynamics skills for effective collaboration and leadership.

COURSE OUTCOMES:

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

CO1 :	Explain the concepts, theories, and determinants of personality and their influence on organizational behaviour.
CO2 :	Describe individual behaviour, perception, attribution and learning theories and their application in organizations.
CO3 :	Explain organizational behaviour, distinguish learning from training and evaluate the role of feedback in learning.
CO4 :	Analyze attitude, values, intelligence, emotional intelligence and motivation in relation to individual and organizational performance.
CO5 :	Explain motivational theories, teamwork and group dynamics for effective collaboration and organizational success.
CO6 :	Apply personality development concepts, communication, teamwork, leadership, conflict management and interpersonal skills to enhance personal effectiveness and professional competence.

UNIT I: Personality	**4 Hrs.**
Personality Definition, Nature of personality, theories of personality and its types - The humanistic approach - Maslow's self-actualization theory, shaping of personality, determinants of personality,	

Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.

UNIT II: Individual Behaviour, Perception and Learning	**3 Hrs.**
Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution – Learning theories and principles of learning.	

UNIT III: Learning, Organizational behaviour, Training and Learning feedback	**3 Hrs.**
Learning and organizational behavior: Elements, Theories and Models of Organisational Behaviour - Learning and training: Types of Training; Learning vs Training and importance of Training -Learning feedback: functions and types of Feedback.	

UNIT IV: Attitude, Values, Intelligence and Motivation	**3 Hrs.**
Attitude and values - Intelligence: Types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behaviour, emotional intelligence.	

UNIT V: Motivation, Teamwork and Group Dynamics	**3 Hrs.**
Motivation: theories and principles - Teamwork: Meaning of Team and Teamwork, Team Development, Types of Team, Factors affecting Teamwork, Enhancing Teamwork, Qualities of an effective team player -Group Dynamics: Meaning, Types, Stages, Functions of Group Dynamics and Factors affecting Group Dynamics.	

Lecture Schedule

1. Personality: Definition, Nature of personality, theories of personality and its types.
2. The humanistic approach - Maslow's self-actualization theory, shaping of personality.
3. Determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours.
4. Personality and Organizational Behaviour: Meaning, Definitions, Types of Personality, Personality Traits, Factors influencing the personality; Personality and Organizational Behaviour.
5. Foundations of individual behavior and factors influencing individual behavior, Models of individual behaviour.
6. Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution, Errors of Perception.

7. Learning: Meaning and definition, theories and principles of learning.
8. Learning and organizational behavior: Meaning, Definition, Elements, Theories and Models of Organisational Behaviour.

Mid Semester Examination.

9. Learning and training: Meaning, Definitions, Types of Training; Learning vs Training and importance of Training.
10. Learning feedback: Meaning, Definitions, functions and types of Feedback.
11. Attitude and values: Meaning, definition, types of Attitude and Values.
12. Intelligence- Types of Intelligence, Theories of intelligence, Measurements of intelligence.
13. Factors influencing intelligence, intelligence and Organizational behavior; Emotional intelligence: Meaning. Significance and Benefits of Emotional Intelligence.
14. Motivation- Meaning, Definitions, Types, Theories and Principles of Motivation.
15. Teamwork: Meaning of Team and Teamwork, Team Development, Types of Team, Factors affecting Teamwork, Enhancing Teamwork, Qualities of an effective team player.
16. Group Dynamics: Meaning, Types, Stages, Functions of Group Dynamics and Factors affecting Group Dynamics.

Practical Schedule

1. Practicing MBTI personality analysis.
2. Studying Learning Styles and Strategies.
3. Understanding Motivational needs.
4. Fundamental Interpersonal Relations Orientation (Firo-B).
5. Understanding Social Skills.
6. Practicing active listening.
7. Interpersonal Communication.
8. Exercise on individual presentation.
9. Practicing teamwork and team building.
10. Understanding Group Dynamics.
11. Win-win game.
12. Study about Conflict Management.
13. Understanding Leadership styles.
14. Case studies on Personality.
15. Case studies on Organizational Behavior.
16. Mock Interview and Personality Development Exercises.

Final Practical Examination.

Total Hours: 48

TEXT BOOKS :	
1.	Poonam Arya and Hemant Kumar Watts, 2025. "Personality Development", Kalyani Publisher, ISBN:978-93-6440-843-1
2.	Shaffer D R, 2009. "Social and Personality Development" (6th Edn.). Belmont, CA: Wadswor.

REFERENCE BOOKS :	
1.	Lucas Stephen, 2001, "Art of Public Speaking", Tata - Mc-Graw Hill, New Delhi.
2.	Smith B. 2004, "Body Language" Rohan Book Company, New Delhi.
3.	Kumar Pravesh, 2005. "All about Self- Motivation", Goodwill Publishing House, New Delhi.
4.	Andrews Sudhir, 2008. "How to Succeed at Interviews" McGraw-Hill, New Delhi.

WEB REFERENCES :	
1	https://www.simplypsychology.org
2	https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BSS201%20-%20PERSONALITY.pdf
3	https://swayam.gov.in

U25AG15P	National Service Scheme - II	(0+1)

COURSE OBJECTIVES:

• To familiarize students with the organizational structure and functioning of the National Service Scheme (NSS).
• To develop leadership, social responsibility, and community service skills through NSS activities.
• To promote awareness of environmental conservation, health, gender equality, and rural development.
• To encourage active participation in community outreach, awareness campaigns, and special village camps.

COURSE OUTCOMES:

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

CO1 :	Explain the organizational structure, objectives, and functioning of the National Service Scheme (NSS).
CO2 :	Plan and participate in NSS programmes, awareness campaigns, and campus development activities.
CO3 :	Demonstrate leadership, teamwork, and communication skills through community service and special camps.
CO4 :	Promote environmental conservation, health awareness, gender equality, and social welfare through extension activities.
CO5 :	Develop a sense of social responsibility, civic engagement, and commitment to sustainable community development.

Practical / Awareness Activities

Practical Schedule:

1. 1–3: Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machineries and NGOs.
2. Campaign on ill effects of plastics in the adjoining campus areas –Villages / urban areas.
3. Campaign on Parthenium eradication.
4. Cycle rally on air pollution –Vehicle exhaust and other means.
5. Popularization of biogas and smokeless chulah.
6. Demonstration on the use of wind energy and solar energy.
7. Demonstration of water harvesting techniques.

8. Demonstration on soil conservation techniques wherever possible.
9. Campaign on Community health programmes of central and state Government –involving Health department officials.
10. AIDS awareness campaign; campaign on diabetes and healthy food habits and drug abuse
11. Planning formation of blood donors club –involving NGOs.
12. Campaign on gender equality and women empowerment.
13. Campaign on child health care –immunization, food habits and child labour abolition.
14. 14, 15, 16. Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers day, Sports meet and other University / College functions. NSS Volunteers will attend one special camp in the selected village for a duration of 7 days and undertake various activities based on the need of that village. For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance) Special camp activity will be conducted in a village situated within a radius of 15 –20 KM.

Total Hours: 32

TEXT BOOKS :	
1.	Government of India, Ministry of Youth Affairs and Sports. (2021). National Service Scheme Manual (Revised ed.). Department of Youth Affairs, Government of India.
2.	Government of India, Ministry of Youth Affairs and Sports. (2020). Handbook for NSS Programme Officers. Department of Youth Affairs, Government of India.
3.	National Service Scheme Cell, Tamil Nadu. (Latest ed.). National Service Scheme: Handbook for NSS Volunteers. Department of Youth Welfare and Sports Development, Government of Tamil Nadu.

REFERENCE BOOKS :	
1.	Basu, D. D. (2022). Introduction to the Constitution of India (26th ed.). LexisNexis.
2.	Khanna, V. N. (2020). India and the Contemporary World. Vikas Publishing House.
3.	Singh, K. (2018). Rural Development: Principles, Policies and Management. Sage Publications.

WEB REFERENCES :	
1.	https://nss.gov.in/
2.	https://yas.nic.in/
3.	https://swayam.gov.in/
4.	https://ndl.iitkgp.ac.in/

U25AG16P	National Cadet Corps - II	(0+1)

COURSE OBJECTIVES:

• To develop discipline, leadership, courage, character, and a spirit of selfless service among students.
• To provide basic military training in drill, weapon handling, map reading, and field craft.
• To foster patriotism, teamwork, and preparedness for community service and national development through NCC activities.
• To develop discipline, leadership, courage, character, and a spirit of selfless service among students.

COURSE OUTCOMES:

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

CO1 :	Explain the aims, values, and organizational structure of the National Cadet Corps (NCC).
CO2 :	Demonstrate proficiency in drill, weapon handling, and safe firing practices.
CO3 :	Apply map reading, navigation, field craft, and basic military techniques in practical situations.
CO4 :	Perform field exercises involving communication, camouflage, obstacle crossing, and section battle drills.
CO5 :	Develop discipline, leadership, teamwork, patriotism, and a sense of responsibility towards national service and community welfare.

Practical / Awareness Activities

Practical Schedule:

1. Introduction to NCC organization, aims, objectives, discipline, and parade procedures. Attention, stand at ease, and stand easy.
2. Basic drill movements: getting on parade, dismissing, falling out, and squad formation.
3. Arms drill: ground/take up arms, examine arms, shoulder arms, present arms, and saluting at halt and on march.
4. Guard mounting, guard of honour, platoon/company drill, and ceremonial practices.
5. Weapon training: characteristics of rifle (.22/.303/SLR), ammunition, firepower, and safety precautions.
6. Weapon handling: stripping, assembling, care and cleaning, loading, cocking, unloading, and sight setting.

7. Marksmanship training: firing positions, trigger control, aiming, alteration of sight, range procedure, and miniature range firing.
8. Introduction to map reading: maps, scales, conventional signs, topographical forms, and technical terms.
9. Grid system, contours, gradients, cardinal points, bearings, service protractor, and prismatic compass.
10. Navigation exercises: setting a map, finding north, own position, map-to-ground and ground-to-map methods.
11. Field craft: knots and lashings, camouflage and concealment, observation, judging distance, and target recognition.
12. Field engineering: obstacles, field defences, bridging, watermanship, field water supply, and track construction.
13. Communication skills: field signals, types of communication media, and modern communication trends.
14. Tactical training: section formations, movement with/without arms, fire control orders, and fire and movement.
15. Section battle drills, practical exercises on field craft, and integrated NCC training activities.
16. Final practical assessment, demonstration of drill, weapon training, map reading, field skills, and course review.

Total Hours: 32

TEXT BOOKS :	
1.	Government of India, Ministry of Youth Affairs and Sports. (2021). National Service Scheme Manual (Revised ed.). Department of Youth Affairs, Government of India.
2.	Government of India, Ministry of Youth Affairs and Sports. (2020). Handbook for NSS Programme Officers. Department of Youth Affairs, Government of India.
3.	National Service Scheme Cell, Tamil Nadu. (Latest ed.). National Service Scheme: Handbook for NSS Volunteers. Department of Youth Welfare and Sports Development, Government of Tamil Nadu.

REFERENCE BOOKS :	
1.	Sharma, R. C. National Cadet Corps: A Complete Guide. New Delhi: Ramesh Publishing House.
2.	Directorate General, National Cadet Corps. NCC Training Manual. New Delhi: Ministry of Defence, Government of India.
3.	NCC Drill Manual. New Delhi: Ministry of Defence, Government of India.

WEB REFERENCES :	
1.	https://indiancc.nic.in
2.	https://mod.gov.in
3.	https://dccp.indiancc.nic.in
4.	https://pib.gov.in
5.	https://indiancc.nic.in

U25TA09P	Illakiyangalil velanmaiyum ariviyal thamizh payanaakamum	(0+1)

பாடக் குறிக்கோள்கள் (COURSE OBJECTIVES):

- தமிழ் இலக்கியங்களில் இடம்பெறும் வேளாண்மை தொடர்பான கருத்துகள், பண்பாடு மற்றும் அறிவியல் சிந்தனைகளை மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- சங்க இலக்கியங்கள் மற்றும் பதினெண் கீழ்க்கணக்கு நூல்களில் காணப்படும் பாரம்பரிய வேளாண் அறிவியல் மற்றும் தொழில்நுட்பங்களைப் புரிந்துகொள்ளச் செய்தல்
- இலக்கியங்களில் இடம்பெறும் நெல் வகைகள், மூலிகைத் தாவரங்கள் மற்றும் அவற்றின் சமூக, பொருளாதார முக்கியத்துவத்தை விளக்குதல்
- அறிவியல் தமிழின் தோற்றம், வளர்ச்சி, பயன்பாடுகள் மற்றும் வேளாண்மைத் துறையில் அதன் பங்களிப்பை அறிமுகப்படுத்துதல்
- மாணவர்களின் தமிழ் மொழித்திறன், மொழிபெயர்ப்புத் திறன், கருத்துப் பரிமாற்றத் திறன் மற்றும் அறிவியல் தமிழ் பயன்பாட்டுத் திறனை மேம்படுத்துதல்

பாடத்தின் கற்றல் பயன்பாடு (COURSE OUTCOMES):

இப்பாடத்தை நிறைவு செய்யும்போது, மாணவர்களால் பின்வருவனவற்றைச் செய்ய இயலும்

CO1 :	தமிழ் இலக்கியங்களில் இடம்பெற்றுள்ள வேளாண்மைச் சிந்தனைகள், வேளாண் மரபுகள் மற்றும் பாரம்பரிய வேளாண் அறிவை புரிந்துகொள்வர்
CO2 :	சங்க இலக்கியங்களில் காணப்படும் வேளாண் தொழில்நுட்பங்கள் மற்றும் வேளாண் பணிகளின் சிறப்புகளை அறிந்து கொள்வர்
CO3 :	இலக்கியங்களில் குறிப்பிடப்பட்டுள்ள அறிவியல், பொருளாதார மற்றும் பண்பாட்டு முக்கியத்துவத்தை பகுப்பாய்வு செய்வார்
CO4 :	அறிவியல் தமிழ் வளர்ச்சி மூலம் மின்னுலகில் தமிழின் பயன்பாட்டை அறிந்து நடைமுறையில் பயன்படுத்துவார்

CO5 :	மொழிப் பயிற்சிக்குத் தேவையான இலக்கணங்களைக் கற்பர்

செய்முறை

வேளாண்மை சொல் விளக்கம் – சங்க இலக்கியங்களில் சொல்லும் பொருளும் – பதினெண் கீழ்க்கணக்கு நூல்களில் சொல்லும் பொருளும் – வேளாண்மை குறித்து மறைமலையடிகளார் கூற்று - தொல்காப்பியம் காட்டும் நிலப்பாகுபாடு - சங்க இலக்கியங்களில் வேளாண் பணிகள் - திருக்குறளில் வேளாண்மை – நான்மணிக்கடிகை கூறும் வேளாண் நுட்பங்கள் – இனியவை நாற்பது காட்டும் வேளாண் செய்திகள் – இன்னா நாற்பது காட்டும் வேளாண் செய்திகள் – ஐந்திணை எழுபது காட்டும் வேளாண் செய்திகள் – திணைமாலை நூற்றைம்பது காட்டும் வேளாண் செய்திகள் - பழமொழிகள் உணர்த்தும் வேளாண் தொழில் நுட்பங்கள் - சங்க இலக்கியங்களில் நெல் வகைகள் – பள்ளு இலக்கியங்களில் நெல்வகைகள் – இலக்கியங்களில் மூலிகை தாவரங்கள் – இலக்கியங்களில் ஆளுமைப் பண்பு மேம்பாடு - அறிவியல் தமிழின் வளர்ச்சி நிலைகள் – அறிவியல் தமிழின் தொன்மை – அறிவியல் தமிழின் இன்றைய வளர்ச்சி – அறிவியல் தமிழின் பயன்பாடுகள் – தமிழில் வேளாண்மை இதழ்கள் – கண்ணி உலகில் தமிழ் - கலைச்சொல்லாக்கம் – கட்டுரைச் சுருக்கம் எழுதுதல் – மென்திறன்கள் – கருத்துப் பரிமாற்றத் திறன் – மொழிபெயர்ப்பு – மொழிபெயர்ப்பின் முக்கிய விதிகள் மற்றும் இன்றியமையாப் பண்புகள் - பிழையின்றி எழுதுதல்.

செய்முறை அட்டவணை

1. வேளாண்மைச் சொற்களை அறிதல், பொருள் விளக்கம் மற்றும் கலைச்சொல் தொகுப்பு தயாரித்தல்.
2. சங்க இலக்கியங்களில் இடம்பெறும் வேளாண்மைச் செய்திகள் மற்றும் வேளாண் பணிகளைத் தொகுத்தல்.
3. தொல்காப்பியம் காட்டும் நிலப்பாகுபாடு மற்றும் ஐந்திணை தொடர்பான வேளாண் கருத்துக்களைப் பயிற்சி செய்தல்.
4. பதினெண் கீழ்க்கணக்கு நூல்களில் காணப்படும் வேளாண் அறிவியல் கருத்துகளை ஆய்வு செய்தல்.
5. திருக்குறள், நான்மணிக்கடிகை மற்றும் பிற கீழ்க்கணக்கு நூல்களில் உள்ள வேளாண் நுட்பங்களை விளக்குதல்.
6. பழமொழிகள் மற்றும் இலக்கியங்களில் காணப்படும் பாரம்பரிய வேளாண் தொழில்நுட்பங்களை சேகரித்தல்.
7. சங்க இலக்கியங்கள் மற்றும் பள்ளு இலக்கியங்களில் குறிப்பிடப்பட்டுள்ள நெல் வகைகளை அடையாளம் காணுதல்.

8. இலக்கியங்களில் குறிப்பிடப்படும் மூலிகைத் தாவரங்கள் மற்றும் அவற்றின் பயன்பாடுகளை தொகுத்தல்.
9. அறிவியல் தமிழின் வளர்ச்சி நிலைகள் மற்றும் வேளாண்மை அறிவியல் கலைச்சொற்களைப் பயிற்சி செய்தல்.
10. தமிழில் வெளிவரும் வேளாண்மை இதழ்கள் மற்றும் அறிவியல் தமிழ் வளங்களை அறிமுகப்படுத்துதல்.
11. கணினியில் தமிழ் பயன்பாடு, தமிழ் தட்டச்சு மற்றும் இணையத் தமிழ் வளங்களைப் பயன்படுத்துதல்.
12. வேளாண்மை தொடர்பான கலைச்சொற்கள் உருவாக்கம் மற்றும் பயன்பாடு.
13. அறிவியல்/வேளாண்மை கட்டுரை எழுதுதல், சுருக்கம் தயாரித்தல் மற்றும் தொகுத்தல்.
14. கருத்துப் பரிமாற்றம், குழு விவாதம் மற்றும் விளக்கக்காட்சி திறன் பயிற்சி.
15. வேளாண்மை சார்ந்த ஆங்கில–தமிழ் மொழிபெயர்ப்பு மற்றும் மொழிபெயர்ப்பு விதிகள் பயிற்சி.
16. பிழையின்றி எழுதுதல், ஒருங்கிணைந்த மொழித்திறன் மதிப்பீடு மற்றும் மாணவர் விளக்கக்காட்சி.

மொத்த மணிநேரம்: 16

பாட நூல்கள் :

1.	கந்தசாமி.இல.செ, வேளாண்மையும் பண்பாடும், தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர், 1974.
2.	கந்தசாமி.இல.செ, இலக்கியத்தில் வேளாண்மை, தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர், 1981.
3.	குழந்தைசாமி.வா.செ, அறிவியல் தமிழ், பாரதி பதிப்பகம், சென்னை, 2002.
4.	இராதாசெல்லப்பன், கலைச்சொல்லாக்கம், தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர். 2006.
5.	இலக்கியமும் வேளாணமையும், அனைத்திந்திய அறிவியல் தமிழ்க் கழகம், தஞ்சாவூர், 2006.

பார்வை நூல்கள் :	
1.	கந்தசாமி.இல.செ, வேளாண்மை பழமொழிகள், தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம், கோயம்புத்தூர், 1983.
2.	மணிமேகலை.ம, தமிழ் மொழித் தடத்தில் வேளாண் அறிவியலின் சுவடுகள், தேவி பதிப்பகம், திருச்சி, 2002.
3.	முருகேசபாண்டியன்.ந, மொழிபெயர்ப்பியல், உயிரெழுத்துப் பதிப்பகம், திருச்சி, 2008.
4.	வெள்ளைச்சாமி.பெ, தமிழ் இலக்கியங்களில் வேளாண்மைத் தொழில் நுட்பங்கள், அஜய் கம்ப்யூட்டர்ஸ் பிரிண்டிங், மதுரை, 2006.
5.	மாதையன்.பெ, சங்க இலக்கியத்தில் வேளாண் சமுதாயம், நியூ செஞ்சுரி புக் ஹவுஸ்(பி) லிமிடெட், சென்னை, 2004.

இணையம்:	
1.	https://keetru.com/index.php/2014-03-08-04-35-27/2014-03-08-12-18-14/31779-2016-11-08-16-04-18
2.	https://www.vallamai.com/?p=74219
3.	https://shorturl.at/HM2Us
4.	https://www.vallamai.com/?p=87316
5.	https://shorturl.at/R4azo

U25EN09P	Development Education	(0+1)

COURSE OBJECTIVES:

• To develop effective communication, professional writing, and presentation skills among students.
• To enhance understanding of learning principles, career development, entrepreneurship, and leadership skills.
• To train students in preparing professional documents, project proposals, reports, and business communication materials.

COURSE OUTCOMES:

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

CO1 :	Explain the principles of learning, education, motivation, and personal development.
CO2 :	Demonstrate effective communication skills through presentations, discussions, and interpersonal interactions.
CO3 :	Prepare professional documents such as notices, letters, reports, articles, proposals, and job applications.
CO4 :	Apply creative thinking, simulation techniques, and problem-solving approaches in educational and business situations.
CO5 :	Develop entrepreneurial skills through project planning, evaluation, and career development activities.

Practical

Project/ presentation on any of the following Circulars – Drafting Notices – Handling Complaints – Evaluating Interview Performance – Articles – Formal Invitations – Proforma for Performance Appraisals – Letters of Appointment – Captions for Advertising – Company Notice related Shares/dividends – MoA – AoA – Annual Reports – Minutes of Meetings – Action taken on Previous Resolution – Use of Google Groups and Google Sheet – Preparing job applications - Simulation exercises: Simulation - educational simulation -Interactive teaching - business simulation – company's annual report for analysis.

Practical Schedule

1. Basic principles of learning: growth and development, education for life, lifelong education, motivation, and morale.
2. Occupation and profession, training and education, lateral and convergent thinking, teaching and learning concepts.

3. Bloom's taxonomy of educational objectives: cognitive, affective, and psychomotor domains.
4. Career development opportunities for agriculture and allied science graduates.
5. Farmer/entrepreneur success stories: factors involved and role-play activities.
6. Brainstorming techniques and creative thinking exercises.
7. Simulation exercises: educational simulation, interactive teaching, business simulation, and annual report analysis.
8. Interpersonal and transactional communication skills; ice-breaking activities.

Mid Semester Examination.

9. Conducting symposiums and developing presentation skills.
10. Conference organization and scientific paper presentation techniques.
11. Scientific article writing, editing, and review practices.
12. Popular article writing, editing, blogging, and digital communication.
13. Preparation of project proposals and planning techniques.
14. Project report writing, documentation, and evaluation.
15. Entrepreneur and intrapreneur concepts, entrepreneurship development, planning, monitoring, and evaluation.
16. Preparation of professional documents: notices, circulars, letters, invitations, job applications, performance appraisals, annual reports, MoA, AoA, and minutes of meetings.

Final Practical Examination.

Total Hours: 32

TEXT BOOKS :	
1.	Quintanilla, Kelly M., Wahl, Shawn T. Business and Professional Communication: Concepts and Skills for Career Success. New Delhi: SAGE Publications, South Asia Edition, 2017.
2.	Lesikar, Raymond V., Flatley, Marie E., Rentz, Kathryn, and Pande, Neerja. Business Communication: Making Connections in a Digital World. New Delhi: McGraw Hill Education, 12th Edition, 2014.
3.	Williams, K., Krizan, A.C., Logan, J., and Merrier, P. Communicating in Business. Boston: Cengage Learning, 8th Edition, 2017.

REFERENCE BOOKS :	
1.	Bovee, Courtland L., Thill, John V. Business Communication Today. Pearson Education.
2.	Locker, Kitty O., Kienzler, Donna S. Business and Administrative Communication. McGraw Hill Education.

3.	Guffey, Mary Ellen, Loewy, Dana. Essentials of Business Communication. Cengage Learning.

WEB REFERENCES :	
1.	http://www.e-booksdirectory.com/details.php?ebook=9481
2.	https://hbr.org
3.	https://us.sagepub.com
4.	https://www.mheducation.com
5.	https://www.cengage.com

U25AG17P	Seed Production Technology	(0+2)

COURSE OBJECTIVES:

- To understand the definitions, concepts of seed, genetic purity, seed deterioration, scope and importance of seed production.
- To learn the pollination behaviour, hybridization tools, designing, planning and preparation of seed, nursery, main field management and hybridization techniques for seed production.
- To acquire knowledge about seed production in major cereals, pulses, oilseeds, and vegetable crops.
- To gain awareness about seed certification procedures, field inspection, seed processing, storage and economics of seed production.
- To understand the concept of seed testing starting from seed sampling, physical/genetic purity assessment, seed quality evaluation, and seed marketing.

COURSE OUTCOMES:

After completion of the course, the students will

CO1 :	Know the fundamentals of seed, seed deterioration factors, genetic purity, physical purity, seed generation, classes of seed and quality seed production.
CO2 :	Demonstrate Planning and designing of nursery, main field management and accomplish hybridization techniques in seed production.
CO3 :	Implement suitable techniques for quality seed production in major cereals, pulses, oilseeds and vegetable crops.
CO4 :	Analyze the seed production procedure for certification and evaluate the post-harvest operations and economics of seed production.
CO5 :	Conduct the seed sampling and seed quality testing to assess the purity, germination, vigour, viability, moisture, seed health and understand the principles of seed marketing.

UNIT I: Seed and Seed quality: Importance and principles of seed production.	**12 Hrs.**

Seed Definition – Difference between seed and grain- Genetic purity of varieties: concept, factors responsible for their deterioration. Methods of maintenance of genetic purity System- Scope and importance of seed production - principles and practices of seed production - generation system of seed multiplication- Different classes of seed - generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio -Seed renewal period- Pollination behavior - tools employed in hybrid seed production - study of morphological characters of

varieties, parental line and hybrids- Designing of planting ratio and border rows - physical and genetic contaminants - isolation distance - Planning of seed production - season and land selection - assessment of seed source and seed selection - Pre sowing seed invigouration treatments - dormancy breaking treatments - seed priming - pelleting - polymer coating - Practicing nursery and main field preparation - practicing the sowing of seeds in the nursery - protray nursery - sowing - nursery management- Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management- Weed management - irrigation management - special cultural practices - pest and disease management - Identification and removal of off-types and volunteer plants - practicing hybridization techniques (emasculation and pollination and detasselling) - identification of physiological disorders and management- Seed production in major cereals: Rice, Maize- Seed production in major cereals: Sorghum, Bajra and Ragi - Seed production in major pulses: Black gram, Green gram, Red gram, Bengal Gram, Field bean and pea- Seed production in major oilseeds: Soybean, Sunflower, castor and Groundnut- Seed production in important vegetable crops- Exposure visit to seed certification department - seed certification procedures - registration and sowing report - Field inspection - field counting- pre-harvest sanitation spray - identification of physiological and harvestable maturity indices- harvesting methods- Post-harvest verification - kapas sorting, cob sorting and pod verification - threshing / extraction of seeds - processing sequence - Seed drying - seed cleaning - grading – Pre-storage seed treatment - seed packing - seed storage - Seed storage godown and learning sanitation measures - Economics of variety and hybrid seed production (cost benefit ratio) - Private seed industry- Sampling- mixing and dividing - equipment – methods- Sampling- mixing and dividing - equipment – methods - Seed purity analysis – reporting results- Germination testing and seedling evaluation- Moisture testing -Viability testing - Seed health testing Vigour testing- Grow out test field and DNA finger printing laboratory for genetic purity assessment- Seed marketing.

Practical Schedule

1. Seed Definition – Difference between seed and grain. Genetic purity of varieties: concept, factors responsible for their deterioration. Methods of maintenance of genetic purity System.
2. Scope and importance of seed production - principles and practices of seed production Different classes of seed - generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio -Seed renewal period.
3. Pollination behavior - tools employed in hybrid seed production - study of morphological characters of varieties, parental line and hybrids.
4. Designing of planting ratio and border rows - physical and genetic contaminants - isolation distance.
5. Planning of seed production - season and land selection - assessment of seed source and seed selection.
6. Pre sowing seed invigouration treatments - dormancy breaking treatments - seed priming - pelleting - polymer coating.
7. Practicing nursery and main field preparation - practicing the sowing of seeds in the nursery - protray nursery - sowing - nursery management.

8. Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management.
9. Weed management - irrigation management - special cultural practices - pest and disease management.
10. Identification and removal of off-types and volunteer plants - practicing hybridization techniques (emasculation and pollination and detasselling) and Identification of physiological disorders and management.
11. Seed production in major cereals: Rice, Maize
12. Seed production in major cereals: Sorghum, Bajra and Ragi.
13. Seed production in major pulses: Blackgram, Greengram, Redgram, Bengal Gram, Field bean and pea.
14. Seed production in major oilseeds: Soybean, Sunflower, castor and Groundnut.
15. Seed production in important vegetable crops.
16. Exposure visit to seed certification department - seed certification procedures - registration and sowing report.

Mid Semester Examination.

17. Field inspection - field counting - visit to seed production plots.
18. Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices- harvesting methods.
19. Post-harvest verification - kapas sorting, cob sorting and pod verification - threshing / extraction of seeds - processing sequence.
20. Seed drying - seed cleaning - grading – Pre-storage seed treatment - seed packing - seed storage.
21. Visit to seed processing unit.
22. Seed storage godown and learning sanitation measures.
23. Economics of variety and hybrid seed production (cost benefit ratio).
24. Visit to private seed industry.
25. Sampling- mixing and dividing - equipment - methods
26. Seed purity analysis – reporting results.
27. Germination testing and seedling evaluation.
28. Moisture testing methods.
29. Viability testing methods.
30. Seed health testing.
31. Vigour testing (Electrical conductivity, Accelerated Ageing, Mean Germination Time, Vigor Index).
32. Visit to grow out test field and DNA finger printing laboratory for genetic purity assessment and seed retail shop - seed marketing.

Final Practical Examination

Total Hours: 64

TEXT BOOKS :	
1.	Agrawal, R.L. "Seed Technology", Oxford & IBH Publishing Co., New Delhi,1996.
2.	Bhaskaran, M. A.Bharathi, K.Vanangamudi, N.Natarajan, P.Natesan, R.Jerlin and K.Prabakar. "Principles of seed production" Kaisher Graphics, Coimbatore,2003.
3.	Copeland LO & McDonald MB. "Principles of Seed Science and Technology", 4th Ed. Chapman & Hall, 2001.
4.	Singhal NC. "Hybrid Seed Production in Field Crops", Kalyani Publishers, New Delhi, 2003.
5.	Vanangamudi, K. "Seed Science and Technology" An Illustrated Text Book. New India Publishing Agency, New Delhi, 2014.

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1.	Trivedi, R. K., and M. Gunasekaran. "Indian minimum seed certification standards." The Central Seed Certification Board, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi, 569 2013.
2.	George, Raymond AT. "Vegetable seed production" (3rd Edition) Cabi, Publishing, Wallingford, UK, 2009.
3.	Kelly, A. Fenwick. "Seed production of agricultural crops", Longman Scientific & Technical, London, 1988.

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2.	http://www.agritech.tnau.ac.in/seed_certification/seedtech_index.html
3.	https://www.seedtest.org/en/publications/international-rules-seed-testing.html
4.	https://seedcertification.tn.gov.in/seedcertification/actrules.php
5	https://plantauthority.gov.in/crop-dus-guidelines
6.	https://www.upov.int/en/find-and-explore/information-and-guidance/examination-guidance/test-guidelines/current-test-guidelines
7.	https://www.tnagrisnet.tn.gov.in/hhbm_public/welcome/stock_position/1

U25AG18P	Post Harvest Processing Technology	(0+2)

COURSE OBJECTIVES:

- To understand the preharvest operations, harvesting practices, maturity indices and packaging methods for improving the postharvest quality of fruits and vegetables.
- To learn postharvest handling operations, processing techniques and value addition of fruits and vegetables.
- To acquire knowledge on processing, preservation and storage technologies for extending the shelf life of horticultural produce.
- To study the physiological and biochemical changes during ripening, cold chain management and quality evaluation of horticultural products.
- To develop practical skills in food preservation, packaging standards, beverage processing, drying technologies and value addition of fruits and vegetables.

COURSE OUTCOMES:

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

CO1 :	Remember the preharvest and harvesting practices of fruits and vegetables.
CO2 :	Understand the postharvest handling and processing techniques of horticultural produce.
CO3 :	Apply storage and preservation methods to improve the shelf life of fruits and vegetables.
CO4 :	Analyse the ripening process, cold chain management and quality evaluation of horticultural products.
CO5 :	Apply food preservation, packaging standards and value addition techniques for fruits and vegetables.

Practical

Pre-harvest operations for improving postharvest shelf life of fruits and vegetables, assessment of maturity indices and harvest criteria, methods and importance of packaging, types of packaging and packaging materials, and identification and causes of chilling injury and freezing injury in fruits and vegetables. Estimation of ethylene evolution in fruit crops, identification of postharvest diseases and physiological disorders, postharvest machineries for fruits and vegetables, postharvest handling operations including washing, fungicide treatment, grading, sorting, precooling, waxing and nano-coating, and preparation and quality evaluation of jam, jelly, RTS, nectar and squash. Processing of dried and dehydrated fruits and

vegetables, preparation and quality evaluation of fruit bar, candy and tomato products, processing of canned fruits and vegetables, and storage methods including zero energy cool chamber, cold storage, controlled atmosphere, modified atmosphere and hypobaric storage. Cold chain management for export of high-value fruits and vegetables, physiological and biochemical changes during maturity and ripening, respiration and factors affecting ripening, physico-chemical and sensory evaluation of processed products, and concepts, processing techniques, spoilage and preventive measures in canning of fruits and vegetables. Food safety and packaging standards in value addition (GMP, HACCP, FSSAI, Codex Alimentarius and ISO certification), principles and methods of preservation, value addition of fruits through jam, jelly, marmalade, preserve and candy, concepts and standards of fermented and non-fermented beverages, drying, dehydration and osmotic dehydration of fruits and vegetables, and exposure visit to processing industry, cold storage and packaging unit.

Practical Schedule

1. Pre-harvest operations to improve post-harvest shelf life of fruits and vegetable crops.
2. Assessment of maturity indices and harvest criteria for fruits and vegetable crops.
3. Methods of packaging in fruits and vegetables.
4. Importance of packaging, types of packaging and packaging materials.
5. Identification and causes of chilling injury in fruits and vegetables.
6. Identification and causes of freezing injury in fruits and vegetables.
7. Estimation of ethylene evolution in fruit crops.
8. Identification of postharvest diseases and physiological disorders of fruits and vegetable crops.
9. Postharvest machineries for fruits and vegetable crops.
10. Postharvest handling of produce – Washing, fungicide treatment, grading and sorting, precooling, waxing and nano-coating.
11. Preparation of jam and jelly and quality evaluation of products.
12. Preparation of RTS, nectar and squash and quality evaluation of products.
13. Processing of dried and dehydrated fruits and vegetables.
14. Preparation of fruit bar and candy and quality evaluation of products.
15. Preparation of tomato products.

Mid Semester Examination.

16. Processing of canned fruits and vegetables.
17. Methods of storage of fruits and vegetables – Zero energy cool chamber and cold storage.
18. Methods of storage of fruits and vegetables – Controlled atmosphere, modified atmosphere and hypobaric storage.
19. Management of cold chain for export of high-value fruits and vegetables.

20. Physiological changes during maturity and ripening of fruits and vegetables.
21. Biochemical changes, respiration and factors affecting ripening of fruits and vegetables.
22. Quality evaluation of products – Physico-chemical analysis.
23. Quality evaluation of products – Sensory evaluation.
24. Canning of fruits and vegetables – Concepts and processing techniques.
25. Spoilage of canned products and preventive measures.
26. Packaging standards in value addition – GMP, HACCP and FSSAI.
27. Packaging standards in value addition – Codex Alimentarius and ISO Certification.
28. Principles and methods of preservation of fruits and vegetables.
29. Preservation and value addition of fruits – Jam, jelly, marmalade, preserve and candy.
30. Concepts and standards in fermented and non-fermented beverages.
31. Drying, dehydration and osmotic dehydration of fruits and vegetables.
32. Visit to processing industry, cold storage and packaging unit.

Final Practical Examination.

Total Hours: 64

TEXT BOOKS :	
1.	Adel A. Kader, "Post-Harvest Technology of Horticultural Crops", University of California Agrl. and Natural Resources Publication, 2002.
2.	Ashwani. S. and Goel, "Post-harvest management and value addition", Daya publishing house, New Delhi, 2007.
3.	Swati Barche and K. S. Kirad, "Post-harvest handling of fruits, vegetables and flowers", Jain Brothers, New Delhi, 2010.
4.	Bhutani, R. C, "Fruit and Vegetable Preservation", Biotech Books, New Delhi, 2003.
5.	Pruthi, J. S, "Major Spices and condiments. Productions and post-harvest technologies", . ICAR publications, New Delhi, 2000.

REFERENCE BOOKS :	
1.	Thompson, A. K., "Fruit and Vegetables: Harvesting, Handling and Storage", Blackwell Publishing, Oxford, UK, 2003.

2.	Verma, L. R. and Joshi, V. K., "Postharvest Technology of Fruits and Vegetables", Indus Publishing Company, New Delhi, 2000.
3.	Srivastava, R. P. and Kumar, S., "Fruit and Vegetable Preservation: Principles and Practices", International Book Distributing Co., Lucknow, 2002.
4.	Salunkhe, D. K. and Desai, B. B., "Postharvest Biotechnology of Fruits", CRC Press, Boca Raton, Florida, 1984.
5.	Salunkhe, D. K. and Kadam, S. S., "Handbook of Fruit Science and Technology: Production, Composition, Storage and Processing", Marcel Dekker Inc., New York, 1995.

WEB REFERENCES :	
1.	https://nptel.ac.in/courses/126105023
2.	https://www.fao.org/platform-food-loss-waste/en/
3.	https://postharvest.org/educational-links/
4.	https://www.agritech.tnau.ac.in/postharvest/postharvest.html
5.	https://postharvest.ucdavis.edu/

U25VA04T	Introduction to Indian Knowledge System	(0+1)

COURSE OBJECTIVES:

- To introduce the origin, concepts, sources, and significance of the Indian Knowledge System (IKS).
- To provide an understanding of Indian philosophical traditions, scientific contributions, arts, literature, and cultural heritage.
- To familiarize students with the relevance of traditional knowledge systems in sustainable living, ethics, health, and contemporary innovations.

COURSE OUTCOMES:

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

CO1 :	Explain the foundations, sources, and key concepts of Indian Knowledge Systems.
CO2 :	Describe major Indian philosophical traditions, schools of thought, and knowledge systems.
CO3 :	Recognize contributions of Indian mathematics, astronomy, Ayurveda, and Yoga to scientific knowledge.
CO4 :	Appreciate Indian literature, arts, aesthetics, architecture, and cultural traditions.
CO5 :	Apply the principles of IKS in sustainable development, ethical practices, and contemporary life.

UNIT I : Natural Resources	**04 Hrs.**
IKS meaning, nature & scope; Sources – Vedas, Upanishads, Puranas, Epics, Agamas. Guru–Shishya tradition; oral & written knowledge. Key ideas: Rita, Dharma, Purusharthas, Samskaras; holistic Indian worldview.	

UNIT II : Ecosystem and Biodiversity	**04 Hrs.**
Indian Darshanas – Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa, Vedanta. Heterodox schools – Buddhism, Jainism. Pramanas (knowledge sources). Concepts of self, mind & consciousness.	

UNIT III : Human population, social issues and the Environment	03 Hrs.
Mathematics & Astronomy – zero, decimals, algebra, geometry; Aryabhata, Brahmagupta, Bhaskaracharya, Kerala School.Timekeeping, Panchanga, cosmology.Ayurveda – Tridosha, Panchamahabhutas; Charaka & Sushruta.Yoga as a science of health.	

UNIT IV : Environmental pollution, Laws and regulations	02 Hrs.
Classical Sanskrit & regional literature.Music, dance, drama; Natyashastra & Rasa theory. Temple architecture, iconography, symbolism.Aesthetic principles – Alankara Shastra.	

UNIT V - Disaster and its management	03 Hrs.
Ancient education – Nalanda, Takshashila, Gurukula. Varna, Jati, Ashrama; ethics in Arthashastra, Tirukkural, Panchatantra. Women in IKS; environmental ethics; traditional agriculture & water systems. Vriksha Ayurveda; sustainable living. NEP 2020 & IKS, yoga/mindfulness, traditional knowledge & innovation.	

Lecture Schedule

1. Introduction to Indian Knowledge Systems.
2. Sources of IKS.
3. Guru–Shishya Tradition.
4. Concepts of Rita, Dharma & Purusharthas.
5. Six Orthodox Darshanas.
6. Buddhism and Jainism.
7. Pramanas – Sources of Knowledge.
8. Indian Mathematics.

   Mid Semester Examination.
9. Indian Astronomy & Panchanga.
10. Ayurveda Fundamentals.
11. Yoga and Well-being.
12. Indian Literature & Performing Arts.
13. Aesthetics & Temple Architecture.
14. Ancient Education Systems.
15. Governance, Ethics & Environment.
16. Contemporary Relevance of IKS.

Total Hours: 16

TEXT BOOKS :	
1.	Mahadevan, B., Bhat, V. R., and Pavana, N. Introduction to Indian Knowledge Systems: Concepts and Applications. New Delhi: PHI Learning, 2022.
2.	Chauhan, Bhag Chand. IKS: The Knowledge System of Bharata. Gurugram: Garuda Prakashan, 2023.
3.	Pandey, Rajesh Kumar. Indian Knowledge System: A Holistic Interpretation. New Delhi: DPS Publishing House, 2025.

REFERENCE BOOKS :	
1.	Radhakrishnan, S. Indian Philosophy (Vol. I & II). New Delhi: Oxford University Press, 1999.
2.	Sharma, Chandradhar. A Critical Survey of Indian Philosophy. Delhi: Motilal Banarsidass Publishers, 1996.
3.	Joseph, George Gheverghese. The Crest of the Peacock: Non-European Roots of Mathematics. Princeton: Princeton University Press, 2011.
4.	Feuerstein, Georg. The Yoga Tradition: Its History, Literature, Philosophy and Practice. Prescott: Hohm Press, 2013.

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1.	https://iks.aicte-india.org
2.	https://www.education.gov.in
3.	https://ndl.iitkgp.ac.in
4.	https://www.dli.gov.in
5.	https://iks.aicte-india.org

U25VA12B	Environmental Studies and Disaster Management	(2+1)

COURSE OBJECTIVES:

- Understand the relationship between the environment and human activities.
- Explain natural resources, their utilization, and associated environmental problems.
- Develop knowledge of ecosystems, biodiversity, and conservation practices.
- Describe environmental pollution, its causes, impacts, and control measures.
- Acquire knowledge of environmental issues, human health, environmental laws, and disaster management for sustainable development.

COURSE OUTCOMES:

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

CO1 :	Explain the concepts of environmental science, natural resources, and sustainable resource management.
CO2 :	Describe ecosystem structure, functions, and biodiversity conservation.
CO3 :	Analyze environmental pollution, its impacts, and control measures.
CO4 :	Evaluate environmental issues, ethics, climate change, and sustainable development.
CO5 :	Explain environmental laws and disaster management practices.
CO6 :	Apply field and laboratory techniques for environmental assessment and pollution monitoring.

UNIT I : Natural Resources	**06 Hrs.**

Multidisciplinary nature of environmental studies Definition, scope and importance - Natural Resources - Renewable and non-renewable resources Natural resources and associated problems - a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people - b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources - Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

UNIT II : Ecosystem and Biodiversity	07 Hrs.

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - a. Forest ecosystem. b. Grassland ecosystem - c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Biodiversity -Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels, India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III : Human population, social issues and the Environment	05 Hrs.

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust - Wasteland reclamation. Consumerism and waste products - Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme - Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare - Role of Information Technology in Environment and human health. Case Studies.

UNIT IV : Environmental pollution, Laws and regulations	07 Hrs.

Environmental Pollution -Definition, cause, effects and control measures of : a. Air pollution - b. Water pollution - c. Soil pollution - d. Marine pollution - e. Noise pollution - f. Thermal pollution - g. Nuclear hazards - Solid Waste Management: causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies. Environmental Laws and regulations - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness.

UNIT V - Disaster and its management	07 Hrs.

Natural Disasters-Meaning and nature of natural disasters, their types and effects - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion - Man Made Disasters-Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management-Effect to migrate natural disaster at national and global levels -

International strategy for disaster reduction - Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community - based organizations and media - Central, state, district and local administration - Armed forces in disaster response - Disaster response - Police and other organizations.

Lecture Schedule

1. Multidisciplinary nature of environmental studies -Definition, scope and importance -Natural Resources: Renewable and non-renewable resources -Natural resources and associated problems.
2. Forest resources: Use and over-exploitation, deforestation, case studies -Timber extraction, mining, dams and their effects on forest and tribal people.
3. Water resources: Use and over-utilization of surface and ground water -Floods, drought, conflicts over water, dams -benefits and problems.
4. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies -Food resources: World food problems, changes caused by agriculture and overgrazing.
5. Effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies -Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies.
6. Land resources: Land as a resource, land degradation, man induced landslides -Soil erosion and desertification -Role of an individual in conservation of natural resources -Equitable use of resources for sustainable lifestyles.
7. Ecosystems -Concept of an ecosystem -Structure and function of an ecosystem -Producers, consumers and decomposers -Energy flow in the ecosystem -Ecological succession -Food chains, food webs and ecological pyramids.
8. Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem and Desert ecosystem.
9. Introduction, types, characteristic features, structure and function of Aquatic ecosystems: ponds, streams, lakes -Rivers, oceans, estuaries.
10. Biodiversity and its conservation -Introduction, definition, genetic, species & ecosystem diversity.
11. Biogeographical classification of India-Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
12. Biodiversity at global, National and local levels -India as a mega-diversity nation -Hotspots of biodiversity -Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
13. Endangered and endemic species of India -Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
14. Social Issues and the Environment -From Unsustainable to Sustainable development -Urban problems related to energy.

15. Water conservation, rain water harvesting, watershed management -Environmental ethics: Issues and possible solutions, climate change, global warming.
16. Acid rain, ozone layer depletion, Nuclear accidents and holocaust -Wasteland Reclamation-Consumerism and waste products.

Mid Semester Examination.

17. Human Population and the Environment: Population growth, variation among nations, population explosion, Family Welfare Programme.
18. Environment and human health: Human Rights, Value Education, HIV/AIDS -Women and Child Welfare -Role of Information Technology in Environment and human health -Case Studies.
19. Environmental Pollution -Definition, cause, effects and control measures of Air pollution and Noise pollution.
20. Definition, cause, effects and control measures of Water pollution and Soil pollution.
21. Definition, cause, effects and control measures of Marine pollution, Thermal pollution and Nuclear hazards.
22. Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.
23. Role of an individual in prevention of pollution -Pollution case studies.
24. Environment Protection Act -Air (Prevention and Control of Pollution) Act -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act.
25. Issues involved in enforcement of environmental legislation -Public awareness.
26. Disaster Management -Natural Disasters -Meaning and nature of natural disasters, their types and effects -Floods, drought, cyclone, earthquakes, Landslides, avalanches.
27. Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.
28. Man Made Disasters -Nuclear disasters, chemical disasters, biological disasters, Building fire, coal fire, forest fire, oil fire, Air pollution, water pollution, deforestation, industrial waste water pollution. Road accidents, rail accidents, Air accidents, sea accidents.
29. Disaster Management -Effect to migrate natural disaster at national and global levels.
30. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements.
31. Role of NGOs, community -based organizations and media in disaster management.
32. Central, state, district and local administration in disaster management. Armed forces in disaster response -Disaster response; Police and other organizations.

Practical schedule

1. Visit to a local area to document environmental assets river / forest / grassland / hill / mountain.
2. Energy: Biogas production from organic wastes.
3. Visit to wind mill / hydro power / solar power generation units.
4. Biodiversity assessment in farming system.
5. Floral and faunal diversity assessment in polluted and un polluted system.
6. Visit to local polluted Site-Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds.
7. Environmental sampling and preservation.
8. Water quality analysis: pH, EC and TDS.
9. Estimation of Acidity, Alkalinity.
10. Estimation of water hardness.
11. Estimation of DO and BOD in water samples.
12. Estimation of COD in water samples.
13. Enumeration of *E. coli* in water sample.
14. Assessment of Suspended Particulate Matter (SPM).
15. Study of simple ecosystem –pond/river/hills.
16. Visit to areas affected by natural disaster.

Final Practical Examination.

Total Hours: 64

TEXT BOOKS :	
1.	Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
2.	Tyler Miller and Scot Spoolman. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA
3.	P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India.
4.	De. A.K., 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp.
5.	Diwan, P. and P. Diwan. 1998. Environmental Management Law and Administration. Variety Books International, New Delhi.

6.	William, P. Cunning Ham and Mary Ann. Inquiry and applications Cunningham 2005. Principles of Environmental science. Tata MCG raw-hill publishing company limited, New Delhi.

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1.	Hegde, D.M., Dwivedi, B.S. and Sudhakara Babu, S.N. (Eds.) (2014). Biofertilizers for Sustainable Agriculture. New India Publishing Agency, New Delhi.
2.	Glick, B.R. (2012). Plant Growth-Promoting Bacteria: Mechanisms and Applications. Scientific Publishers.
3.	Lugtenberg, B. (Ed.) (2015). Principles of Plant-Microbe Interactions: Microbes for Sustainable Agriculture. Springer International Publishing.
4.	Harman, G.E. and Kubicek, C.P. (Eds.) (2002). Trichoderma and Gliocladium, Volume 2: Enzymes, Biological Control and Commercial Applications. Taylor & Francis.
5.	Burges, H.D. (Ed.) (1998). Formulation of Microbial Biopesticides: Beneficial Microorganisms, Nematodes and Seed Treatments. Springer.

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1.	https://cpcb.nic.in/
2.	https://indiabiodiversity.org/
3.	https://ndl.iitkgp.ac.in/
4.	https://ndma.gov.in/
5.	https://swayam.gov.in/