

**2015 Syllabus**  
**B.Sc. (Agriculture)**

**II year III Semester**

<b>S.No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Credit Hours</b>
1.	AGR 201	Weed Management	1+1
2.	AEN 201	Fundamentals of Entomology	2+1
3.	AGR 202	Irrigation Management	1+1
4.	PAT 201	Fundamentals of Plant Pathology	2+1
5.	SAC 201	Fundamentals of Soil Science	2+1
6.	AMP 201	Livestock and Poultry Production Management	2+1
7.	AGM 201	Fundamentals of Microbiology	2+1
8.	AEX 201	Dimensions of Agricultural Extension	1+1
9.	FMP 211	Farm Power and Machinery	1+1
10.	AEC 201	Production Economics and Farm Management	1+1
11.	NSS/NCC 101	National Service Scheme/ National Cadet Corps	Regd. in I Sem
12.	PED 101	Physical Education	
		<b>Total</b>	<b>15+10=25</b>

**Theory:****Unit - I:**

Weeds: Introduction, Definitions; harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy.

**Unit - II:**

Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical, biological and biotechnological methods. Integrated weed management.

**Unit - III:**

Herbicides - Classification, characteristics, formulations, methods of application; advantages and limitation of herbicide usage in India - adjuvants - herbicide mixture.

**Unit - IV:**

Herbicides - selectivity of herbicides; Herbicide absorption and translocation; Compatibility of herbicides and other agro inputs - Herbicide residue management - Herbicide resistant weeds and their management - Herbicide resistant crops.

**Unit - V:**

Weed management in major field and horticultural crops - weed shift - weed control in non cropped areas - aquatic and problematic weeds and their control.

**Practical:**

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices ; Visiting problematic / parasitic weed infestation areas.

**Theory - Lecture Schedule:**

1. Weeds - Definition, classification and characteristics, harmful and beneficial effect of weeds.
2. Weed biology and ecological adaptation to different agro ecosystems.

3. Classification and characteristics of weeds of different agro ecosystems-lowland weeds, irrigated upland and rainfed land weeds.
4. Classification and characteristics of weeds - Aquatic, parasitic and obnoxious weeds.
5. Life cycle of weeds, weed migration, weed seed distribution, dormancy, germination, establishment and perennation of weeds in different ecosystems.
6. Crop weed interactions - Critical crop weed competition, competitive and allelopathic effects of weeds and crops.
7. Principles and methods of weed management: Preventive, cultural, mechanical.

#### **8. Mid semester examination.**

9. Principles and methods of weed management: chemical, biological and alternate methods.
10. Classification and characteristics of herbicides and herbicide formulations - History and Development.
11. Herbicide Use Efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India - Interaction with moisture, fertilizer and other agrochemicals.
12. Mode of action of herbicides and their selectivity - Mechanism of action of herbicides and their selectivity.
13. Herbicide persistence and degradation in plants and soils-Herbicide residue and management.
14. Herbicide resistant weeds and their impact on weed management.
15. Success of Herbicide Resistant Crops (HRC) in Indian and World agriculture.
16. IWM in crops and cropping systems-Agricultural Crops, Horticultural Crops.
17. Weed shift: Causes and management options for weed shift in crop production.

#### **Practical Schedule:**

1. Identification, classification and characterization of terrestrial weeds.
2. Identification, classification and characterization of aquatic weeds.
3. Identification, classification and characterization of problem and parasitic weeds.
4. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI.
5. Study on biology of nut sedge, bermuda grass, parthenium and celosia.
6. Practicing skill development on cultural and non chemical weed management.
7. Identification, classification and characterization of herbicides.
8. Practicing skill development on herbicide application techniques.
9. Practicing Skill development on spray equipment's and spray fluid calibration.

10. Practicing Skill development on herbicide weed management in lowland, upland and rainfed ecosystems.
11. Calculation of herbicide quantity and recommendation for different eco systems.
12. Study on phytotoxicity symptoms of herbicides in different crops.
13. Visit to Problem and parasitic weed infestation areas/ herbicide industries.
14. Herbicide residue determination by bioassay techniques.
15. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods.
16. Economic analysis of different weed management methods in crops and cropping systems.

**17. Practical Examination.**

**References:**

Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.

Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.

Jaganathan R., and R.Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.

**E-References:**

[www.tnau.ac.in](http://www.tnau.ac.in)

[www.fao.org](http://www.fao.org)

[www.tnau.ac.in/agriportal](http://www.tnau.ac.in/agriportal)

**Aim:**

To acquaint the students with external morphology of the insect, basic aspects of anatomy of different systems and identification of insects up to family level with hands-on experience.

**Theory****Unit I: History and importance**

History of Entomology in India; Position of insects in the animal kingdom and their relationship with other classes of Arthropoda; Reasons for insect dominance.

**Unit II: Morphology**

General organisation of insect body wall - structure and function, cuticular appendages, moulting; Body regions - insect head, thorax and abdomen, their structure and appendages.

**Unit III: Anatomy and physiology**

Digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects, sense organs and their functions, exocrine and endocrine glands; Embryonic and post embryonic development.

**Unit IV: Taxonomy of Apterygota and Exopterygota**

Insect systematics; Distinguishing characters of agriculturally important orders and families of Hexapoda. Apterygota (Thysanura, Diplura, Protura and Collembola); Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Thysanoptera and Siphunculata).

**Unit V: Taxonomy of Endopterygota**

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera.

**Practical**

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation – Preparation of Riker mount. Types of insect head, antenna, mouth parts – Structure of thorax. Types of insect legs, wings and their modifications – wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects – immature stages in insects. Study of digestive and reproductive systems of grasshopper / cockroach – Observing the characters of agriculturally important orders and families.

### Theory lecture schedule:

1. History of Entomology in India; Position of insects in the animal kingdom - relationship with other members of Arthropoda
2. 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. Structure of alimentary canal and its modifications; Digestive enzymes, digestion and absorption of nutrients
9. Malpighian tubules - accessory excretory organs and physiology of excretion
10. Structure of trachea - tracheoles - types of respiratory system - types of spiracles - respiration in aquatic and endoparasitic insects.
11. Haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions
12. Structure of neuron – types of nervous systems.
13. Axonic and synaptic transmissions
14. Male and female reproductive systems in insects – structure and modifications  
Spermatogenesis and Oogenesis
15. Oviparous, viviparous, paedogenesis, polyembryony ovoviporous and parthenogenesis
16. Embryogenesis; Types of metamorphosis – Immature stages of insects
17. Mid-semester examination
18. Structure of sense organs - types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects — Sound and light production
21. Systematics - principles and procedures of classification and nomenclature of insects
22. Distinguishing characters of insect orders — Apterygota (Thysanura, Diplura, Protura and Collembola), Exopterygota — (Ephemeroptera, Odonata and Phasmida)
23. Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Dictyoptera, Dermaptera and Embioptera
24. Isoptera — social life in termites
25. Thysanoptera, Pscoptera, Mallophaga and Siphunculata.
26. Hemiptera – Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae)
27. Hemiptera - Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)

28. Endopterygota — Classification of Lepidoptera – suborders; butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperidae)
29. Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
30. Classification of Coleoptera – suborders; Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae)
31. Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)
32. Diptera – Suborders; Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombyliidae), Cyclorhapha (Syrphidae, Drosophilidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
33. Hymenoptera–Suborders; Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethyidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
34. Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae); Siphonaptera and Strepsiptera

**Practical schedule:**

1. Observations on external features of grasshopper / cockroach and other members of phylum Arthropoda
2. Methods of insect collection, preservation, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, house fly, moths and butterflies
5. Structure of thorax and abdomen and their appendages —modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Types of immature stages of insects
7. Study of digestive system.
8. Study of male and female reproductive systems

9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota - Odonata and Ephemeroptera and Phasmida
10. Observing the characters of Dictyoptera, Dermaptera, Embioptera, Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Mallophaga and Siphunculata
11. Observing the characters of Exopterygota — Isoptera and Hemiptera — Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae) Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
12. Observing the characters of orders Thysanoptera and Diptera- Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombyliidae.), Cyclorhapha (Syrphidae, Drosophilidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
13. Observing the characters of Hymenoptera-Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethyidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
14. Observing the characters of Coleoptera - Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae) Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)
15. Observing the characters of Lepidoptera - Butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperidae), Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochliidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and



Lymantriidae)

16. Observing the characters of Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family
17. Final Practical examination

### **Assignment**

- Collection and submission of 50 insects
- Preparation and submission of one riker mount

### **Outcome/Deliverables:**

The students gain knowledge on external morphology of the insect i.e., head, thorax and abdomen, their appendages and functions. Moreover, this course imparts knowledge on basic aspects of anatomy of different systems, physiology, classification and identification of insects up to family level with hands-on experience.

### **References:**

#### **A. Text Book:**

1. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}

#### **B. Reference Books:**

1. Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}
2. Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.
3. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
4. Srivastava, P. D. and R. P. Singh. 1997. *An Introduction to Entomology*. Concept Publishing Company, New Delhi.

#### **C. Supplementary references:**

1. Borror, D.J., D.M. DeLong and C.A. Triple Horn. 1976. *An introduction to the study of insects* (IV Edition). Holt McDougal, New York. 864p. {ISBN 978-0030884061}

2. Cedric Gillott. 2005. *Entomology* (Third Edition). Springer, Netherlands.832p. {ISBN 978-1402031823}
3. Nayar. K.K., T.N. Ananthkrishnan and B.V. David 1976. *General and Applied Entomology*. Tata Mc-Graw Hill publishing Company Ltd, New Delhi.
4. Paulson, G.S. 2005. *Hand book to the Construction and Use of Insect Collection and Rearing Devices*. Springer, New York.121p. {ISBN 1402029748}

**D. Web resources:**

1. <http://www.itis.usda.gov/it is/>
2. [www.zin.ru/animalia](http://www.zin.ru/animalia)
3. <https://courses.cit.cornell.edu/ent201/content/anatomy2.pdf>
4. [www.insectsexplained.com/03external.htm](http://www.insectsexplained.com/03external.htm)
5. [www.earthlife.net/insects/anatomy.html](http://www.earthlife.net/insects/anatomy.html)
6. [www.insectidentification.org/orders\\_insect.asp](http://www.insectidentification.org/orders_insect.asp)

**AGR 202**

**Irrigation Management**

**1+1**

**Theory:**

**Unit - I:**

Role of water in plant growth - Importance of irrigation - Water resources and irrigation potential of India and Tamil Nadu - History and development of irrigation in India - Irrigation systems of India and Tamil Nadu.

**Unit - II:**

Soil - water - plant relationship - Soil Plant Atmospheric Continuum (SPAC) - Hydrological cycle - Soil water movement - soil moisture constants - Moisture extraction pattern - Absorption of water – Evapotranspiration - Plant water stress and its effect and methods to overcome stress.

**Unit - III:**

Crop water requirement - Potential evapotranspiration (PET) and consumptive use - Definition and estimation - Factors affecting water requirement - Effective rainfall - Critical stages for irrigation - water requirement of crops.

**Unit - IV:**

Scheduling of irrigation - Different approaches - Methods of irrigation: surface, sub-surface sprinkler and drip irrigation - Micro irrigation: layout, suitability, merits and scope - Fertigation - Water use efficiency - Methods to improve WUE - Conjunctive use of surface and ground water - Water management for major field crops of Tamil Nadu.

**Unit - V:**

Irrigation management under limited water supply, Quality of irrigation water - Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation - tank irrigation, canal irrigation, well irrigation - Drainage, importance and methods.

**Practical:**

Estimation of soil moisture - Measurement of irrigation water through water measuring devices (flumes, weirs and water meter) - Calculation of irrigation water requirement (problems) - Acquiring skill in land shaping for different surface irrigation methods - Operation and economics of drip and sprinkler irrigation systems - Estimation of crop water requirement - Scheduling of irrigation based on different approaches - Irrigation efficiency (problems) - Irrigation water quality (lab analysis) - On-farm irrigation structures - Visit to irrigation command area (Reservoirs and tanks) and water management institutes - Methods of drainage and observation of drainage structures.

**Theory - Lecture Schedule:**

1. Role of water in plants - Importance of irrigation - water resources of India and Tamil Nadu - History and development of irrigation in India - Irrigation systems of India and Tamil Nadu.
2. Soil - Plant -water relationship - Soil-plant-atmospheric continuum - Hydrologic cycle - absorption of water and evapotranspiration.
3. Plant water stress - causes - plant response and adaptations - method to overcome plant water stress.
4. Soil water movement - saturated and unsaturated flow and vapour movement - soil moisture constants and their importance in irrigation.

5. Available soil moisture - definition and importance - moisture extraction pattern - soil physical characteristics (texture, structure, porosity, bulk density and particle density) in influencing irrigation - soil moisture estimation methods.
6. Crop water requirement - factors affecting crop water requirement - effective rainfall - potential evapotranspiration (PET), consumptive use (CU) - definition and estimation.
7. Factors affecting crop water requirement (contd...)- Critical stages for irrigation - water requirement for different field crops.

#### **8. Mid-Semester Examination.**

9. Methods of irrigation - surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub-surface methods.
10. Micro irrigation system (drip and sprinkler irrigation) - suitability, components, layout, operation, advantage and disadvantage.
11. Scheduling of irrigation - criteria based on plant, soil moisture - different approaches - climatological approach, empirical methods, crop co-efficient.
12. Water use efficiency - definition and concept - methods to improve WUE - conjunctive use of water- water budgeting.
13. Water management for cereals, pulses and oilseeds.
14. Water management for commercial crops (cotton, sugarcane, sugar beet, tobacco).
15. Quality of irrigation water - irrigation management under limited water supply - Agronomic practices for use of poor quality water (saline, effluent and sewage water).
16. Tank irrigation, well irrigation - on farm development - command area development.
17. Agricultural drainage - importance of drainage and different methods of drainage.

#### **Practical Schedule:**

1. Estimation of soil moisture by gravimetric method and tensiometer.
2. Estimation of soil moisture by resistance blocks and neutron probe and other improved devices.
3. Measurement of irrigation water with flumes and weirs.
4. Calculation of irrigation water based on source, water flow, soil moisture status and depth of irrigation.
5. Land leveling and land shaping - Beds and channels - ridges and furrows.
6. Land leveling and land shaping for border strips - broad bed furrow method of irrigation.
7. Layout, operation and maintenance of drip and sprinkler irrigation systems.
8. Estimation of crop water requirement by direct and indirect methods.

9. Scheduling of irrigation based on indicator plants, soil-sand mini plot technique.
10. Scheduling of irrigation based on depletion of available soil moisture and IW/CPE ratio.
11. Calculations on irrigation efficiency parameters.
12. Assessment of irrigation water quality parameters.
13. Observation of irrigation structures in wetlands and irrigated drylands.
14. Visit to irrigation command area and study of command area development.
15. Observation on drainage structures during on / off campus field visit.
16. Visit to water management and training institute.

**17. Practical Examination.**

**References:**

Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers.

Sankara Reddy, G.H. and T. Yellamanda Reddy. 1997. Efficient use of irrigation water. Kalyani Publishers.

**e-References:**

[www.irri.org](http://www.irri.org)

[www.wcc.nrcs.usda.gov/nrcsirrig](http://www.wcc.nrcs.usda.gov/nrcsirrig)

[www.wcc.nrcs.usda.gov/irrig.info.html](http://www.wcc.nrcs.usda.gov/irrig.info.html)

[www.croinfo.net/irrigschedule.htm](http://www.croinfo.net/irrigschedule.htm)

**PAT 201**

**Fundamentals of Plant Pathology**

**2+1**

**Theory**

**Unit I: Plant pathogenic organisms**

Introduction – Definition – Plant Pathology – History of Plant Pathology- causes of plant diseases- biotic and abiotic- Losses due to plant diseases – Plant Pathogenic organisms – Protozoa ,chromista, Fungi, Bacteria, *Candidatus Phytoplasma*, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites

**Unit II: Pathogenesis**

Pathogenesis - Mode of infection – pre-penetration, penetration and post penetration -- Effect of pathogen on physiological functions of the plants - Role of enzymes and toxins on disease development – Plant defense mechanisms

**Unit III: General characters and molecular phylogeny of fungi**

General characters of fungi – somatic structures, types of fungal mycelia - Modification of mycelia – reproduction in fungi (Vegetative, asexual and sexual) –nutrition in fungi- Disease cycle –Symptoms of fungal diseases - Classification based on molecular phylogeny. **I Kingdom: Protozoa,** Phylum: Plasmodiophoromycota, Class: Plasmodiophoromycetes (Plasmodiophorales) **II. Kingdom: Chromista,** Phylum: Oomycota, Class: Oomycetes (Pythiales and Peronosporales). **III. Kingdom: Fungi. Phylum: Chytridiomycota,** Class: Chytridiomycetes (Chytridiales, Spizellomycetales); **Phylum: Blastocladiomycota,** Class: Blastocladiomycetes (Physodermaceae); **Phylum: Zygomycota,** Subphylum: Mucoromycotina (Mucorales).

#### **Unit IV: Phylum Ascomycota and Basidiomycota**

**Phylum: Ascomycota,** Classes: Taphrinomycetes (Taphrinales), Dothideomycetes (Dothidiales, Capnodiales, Pleosporales,) Eurotiomycetes (Eurotiales), Leotiomycetes (Erysiphales and Helotiales), Sordariomycetes (Hypocreales, Phyllochorales, Glomerales, Diaporthales,) and mitosporic ascomycetes; **Phylum: Basidiomycota,** Classes: Agaricomycetes (Agaricales, Corticiales, Cantharellales and Polyporales), Pucciniomycetes (Pucciniales) and Ustilaginomycetes (Ustilaginales, Urocystidales) Exobasidiomycetes (Exobasidiales and Tilletiales)

#### **Unit V: Bacteria, Phytoplasma, virus viroid, Algae, Phanerogams and abiotic disorders**

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria -general characters and symptoms of *Candidatus Phytoplasma*, Spiroplasma, Fastidious vascular bacteria, viruses ,viroids, algae –Abiotic disorders.

#### **Practical**

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* *Phytophthora*, *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora*, and *Plasmopara*, *Mucor*, *Rhizopus*, *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Botryodiplodia* (*Botryosphaeria*), *Curvularia*, *Drechslera* (*Helminthosporium*), *Alternaria*, *Venturia*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula* and *Claviceps*, *Fusarium* (*Gibberella* ,*Nectria*), *Verticillium* ,*Colletotrichum* (*Glomerella*) *Pestalotia* (*Pestalosphaeria*), *Pyricularia*(*Magnaporthe*) *Sarocladium*, *Macrophomina*, , *Puccinia*, *Uromyces* , *Hemileia*,

*Ustilago Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Exobasidium, Sclerotium, Rhizoctonia (Thanatephorus) Ganoderma Agaricus, Pleurotus, Volvariella* and *Calocybe*. Symptoms of bacterial diseases, *Candidatus Phytoplasma*, Fastidious vascular bacteria, algal parasite, phanerogamic parasites and non-parasitic diseases

**Note: Students should submit 50 well-preserved Herbariums**

### **Theory schedule**

1. Definition of Plant Pathology – History of Plant Pathology
2. Losses caused by plant diseases
3. Causes of Plant diseases – Protozoa , Chromista, , fungi, Bacteria, Fastidious vascular bacteria, Spiroplasma, *Candidatus Phytoplasma*,
4. Causes of Plant diseases -Virus, viroid, algal, phanerogamic parasites and abiotic disorders
5. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and post penetration
6. Role of enzymes in disease development
7. Role of toxins in disease development
8. Effect of pathogen on physiological functions of the plants- Effect on Photosynthesis- Transpiration- Respiration- translocation of water and nutrients
9. General characters of fungi- Mycelia – vegetative resting structures
10. Asexual reproduction in fungi
11. Sexual reproduction in fungi
12. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, facultative saprophyte- Mode of nutrition in fungi- biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
13. Classification of Kingdom Protozoa - important taxonomic characters , symptoms and life cycle of *Plasmodiophora brassicae* and symptoms of Protozoan diseases
14. Classification of Kingdom Chromista- General characters of Oomycetes- Symptoms and life cycle of *Pythium, Phytophthora* and *Albugo*
15. Symptoms and life cycle of *Peronosclerospora, Sclerospora. Perenospora, Pseudoperenospora* and *Plasmopara*
16. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Synchtrium* and *Rhizopus* and *Mucor*

### **17. Mid Semester Examination**

18. Classification of Kingdom– Ascomycota- important characters

19. Symptoms and life cycles of *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*), *Alternaria* and *Venturia and Macrophomina*
20. Symptoms and life cycles of *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podospaera* and *Sphaerotheca*
21. Symptoms and important characters of *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
22. Symptoms and important characters of *Colletotrichum* (*Glomerella*) *Pestalotia* (*Pestalosphaeria*), *Pyricularia* (*Magnoportha*) and *Sarocladium*
23. Classification of Kingdom - Basidiomycota- important characters
24. Symptoms and life cycles of *Puccinia*, *Uromyces*, *Hemileia*
25. Symptoms and life cycles of *Ustilago*, *Sphacelotheca* (*Sporisorium*), *Tolyposporium* (*Moesziomyces*), *Tilletia* and *Exobasidium*
26. Symptoms and life cycles of *Athelium*, *Thanetophorus* and *Ganoderma*
27. Important taxonomic characters of *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*
28. Classification and general characters of phytopathogenic bacteria
29. Symptoms and characters of *Xanthomonas*, *Ralstonia*, *Erwinia*, *Pantoea*, *Pectobacterium*, *Agrobacterium* (*Rhizobium*), *Corynebacterium* (*Clavibacter*,) and *Streptomyces*
30. Important characters and symptoms of *Candidatus Phytoplasma* diseases – Phyllody, little leaf, yellow dwarf and sandal spike, Fastidious vascular bacteria and Spiroplasma
31. Virus - definition, nature and properties of plant virus, Single stranded, Double stranded RNA and DNA viruses and Transmission of plant viruses
32. Common symptoms of virus diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunched top
33. Important characters and symptoms of Viroid, Algal and Phanerogamic parasites
34. Symptoms and characters of non-parasitic diseases

### **Practical schedule**

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies.
2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* and *Phytophthora*.



3. Study of important taxonomic characters and symptoms produced by *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*
4. Study of important taxonomic characters and symptoms produced by *Albugo* and *Rhizopus*.
5. Study of important taxonomic characters and symptoms produced by *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*) and *Alternaria*
6. Study of important taxonomic characters and symptoms produced by *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podospaera* and *Sphaerotheca*
7. Study of important taxonomic characters and symptoms produced by *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
8. Study of important taxonomic characters and symptoms produced by *Colletotrichum* (*Glomerella*), *Pestalotia* (*Pestalospaeria*), *Pyricularia* (*Magnoportha*) *Sarocladium* and *Macrophomina*
9. Study of important taxonomic characters and symptoms produced by *Puccinia*, *Uromyces*, and *Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago*, *Sphacelotheca* (*Sporisorium*), *Tolyposporium* (*Moesziomyces*), and *Exobasidium*
11. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella* and symptoms produced by *Athelium*, *Thanetophorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
13. Symptoms of *Candidatus Phytoplasma* and Algae
14. Symptoms and vectors of viral diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top
15. Phanerogamic parasites and non-parasitic diseases
16. Field visit
17. **Final Practical Examination.**

Note: Students should submit 50 well-preserved disease specimens.

## References

1. Agrios, G.N. 2005. Plant Pathology – (5<sup>th</sup> Edition). Academic Press, New York.

2. Alexopoulos,C.J., Mims,C.W. and Blackwell, M.2010 Introductory Mycology. John Wiley and Sons Ltd., N.York.
3. Alice D, and Jeyalakshmi C 2014. Plant Pathology. A.E Publications ,Coimbatore
4. Dube, H.C.2009. A textbook of Fungi, Bacteria and Viruses, Vikas Publishing House P. Ltd, New Delhi.
5. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E.Ltd. New Delhi.
6. Singh, R.S.1982. Plant Pathogens – The Fungi. Oxford and IBH Publishing Co., New Delhi.
7. Vidyasekaran, P. 1993. Principles of Plant Pathology –. CBS Publishers & Distributors, New Delhi.

#### **E-books**

1. Agrios, G.N. 2005. Plant Pathology – (5<sup>th</sup> Edition). Academic Press, New York.
2. Janse,J.D. 2006. Phyto bacteriology- Principles and practice, CABI Publishing, UK
3. Phyllis G. Weintraub and Phil Jones ,2010. Phytoplasma- Genomes,plant host and vectors

#### ***Web resources***

1. [www.mycobank.org](http://www.mycobank.org)
2. [www.mycology.net](http://www.mycology.net)
3. [www.bspp.org.uk](http://www.bspp.org.uk)
4. [www.ictv.org](http://www.ictv.org)
5. [www.bibo.library.cornel.edu](http://www.bibo.library.cornel.edu)

**SAC 201**

**Fundamentals of Soil Science**

**2 + 1**

#### **Aim:**

To impart knowledge about soils, their formation, pedological and edaphological approaches and physical, chemical and biological properties of soils.

#### **Syllabus - Theory**

##### **Unit I-Earth, Rocks and Minerals**

Soil - Pedological and edaphological concepts - Origin of the Earth - Composition of Earth's crust -Rocks and minerals - primary and secondary minerals.

##### **Unit II - Soil Formation**

Weathering of rocks & minerals - Physical, chemical and biological weathering - Soil formation - factors-active & passive. - Soil forming processes - Simenson's and specific - Soil profile.

### **Unit III- Physical Properties**

Soil physical properties and their significance - Soil texture and textural classes - Soil structure and classification - Soil consistence. Bulk density, particle density and porosity - Soil colour - significance -causes and measurement. Soil temperature - Soil air - Soil water-Measurement - Soil water potentials -Soil moisture constants - Movement of soil water - saturated and unsaturated flow - infiltration, hydraulic conductivity, percolation, permeability and drainage.

### **Unit IV-Chemical Properties**

Soil colloids - Properties, types and significance - Layer silicate clays - their genesis and sources of charges - Ion exchange - CEC, AEC and Base saturation - Factors influencing Ion exchange -significance. Soil reaction, Buffering capacity and EC.

### **Unit V-Organic matter and Humus**

Soil organic matter - Composition - decomposition and mineralization, C : N ratio, Carbon cycle -Fractions of soil organic matter - Humus formation. Soil organisms - Beneficial and harmful effects.-Soil enzymes.

### **Syllabus-Practical**

Identification of rocks and minerals - Study of soil profile - collection and processing of soil samples -Determination of bulk density, particle density and porosity - Particle size analysis - Feel method -International pipette method - Soil colour - Munsell colour chart. Soil moisture determination -Gravimetric method, gypsum block, tensiometer, TDR and neutron probe moisture meter. Determination of infiltration rate and hydraulic conductivity - Soil temperature. Soil pH and EC - Organic carbon -Chemical constituents of soil - Field study of different soil types.

### **Lecture Schedule**

1. Soil definition – soil as a three dimensional natural body – Pedological and edaphological concepts.
2. Origin of Earth – theories – planetesimal and nebular hypothesis – Composition of Earth's crust

3. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks
4. Brief description of important rocks – mineralogical composition
5. Minerals – definition, occurrence, classification of important soil forming primary minerals – silicate and non silicate minerals, ferro and non-ferro magnesium minerals
6. Formation of secondary minerals – clay minerals and amorphous minerals
7. Weathering of rocks and minerals – Physical, chemical and biological
8. Soil profile description – Master horizons – pedon and poly pedon
9. Factors of soil formation – Passive soil forming factors
10. Factors of soil formation – Active soil forming factors
11. Fundamental soil forming process – Simenson’s four fold soil forming process – eluviation, illuviation, translocation and humification.
12. Specific Soil forming processes – podzolization, laterization, salinization, alkalization, calcification, decalcification and pedoturbation.
13. Soil texture – particle size distribution – textural classes – textural triangular diagram – significance of soil texture
14. Soil structure – classification – genesis – factors influencing structural stability – significance of soil structure
15. Soil consistence – cohesion, adhesion, plasticity, Atterberg’s constants – upper and lower plastic limits, plasticity number – significance of soil consistence
16. Soil bulk density, particle density and porosity – factors influencing – significance
17. Mid semester Examination
18. Soil colour – causes and measurement – Munsell colour chart – factors influencing soil colour – significance
19. Soil temperature – measurement , soil air – composition – aeration, measurement – significance of soil temperature and soil air
20. Soil water – forms of water, units of expression and pF scale
21. Measurement of soil moisture – Gravimetric, Tensiometer, Gypsum Block, TDR, Neutron probe and Theta probe
22. Soil water potentials – gravitational, matric, osmotic –soil moisture constants
23. Movement of soil water – Saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage.

24. Soils colloids – types, properties – inorganic colloids and organic colloids
25. Layer silicate clays – genesis and classification – 1:1, 2:1 expanding and non expanding – 2:2 clay minerals, amorphous minerals.
26. Sources of charges in expanding and non expanding crystalline lattice clays, amorphous minerals and organic colloids
27. Ion exchange reactions – cation exchange, anion exchange and base saturation – significance
28. Soil reaction (pH) – definition, pH scale, factors affecting soil pH, buffering capacity – Significance
29. Soil Electrical Conductivity – factors affecting EC – Significance
30. Soil organic matter – composition, decomposition, mineralization and immobilization  
Carbon cycle, C:N ratio, biomass carbon and nitrogen.
31. Fractions of soil organic matter – humus formation and stabilization
32. Soil organisms – soil flora and fauna formation and stabilization
33. Soil organisms – soil flora and fauna – beneficial and harmful roles – earth worms – micro – organisms and their influence on soil properties – Soil enzymes – Dehydrogenase, catalase and phosphatase
34. Importance of soil properties on crop growth.

### **Practical Schedule**

1. Identification of common rocks and minerals
2. Methods of soil sample collection
3. Visit to soils of different terrains and study of soil profiles
4. Determination of bulk density, particle density and porosity - cylinder, wax coating and core methods.
5. Soil textural analysis - feel method, International pipette method (part 1)
6. International pipette method (part 2)
7. International pipette method (part 3)
8. Determination of soil colour and temperature.
9. Determination of soil moisture- Gravimetry and moisture probes
10. Determination of available soil moisture - Pressure Plate Apparatus
11. Determination of Infiltration rate - Double Ring Infiltrometer
12. Determination of hydraulic conductivity - Constant head Hydraulic Conductivity unit

13. Determination of soil pH and EC
14. Estimation of soil organic carbon
15. Colloquium 1. - Chemical constituents of soil - Total elemental composition - relevance in soil properties and behaviour
16. Colloquium 2. - Preparation of interpretative reports of soil analysis and assignments
17. Final Practical Examination

### **Text Books**

1. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14<sup>th</sup> Edition). Pearson Education, Inc. Publishing as Prentice Hall.
2. Sehgal, J. 2005. Pedology concepts and applications, Kalyani Publishers, New Delhi.

### **References**

1. Arun Kumar Saha and Anuradha Saha. 2012. Text book of Soil Physics. Kalyani Publishers. New Delhi.
2. Bear, Firman.E. 2012. Soil Science. Vol. 8. Scientific Publishers, Jodhpur, India.
3. Bear, Firman.E. 2014. Chemistry of the soil. 2<sup>nd</sup> Edition. Scientific Publishers, Jodhpur, India.
4. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science-Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5. Black, C.A. 1965. Agronomy Monograph. Methods of Soil Analysis. Part 1. Physical and Mineralogical properties including Statistics of Measurement and Sampling. Wiley, New York.
6. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14<sup>th</sup> Edition). Pearson Education, Inc. Publishing as Prentice Hall.
7. Daji A.J. 1970. A Text Book of Soil Science - Asia Publishing House, Madras.
8. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, New Delhi
9. Fanning, D.S. and C.B.Fanning. 1989. Soil: Morphology, Genesis and Classification. John Wiley and Sons, New York.
10. Fundamentals of Soil Science. 2009. ISSS Publication, New Delhi.
11. Garrison Sposito. 2008. The Chemistry of Soils. Amazon Publishers, India.
12. Ghildyal, B.P. and Tripathi, R.P. 2001. Soil Physics. New Age International Publications.
13. Hillel, D. 1998. Environmental Soil Physics. Academic Press: Orlando, FL.

14. Helmut Kohnke and D.P.Franzmeier. 2013. Soil Science Simplified. Amazon Publishers, India
15. Henry D.Foth. 1990. Fundamentals of Soil Science. Amazon Publishers, India.
16. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGraw-Hill Book Company INC. NewYork.
17. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersey.
18. Kim H.Tan. 2003. Principles of Soil Chemistry. Third Edition. Scientific Publishers, Jodhpur, India.
19. Kohnke, H. and D.R.Franzmeier. 2013. Soil Science Simplified. Amazon Publishers.
20. Michael J.Singer and Donald N. Munns. 2005. Soils : an introduction (6<sup>th</sup> Edition). Amazon Publishers.
21. Sahai, V.N. 2008. Fundamentals of Soils. Kalyani Publishers, New Delhi.
22. Schaetzl, R. and S.Anderson. 2005. Soils - Genesis and geomorphology. Cambridge University Press, Cambridge.
23. Soil Science Society of America. 2001. Glossary of Soil Science Terms 1996. Soil Science Society of America, Madison, Wis.
24. Michael J.Singer and Donald N.Munns. 2005. Soils : An Introduction (6<sup>th</sup> Edition) Amazon Publishers.
25. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers.
26. William A.Jury and Robert Horton. 2004. Soil Physics. Amazon Publishers.

#### **e-references**

1. <http://www.sciencedirect.com/science/books>
2. <http://202.200.144.17/sykc/hjx/content/ckzl/6/2.pdf>
3. [http://www.pedosphere.com/volume01/pdf/Section.\\_01.pdf](http://www.pedosphere.com/volume01/pdf/Section._01.pdf)
4. [http://waterquality.montana.edu/docs/homeowners/Septic Drainfield Soil Suitability, Presentations /6 Soil Texture and Structure.pdf](http://waterquality.montana.edu/docs/homeowners/Septic_Drainfield_Soil_Suitability_Presentations/6_Soil_Texture_and_Structure.pdf)
5. [http://wfrec.ifas.ufl.edu/landscape\\_horticulture/PDFdocuments/SoilProp.pdf](http://wfrec.ifas.ufl.edu/landscape_horticulture/PDFdocuments/SoilProp.pdf)
6. [http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20\(Feb%2008\).pdf](http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20(Feb%2008).pdf)
7. <http://www.soils.wisc.edu/courses/SS325/morphology.htm>
8. <http://www.google.co.in/#hl=Base+saturation+%E2%80%93+Factors+influencing+ion+exchange+significance.+Soil+reaction%2C+Buffering+capacity+and+EC++&btnG>

9. [ftp://ftp-fc.sc.egov.usda.gov/NSSC/Lab Methods Manual/ SSIR42 2004 print. pdf](ftp://ftp-fc.sc.egov.usda.gov/NSSC/Lab%20Methods%20Manual/SSIR42%202004%20print.pdf)
10. [www.scribd.com/.../15751720-Soil-Survey-lab-Methods-Manual-2004-USDA](http://www.scribd.com/.../15751720-Soil-Survey-lab-Methods-Manual-2004-USDA)
11. [www.asssi.asn.au/.../Understanding\\_Soils\\_and\\_Their\\_Interactions\\_with\\_Land Management\\_2005.pdf](http://www.asssi.asn.au/.../Understanding_Soils_and_Their_Interactions_with_Land_Management_2005.pdf)
12. <http://www.soils.wis.edu/courses/SS325/morphology.htm>
13. <http://landresources.montana.edu/>
14. <http://ftp.wcc.nrcs.usda.gov/H...soilOther/soil-USDA-textural-class.pdf>

**Outcome:**

This course will give a comprehensive knowledge on rocks and minerals, their composition and the types of soils formed from different parent materials. It will enrich the students on the role of soil forming factors and processes in soil formation. The students will understand the various soil physical, chemical and biological properties and their impact on plant growth. The knowledge gained in this course will be useful in understanding the behaviour of soils in crop production and management

**AMP 201**

**Livestock and Poultry Production Management**

**2+1**

**Theory**

**Unit I: Introduction to Livestock Management**

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu- Various systems of livestock production-extensive – semi intensive - intensive- mixed- Integrated and specialized farms.



## **Unit II: Dairy Cattle Management**

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle –Culling - Estrus Cycle – Artificial Insemination – Introduction to Embryo transfer – Housing – Space requirement calf and adult stock – System and types of housing - Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder –Total Mixed Ration – composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

## **Unit III: Sheep and Goat Management**

Breeds - Sheep and goat classification — Economic traits - system of rearing - Housing Management – Floor space requirement - Care and Management of young and adult stock – Nutrition – Feed and fodders of Small ruminants – Flushing - Common diseases – prevention and control.

## **Unit IV: Management of Swine**

Classification of breeds – Economic traits - Housing - Nutrition – creep feeding - Care and Management of Adult and Young Stock - Common disease- prevention and control.

## **Unit V: Poultry Management**

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers -Nutrition of Chick, grower, Layer and broiler – Incubation and Hatching of Eggs - Common Diseases - Control and prevention.

## **Practical**

Study of external parts of Livestock - Identification of livestock and poultry-Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) Dehorning-Different methods of castration- Dentition-Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk- Demonstration of cream separation, - Identification of feeds and fodder- Economics Dairy, Goat and Swine farming - Study of external parts of Fowl - Preparation of Brooder House -

Brooder management-Identification of layer and non layer- Debeaking, delousing and deworming of poultry-Vaccination schedule for broiler and layer-Dressing of broiler chicken - Economics of Broiler and Layer Farming - Visit to a modern Dairy and commercial layer and broiler farms - Demonstration of incubator and setter.

### Lecture schedule

S. No	Lecture Unit	Reference Book & Page No
1	Significance of livestock and poultry in Indian economy- livestock and poultry census. Different livestock development programmes of Government of India and Tamil Nadu	<a href="http://www.indiastat.com">www.indiastat.com</a> , Livestock census 2012, Dairying in Tamil Nadu 2014 by NDDB
2	Various systems of livestock production-extensive – semi intensive, intensive- mixed- integrated and specialized farms.	357- 396 Handbook of Animal Husbandry - ICAR
3	Definition of breed-classification of indigenous white and black cattle-breed characteristics of Tamil Nadu cattle breeds and Indian breeds -Sindhi, Gir and Sahiwal.	1-53- Handbook of Animal Husbandry - ICAR
4	Breed-characteristics of exotic cattle -Jersey and Holstein Friesian – Indian Buffaloes- Murrah, Surti and Toda.	1-53- Handbook of Animal Husbandry - ICAR
5	Breeding-cross breeding-upgrading-economic traits of cattle-culling importance and methods	1-53- Handbook of Animal Husbandry - ICAR
6	Estrous cycle – signs of estrous - artificial insemination-merits and demerits-Principles and outline of embryo transfer	722-723 Handbook of Animal Husbandry - ICAR
7	Housing management-farm site selection and floor space requirement for calves, heifer, milch animal and work bullocks.	364-379 Handbook of Animal Husbandry - ICAR
8	Systems of housing-single row system-double row system- head to head and tail to tail-merits and demerits - Type design of house.	364-379 Handbook of Animal Husbandry - ICAR
9	Care and management of new born calf and heifers	358-362 Handbook of Animal Husbandry - ICAR
10	Care and management of pregnant animal and lactating animals.	362-363 Handbook of Animal Husbandry - ICAR

11	Care and management of dry cows and work bullock.	756-757 Handbook of Animal Husbandry - ICAR
12	Nutrition-definition-ration-balanced ration-desirable characteristics of a ration. Classification of feed stuffs-concentrate and roughage-comparison, Total Mixed Ration	395-447 Handbook of Animal Husbandry - ICAR
13	Model composition of concentrate mixture of young and adult stock-age wise feed and fodder requirement-Importance of green fodder.	395-447 - Handbook of Animal Husbandry - ICAR
14	Milking methods-clean milk production-factors affecting milk yield and composition	363 Handbook of Animal Husbandry – ICAR
15	Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.	448-551 Handbook of Animal Husbandry - ICAR
16	Viral diseases-foot and mouth disease, bacterial diseases, anthrax, hemorrhagic septicemia- black quarter - metabolic- tympanites, acidosis, ketosis and milk fever	448-551 Handbook of Animal Husbandry - ICAR
17	<b>Mid semester examination</b>	
18	Sheep and goat farming-classification of breeds of Indian and exotic origin – economic traits.	54-120 Handbook of Animal Husbandry - ICAR
19	Systems of rearing-housing management - type design-floor diagram-space requirement for adult and young stock.	101 Handbook of Animal Husbandry - ICAR
20	Care and management of ram, ewe and lamb-nutrition-feeds and fodder for small ruminants.	99-101 Handbook of Animal Husbandry - ICAR
21	Care and management of buck, doe and kid- nutrition-flushing.	102 Handbook of Animal Husbandry - ICAR
22	Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue- PPR- enterotoxaemia- Ecto and endo parasites.	448-551 Handbook of Animal Husbandry - ICAR
23	Swine husbandry –Common breeds of exotic origin-Large White Yorkshire, Landrace and Duroc -economic traits- housing of Swine.	256-271Handbook of Animal Husbandry - ICAR
24	Care and management of sow, boar and piglets-nutrition-creep feeding.	256-271Handbook of Animal Husbandry - ICAR

25	Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.	448-551 Handbook of Animal Husbandry - ICAR
26	Classification of breeds - commercial strains of layer and broiler.	206-255 Handbook of Animal Husbandry - ICAR
27	Care and management of Chicks-brooder management.	206-255 Handbook of Animal Husbandry - ICAR
28	Systems of housing- deep litter and cage system- floor space requirement-common litter material-litter management-merits and demerits.	206-255 Handbook of Animal Husbandry - ICAR
29	Care and management of Grower and Layers- vaccination schedule.	206-255 Handbook of Animal Husbandry - ICAR
30	Care and management of broilers-vaccination schedule.	206-255 Handbook of Animal Husbandry - ICAR
31	Incubation and hatching of eggs.	206-255 Handbook of Animal Husbandry - ICAR
32	Nutrition-feed formulation-composition of chick, grower, layer broiler- starter and Finisher mashes-Feed Conversion Ratio /dozen egg or kg of meat production.	206-255 Handbook of Animal Husbandry - ICAR
33	Classification of disease –viral – bacterial - protozoan-causative organisms, symptoms and prevention – viral diseases- Ranikhet – IBD-avian flu	448-551 Handbook of Animal Husbandry - ICAR
34	Bacterial disease-E.coli-coryza-salmonellosis-protozoan-coccidiosis-casulative organism, symptoms and preventive measures. Management of dead birds and manure	448-551 Handbook of Animal Husbandry - ICAR

**Practical:**

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, Dehorning, Castration and Dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock

7. Determination of specific gravity, fat %, total solids, solids not fat
8. Demonstration of cream separation
9. Identification of feed & fodder
10. Economics of dairy, goat and swine Farming
11. Study of external parts of fowl. Preparation of brooder house
12. Identification of layer and non- layer
13. Debeaking, delousing, deworming of poultry Vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler. Economics of layer and broiler farming
15. Visit to a modern dairy and commercial layer and broiler farms
16. Demonstration of incubator and setter
17. **Practical examination**

**Reference books:**

ICAR (2002) Hand of Animal Husbandry, ICAR, New Delhi.

**E- reference:**

<http://www.elearnvet.net/>

[http://agridr.in/expert\\_system/cattlebuffalo/Breeding%20management%20of%20cattle%20and%20buffaloes-2.html](http://agridr.in/expert_system/cattlebuffalo/Breeding%20management%20of%20cattle%20and%20buffaloes-2.html)

**Aim**

1. To enable better understanding of students about the microscopic world around them
2. To acquaint students with the basic laboratory techniques and tools of microbiology
3. To introduce the fundamental characteristics of various microorganisms
4. To develop experimental skills, including the collection and analysis of data, the ability to draw valid conclusions and apply these conclusions within a larger framework

**Theory****Unit I. History of Microbiology**

Definition and scope of microbiology – microbes for human welfare and environment. Historical roots of microbiology; biogenesis and abiogenesis theory; germ theory of diseases and fermentation. Contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.

**Unit II. Microbiological Techniques**

General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes; three dimensional imaging - Atomic force and Confocal scanning laser microscopy. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization - physical methods – heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, moulds and actinobacteria. Preservation of microbial cultures.

**Unit III. Position of Microbes in the living World and their Structure**

Evolutionary relationship among the living organisms. Whittaker's Five Kingdom concept of living organism and Carl Woese systems. Three domains of life – similarities and differences; Modern approach to the bacterial systematics; Differentiation of bacteria, archaea and eukaryotes; Systematic bacteriology; prokaryotic diversity - Bergey's Manual of Systematic Bacteriology. Cell biology - bacterial size, shape and arrangement; cell structure and components of bacteria. Morphology of fungi and algae.

**Unit IV. Growth, Nutrition and Metabolism**

Bacterial growth- population growth- growth cycles of population - measurement of growth ; environment on growth – temperature, oxygen, pH and salts; energetics in bacteria; oxidation –

reduction , electron carrier – overview of aerobic and anaerobic respiration and fermentation in bacteria.

### **Unit V. Viruses, Bacterial Genetics and Immunology**

General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages. Genetic elements of bacteria; bacterial chromosomal DNA and plasmid; gene arrangements. Mutation - types and mutagens. Genetic recombinations: Transformation, transduction and conjugation. Genetic engineering – an introduction. Basic concepts of immunology – antigen – antibody reactions and vaccines.

### **Practical**

Safety in Microbiology laboratory. Microscopes – Micrometry – Sterilization techniques and equipment – Growth media preparation – bacteria, fungi and actinobacteria. Isolation, purification and preservation of bacteria yeast and moulds. Staining techniques: Simple and differential staining - spore staining - Measurement of bacterial growth. Identification of microorganisms: cultural, physiological and biochemical tests for bacteria and actinobacteria. Morphological identification of yeasts, moulds and algae. Molecular identification of bacteria (16s rDNA). Isolation of bacteriophages. Isolation of mutants employing physical or chemical mutagens.

### **Theory schedule**

1. Definition and scope of microbiology – Development of microbiology as science
2. Biogenesis and a biogenesis theory. Contributions by Antonie Van Leeuwenhoek, Louis Pasteur
3. Contributions of John Tyndall, Joseph Lister, Edward Jenner, Robert Koch, Alexander Fleming and Waksman. Germ theory of fermentation and disease
4. Microscopy; principles – resolving power and magnification. Light microscopy
5. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence and Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
6. Staining techniques - principle and types of stains - staining techniques- simple, negative, differential and structural staining methods
7. Sterilization – principle – physical agents and chemical methods
8. Isolation and enrichment culture techniques; preservation techniques

9. Evolutionary relationship - Position of microbes in living world – concepts and developments in classification of microorganisms
10. Groups of microorganisms - prokaryotes and eukaryotes
11. Archaea – ecology; differences among archaea, eubacteria and eukaryotes
12. Systematic bacteriology - Bergey's manual of systematic bacteriology – outline only
13. Cell biology; size, shape, structure and arrangement of cells
14. External structures in bacteria and their functionality
15. Functional anatomy and reproduction in bacteria
16. Morphology of fungi – economic importance
17. Morphology of algae – economic importance
18. **Mid Semester Examination**
19. Bacterial growth- population growth and growth cycle – continuous culture -chemostat and turbidostat; synchronous culture
20. Conditions for growth - temperature requirements - aerobes and anaerobes – factors influencing growth and methods of assessment of growth
21. Nutritional types of bacteria; energetics in bacteria. Metabolic diversity/ pathways specific to bacteria
22. Microbial metabolism- Energy generation by substrate level phosphorylation, oxidative and photo phosphorylation
23. Aerobic respiration and anaerobic respiration
24. Fermentative mode of respiration
25. Viruses and their properties; bacteriophages – lytic and lysogenic and temperate phages
26. Genetic elements in bacteria – structure and functions of bacterial chromosome and plasmid
27. Mutation in bacteria – principles and types
28. Mutagens – physical, chemical and biological
29. Genetic recombination – competency - transformation
30. Genetic recombination by Conjugation – concept of Hfr
31. Genetic recombination by Transduction – generalized and specialized
32. Microorganisms as tools in genetic engineering
33. Immunology – principles – specific and non-specific defense
34. Antigen – antibody reactions – vaccines - applications



## **Practical schedule**

1. Safety in Microbiology laboratory. Microscopes – handling light microscope
2. Micrometry-measurement of microorganisms
3. Aseptic techniques – working with equipment and apparatus
4. Preparation of growth media for bacteria, yeast moulds and actinobacteria
5. Isolation of microorganisms by serial dilution and plating technique
6. Purification and preservation of bacteria and actinobacteria
7. Purification and preservation of yeasts and moulds
8. Staining techniques - positive and negative staining
9. Differential staining - Gram and spore staining
10. Turbidometric assessment of growth of bacteria
11. Morphological and physiological characteristics of bacteria and actinobacteria
12. Biochemical characteristics of bacteria and actinobacteria
13. Identification of yeasts moulds and algae - morphological characterization
14. Molecular identification of bacteria by 16s r DNA sequencing
15. Isolation of bacteriophages
16. Isolation bacterial mutants by UV irradiation / chemical mutagenesis

## **17. Practical Examination**

### **Outcome**

1. Skill development in the safe handling, culturing and staining of microorganisms
2. Learning the laboratory procedures needed to identify a bacterial culture
3. Understanding the structural, reproductive and metabolic characteristics of bacteria and morphology of eukaryotic microorganisms
4. Acquiring knowledge about the factors that influence microbial growth and how it can be controlled
5. Exposure to the mechanisms of genetic recombination in bacteria and describe the practical applications of these methods

### **Text Books**

1. Prescott, Harley and Klein, 2013. Microbiology, 9<sup>th</sup> edition, McGraw Hill Publishing
2. Michael J. Pelczar, JR., E.C.S. Chan, Noel R.Krieg, 2005. Microbiology
3. ebook: Luis M. de la Maza, Marie T. Pezzlo and Ellen Jo Baron 1997. Color Atlas of diagnostic Microbiology, Published by Mosby- Year Book Inc.

4. ebook: Michael J. Leboffee and Burton E.Pierce 2011. A photographic Atlas for the Microbiology Laboratory 4<sup>th</sup> edition, Marton Publishing Company

### **Reference Books**

1. Hans G. Schlegel, 2012. General Microbiology, 7<sup>th</sup> edition
2. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
3. Tortora, G.J., B.R.Funke and C.L. Case, 2009. Microbiology- An Introduction, 9<sup>th</sup> edition
4. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

### **Web pages**

<http://www.microbes.info>

<http://aem.asm.org>

<http://microbelibrary.com>

<http://www.rapidmicrobiology.com>

The course intends to expose students to the fundamentals of extension education, extension systems in India, programme planning and rural development efforts. The course will also provide an opportunity to students to visit different organizations involved in extension activities and rural development work.

**Theory**  
**UNIT I**

**Introduction to Extension Education**

Extension Education – meaning, definition, scope, objectives, philosophy, principles; Extension Education Process; Differences among formal, informal and non-formal education; Extension education as a science – relationship with other social sciences.

**UNIT II**

**Early Rural Development attempts, Extension in USA, Extension approaches in India**

Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon Experiment, Sriniketan, Sevagram, Marthandam project, India Village Service, Firka development scheme, Etawah pilot project, Nilokheri Experiment; Extension in USA – origin, Cooperative Extension Service, organization of extension work, 4-H club; Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Farming System Research Extension(FSRE) , Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, IVLP, ATIC, Frontline demonstrations.

**UNIT III**

**Major Rural Development Programmes**

Rural Development – meaning, definition, concept, importance; Rural Development in India - Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup –Community Development Programme (CDP), National Extension Service (NES), IADP, IAAP, HYVP, IVLP, WDP, NATP, ITDP, IRDP, SFDA, MFAL, NREP, RLEGP, DPAP, CADP, FFW, JRY, EAS, IAY, SGSY, PMEY, SJSRY, PMGSY, SGRY, MGNREGA, PURA, NAIP, NADP (RKVY) - the strengths and weaknesses of the above programmes.

## **UNIT IV**

### **Women and Youth Development Programmes**

Women Development Programmes – DWCRA, RMK, ICDS, MSY, TANWA; Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), ARYA - the strengths and weaknesses of the above programmes.

## **UNIT V**

### **Extension Programme Planning**

Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

#### **Practical**

Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes; Visit to Panchayat Union office to learn their functions; Exposure to Grama Panchayat activities; Study of the functions of JDA / ADA and to learn about ATMA and other schemes; Interaction with a Self-Help Group to study its activities; Exposure to a Non-Governmental Organization (NGO) to study its role in rural development; Study of the activities of State Department of Horticulture to learn their extension activities; Visit to Krishi Vigyan Kendra (KVK) to learn their roles and activities; Visit to Social Welfare Department to study the women development programmes; Exercise to assess the awareness and participation of village people in rural development programmes in a rural setting.

#### **Theory Schedule**

1. Extension Education – meaning, definition, scope, objectives, philosophy, principles.
2. Extension Education Process, Differences among formal, informal and non-formal education.
3. Extension education as a science – relationship with other social sciences.
4. Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon experiment, Sriniketan.
5. Sevagram attempt, Marthandam Project, Indian Village Service, Firka Development Scheme, Etawah Pilot project, Nilokheri Experiment.
6. Extension in USA – origin, Cooperative Extension Service, organization of extension work, 4-H clubs.
7. Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Farming System Research Extension (FSRE), Agricultural Technology Management Agency (ATMA).
8. Firstline Extension System – Krishi Vigyan Kendra (KVK), Institution Village Linkage Programme (IVLP), Agricultural Technology Information Centre (ATIC), Frontline

- demonstrations.
9. **Mid Semester Examination**
  10. Rural Development – meaning, definition, concept and importance. Rural Development in India. Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.
  11. Community Development Programme (CDP), National Extension Service (NES), Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP) - their strengths and weaknesses.
  12. High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), Integrated Rural Development Programme (IRDP) - their strengths and weaknesses.
  13. National Agricultural Technology Project (NATP), Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL) - their strengths and weaknesses.
  14. National Rural Employment Programme (NREP), Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development Programme (CADP), Food for Work Programme (FFW), Jawahar Rozgar Yojana (JRY), Employment Assurance Scheme (EAS), Indira Awaas Yojana (IAY), Swarnajayanthi Gram Swarozgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY), Swarna Jayanthi Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY) - their strengths and weaknesses.
  15. Sampoorna Grameen Rozgar Yojana (SGRY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY) - their strengths and weaknesses.
  16. Women Development Programmes – Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS), Mahila Samridhi Yojana (MSY), Tamil Nadu Women in Agriculture (TANWA), Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), Attracting Rural Youth towards Agriculture (ARYA) - their strengths and weaknesses.
  17. Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

### **Practical Schedule**

1. Visit to District Rural Development Agency (DRDA) to study the organizational set up

- and rural development programmes.
2. Visit to a Panchayat Union Office to learn about its functions.
  3. Exposure to the activities of a Grama Panchayat.
  4. Study of the functions of JDA / ADA and to understand the reorganized extension system, organizational setup, functions, ATMA scheme and other schemes.
  5. Interaction with a SHG to study its activities.
  6. Exposure to an NGO to study their role in rural development activities.
  7. Study of the extension activities of the State Department of Horticulture.
  8. Visit to a nearby KVK to study its role and activities.
  9. Visit to the Social Welfare Department to study the social welfare and women development programmes.
- 10 & 11. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise)
- 12 & 13. Visit to a village to collect data (Group exercise).
- 14 & 15. Preparation of report.
16. Presentation of report.
17. **Final Practical Examination**

**Suggested Readings** (Textbooks, Reviews, Journals)

- Dipak de, Basavaprabhu Jirli. 2010. A Handbook of Extension Education, Agrobios, India.
- Pandey, B.K. 2005. Rural Development, ISHA Books, New Delhi.
- Puran, Chandra. 2005. NGOs in India. A. Kansha Publishing, New Delhi.
- Ray, G.L. 1999. Extension Communication and Management, Noya Prakash, Kolkatta, West Bengal.
- Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
- Sagar Mondal and Ray, G.L. 2007. Text book of Rural Development, Kalyani Publishers, New Delhi.
- Sanjay Prakash Sharma. 2006. Panchayat Raj, Vista International Publishing House, New Delhi.
- Singh, A.K. 2012. Agricultural Extension, Agrobios, New Delhi.
- Van den Ban, A.W and H.S. Hawkins. 2002. Agricultural Extension, CBS Publishers & Distributors, New Delhi.
- Viswanathan Maithili. 1994. Women in Agriculture and Rural Development, Printwell, Jaipur.

**Journals**

- International Journal of Extension Education
- Indian Journal of Extension Education

- Journal of Extension Education – Coimbatore
- Journal of Extension Education – Bhubaneshwar
- Rajasthan Journal of Extension Education
- The Journal of Agricultural Education and Extension
- Journal of Agricultural Extension Management
- Journal of Agricultural Education and Extension
- Indian Journal of Gender Studies
- Indian Research Journal of Extension Education
- Journal of Community Mobilization and Sustainable Development

**Web resources**

- rural.nic.in
- www.panchayat .gov.in
- wcd.nic.in
- moud.nic.in
- mhupa.gov.in

**FMP 211**

**Farm Power and Machinery**

**1+1**

**Aim :** To equip the students with sufficient theoretical knowledge and practical skills about farm power and tractor power, implement resources used in agriculture, their cost of operation and selection

**Theory:**

**UNIT I – Farm Power & Tractors**

Farm power in India- sources, IC engines- working principles, two stroke and four stroke engines, IC engine terminology, different systems of IC engine. Tractors- types and utilities.

**UNIT II – Tillage and Tillage Machinery**

Tillage – ploughing methods - primary tillage implements – mould board, disc ploughs and chisel plough – secondary tillage implements – cultivators, harrows and rotovators – wetland equipment - puddlers, trammers and cage wheels.

**UNIT III – Sowing, Planting and Intercultural Equipment**

Sowing methods - seed drills, seed cum fertilizer drills - Paddy transplanters - nursery requirements - implements for intercultural operations - wet land, dry land and garden land intercultural tools.

#### **UNIT IV – Plant Protection Gadgets, Harvesting Machinery and Horticulture Tools**

Plant protection equipment - harvesting tools and equipment - reapers and combine - harvesting machinery for groundnut, tuber crops and sugarcane - tools for horticultural crops

#### **UNIT V – Equipment for Land Development and Farm Machinery Selection**

Equipment for land development and soil conservation – Cost of operation of farm machinery - Tractor and implement selection.

#### **Practical:**

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms. Operation of tractor and implements - operation and maintenance of power tiller – Study of different inter-cultivation equipments - Sprayers and dusters – their operation, repairs and adjustment - Paddy transplanting and allied machines. Harvester for paddy, sugarcane, groundnut – horticultural tools – land development and soil conservation machines – Field capacity and cost economic analysis

#### **Lecture Schedule:**

- |  |  |
|--|--|
| 1. Farm power in India - human, animal, mechanical and electrical energy sources and their use in agriculture                          | <b>TB1: 1-11</b><br><b>TB2: 1-16</b>                                       |
| 2. Two stroke and Four stroke engines, working principles, applications - types, power and efficiency                                  | <b>TB1: 27-39</b><br><b>TB2: 32-39</b><br><b>52-55</b>                     |
| 3. Different systems of IC engine – cooling, lubricating, fuel injection systems   | <b>TB1: 18-26</b><br><b>TB2: 39-46</b>                                     |
| 4. Tractors- types and utilities   | <b>TB1:12-18</b><br><b>TB2:135-137</b>                                     |
| 5. Tillage, objectives, types - ploughing methods. Field capacity and field efficiency   | <b>TB1:40-52</b><br><b>TB2:224-226</b><br><b>234-235</b><br><b>244-247</b> |
| 6. Primary tillage, objectives, mould board ,disc plough, chisel plough and subsoiler, components and functions, types, advantages and | <b>TB1:53-71</b><br><b>TB2:226-244</b>                                     |



- disadvantages.
- 7 Secondary tillage equipment – harrows, land forming equipment – rotaravators – wet land equipment – puddlers, manure trawlers and cage wheels **TB1:72-91**  
**TB2:254-274**
  - 8 Sowing methods - seed drills, seed cum fertilizer drills - components and functions **TB1:92-106**  
**TB2:277-294**
  - 9 Mid semester examination
  - 10 Paddy transplanters, types, working principle, field and nursery requirements **TB1:106-119**
  - 11 Implements for intercultural operations – cultivators, sweep, junior hoe, manual weeders and power operated weeders for wet land and garden land **TB1:121-129**
  - 12 Sprayers and their functions, classification, manually operated sprayers, power sprayers - dusters, types and uses **TB1:130-143**  
**TB2:326-337**
  - 13 Harvesting tools and equipment- sickles, paddy reapers and combine - Harvesting machinery for groundnut, tuber crops and sugarcane **TB1:144-167**  
**TB2:340-347**
  - 14 Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery **TB1:168-190**
  - 15 Equipment for land development and soil conservation - dozers, levelers, chisel plough, sub soil plough, blade harrow and bund former **TB1:191-198**
  - 16 Cost of operation of farm machinery – problem solving **TB1:212-217**
  - 17 Tractor and implement selection for different agricultural operations **TB1:199-211**

**Practical Schedule:**

- 1 Study of working of two and four stroke IC engines
- 2 Study of MB plough and disc plough, measurement of plough size, different parts, horizontal and vertical suction,
- 3 Study of disc harrows, bund former, leveller and rotavator
- 4 Study of seed-cum-fertiliser drills- furrow opener, metering mechanism and calibration
- 5 Study of tractors – their operation and maintenance
- 6 Learning to drive and operate the tractor
- 7 Learning to operate tractor with mounted implement
- 8 Study of power tiller - their operation and maintenance
- 9 Study of different inter-cultivation equipments in terms of efficiency, field capacity
- 10 Study of plant protection equipment – power sprayers, knapsack sprayers, dusters – minor repairs and adjustment of sprayers
- 11 Study of paddy transplanters – allied machinery for raising mat nursery
- 12 Study of paddy reaper and paddy combine – Registration and alignment of cutter bars

- 13 Study of sugarcane, turmeric and groundnut harvesters.
- 14 Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery
- 15 Study of land development and soil conservation machinery - dozers, levelers, chisel plough, blade harrow, bund former and trenchers
- 16 Problems on field capacity and cost of operation of farm machinery
- 17 Final practical examination

**Text Books:**

1. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. **A Text Book of Farm Machinery**, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305
2. Jagadishwar Sahay, 2010. **Elements of Agricultural Engineering**. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440

**Reference Books:**

1. Ojha, T.P and A.M.Michael 2005. **Principles of Agricultural Engineering Vol-I**. Jain Brothers, New Delhi. ISBN: 978-8186321638
2. Nakra C.P 1970. **Farm Machinery and Equipment**,: Dhanpat Rai Publishing Company Ltd, New Delhi ISBN: 978-8187433231
3. Srivastava, A.C., 1991. **Elements of Farm Machinery**. Oxford & IBH Publishing Co Pvt Ltd, New Delhi. ISBN: 978-8120405134

**WEB RESOURCES:**

[www.agricoop.nic.in/dacdivision/Machinery1/directory.htm](http://www.agricoop.nic.in/dacdivision/Machinery1/directory.htm)

[www.farmmachineryshow.org](http://www.farmmachineryshow.org)

**Outcome:**

Students will be equipped with sufficient theoretical knowledge with practical skills on farm power sources, the availability of tractors and handling of tractors, power tillers and various implements used in land preparation, sowing, inter cultivation, plant protection and harvesting operations.

**AEC 201**

**Production Economics and Farm Management**

**1+1**

**Objectives**

This course aims at imparting knowledge on principles of farm management. This course also would help the Under Graduate students in using different methods and tools for decision making in farm management, which would facilitate profit maximization through optimizing farm resource use.

**Theory**

**Unit 1: Production Economics and Farm Management - Nature and Scope**

Production Economics: Meaning, Definition and Nature and Scope – Farm Management: Definition and Objectives of farm management – Production Economics Vs. Farm Management – Farm Management Decisions: Decision making process – Scope of farm management – Types and Systems of farming: Types – Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

**Unit 2: Factor – Product Relationship**

Factor – Product relationship: Meaning – Agricultural Production Function: Meaning, Definition – Laws of Returns: Increasing, Constant and Decreasing Returns – Classical production function and Three stages of production – Elasticity of production –Types / Forms of Production functions – Linear, Cobb–Douglas and Quadratic – Cost Concepts and Cost curves: Total, Average and Marginal Costs – Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.

**Unit 3: Factor – Factor Relationship**

Factor – Factor relationship: Meaning - Isoquant: Definition and Types, Isoquant map – Marginal Rate of Technical Substitution – Factor Intensity – Isocline – Ridge Line – Returns to Scale – Elasticity of Factor Substitution – Isocost line – Principle of Factor Substitution and Least Cost Combination of inputs – Expansion Path – Effect of input price changes on the least cost combination.

#### **Unit 4: Product – Product Relationship**

Product – Product relationship: Meaning – Production Possibility Curve – Marginal Rate of Product Transformation – Enterprise relationship: Joint Products, Complementary, Supplementary and Competitive Products – Isorevenue line – Optimum Combination of Products – Principle of Equi-Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle.

#### **Unit 5: Farm Planning and Budgeting**

Farm Planning: Importance – Characteristics of good Farm Plan – Farm planning procedure – Budgeting: Definition and Types: Partial budgeting, Enterprise budgeting, Complete budgeting and Cash flow budgeting – Limitations of budgeting – Linear Programming: Assumptions – Linear Programming Model: Definition, Graphical solution, Advantages and Limitations – Risk and Uncertainty: Definition – Types of Risk and Uncertainty – Safeguards against Risk and Uncertainty.

#### **Practical**

Problems on Factor – Product relationship – Determination of Least Cost Combination – Determination of Optimum Product Combination – Computation of cost concepts – Cost of cultivation and Cost of production of agricultural crops, horticultural and livestock products – Depreciation: Methods of calculation of depreciation – Farm records and accounts: Analysis of farm records and accounts – Farm inventory analysis – Cash Flow statement - Net Worth statement – Profit and Loss statement – Break – even analysis – Preparation of Complete and Partial budgets – Preparation of farm plan – Graphical solution to Linear Programming problem.

#### **Theory Schedule**

1. Production Economics: Meaning, Definition, Nature and Scope – Farm Management: Definition and Objectives of Farm Management – Production Economics Vs. Farm Management.
2. Farm Management Decisions: Decision making process – Scope of farm management.
3. Types and Systems of farming, Types of farming: Specialized, Diversified and Mixed – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co-operative Farming.
4. Factor – Product relationship: Meaning – Agricultural Production Function: Meaning and Definition – Laws of Returns: Increasing, Constant and Decreasing Returns.

5. Classical Production Function and Three stages of production – Elasticity of Production.
6. Types / Forms of Production Functions – Linear, Cobb–Douglas and Quadratic Functions.
7. Cost concepts and Cost curves: Total, Average and Marginal Cost Concepts and Curves - Economies of Size and Minimum Loss principle.
8. Determination of Optimum Input and Output: Input Approach and Output Approach – Physical and Economic Optimum.

### **9. Mid Semester Examination**

10. Factor – Factor relationship: Meaning – Isoquant: Definition and Types – Isoquant map – Marginal Rate of Technical Substitution – Factor Intensity – Isoclines – Ridge Line.
11. Returns to Scale and Economies of Scale – Elasticity of Factor Substitution– Isocost line – Principle of Factor Substitution and Least Cost Combination of Inputs – Expansion Path – Effect of input price changes on the least cost combination.
12. Product – Product relationship: Meaning – Production Possibility Curve – Marginal Rate of Product Transformation – Enterprise relationship and Types of Products: Joint Products, Complementary, Supplementary and Competitive Products – Isorevenue line – Optimum Combination of Products.
13. Principle of Equi–Marginal Returns – Principle of Opportunity Cost.
14. Farm Planning: Importance – Characteristics of good Farm Plan – farm planning procedure
15. Budgeting: Definition and Types – Partial budgeting, Enterprise budgeting, Complete budgeting and Cash flow budgeting – Limitations of budgeting.
16. Linear Programming: Assumptions – Linear Programming Model: Definition – Advantages and Limitations.
17. Risk and Uncertainty: Definition – Types of Risk and Uncertainty – Safe guards against Risk and Uncertainty.

### **Practical Schedule**

1. Estimation of Optimum Input – Output combination.
2. Determination of Least–Cost Combination.
3. Determination of Optimum Product combination.
4. Cost of Cultivation and Cost of production of agricultural crops.
5. Cost of Cultivation and Cost of production of perennial crops / horticultural crops.
6. Cost of production of livestock products.

7. Farm Records and Accounts: Usefulness, types of farm records: farm production records and farm financial records.
8. Visit to a private agricultural farm to collect information on farm business.
9. Depreciation: Methods of calculating depreciation.
10. Computation of Cost concepts – Farm inventory analysis: Valuation of assets by different methods.
11. Preparation of Cash flow statement.
12. Preparation and Analysis of Net worth Statement and Profit and Loss statement.
13. Estimation of Break–even analysis.
14. Preparation of Complete Budget and Partial Budgets.
15. Preparation of Farm Plan.
16. Graphical solution to Linear Programming problem.

**17. Final Practical Examination.**

**References**

1. Sankayan, P.L. 1983. Introduction to Farm Management. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Johl, S.S & Kapoor, T.R. 1973. Fundamentals of Farm Business Management. Kalyani Publishers. Ludhiana.
3. Kahlon, A.S and Singh K. 1992. Economics of Farm Management in India. Allied Publishers. New Delhi.
4. Doll, J.P. and F. Orazem. 1983. Theory of Production Economics with Applications to Agriculture. John Wiley, New York.
5. Debertin, D.L. 1986. Agricultural Production Economics. Macmillan. New York.
6. Heady, E.O. and H.R. Jensen. 1954. Farm Management Economics. Prentice – Hall. Englewood Cliffs.
7. Kay, Ronald D., and William M. Edwards, and Patricia Duffy. 2004. Farm Management, Fifth Edition, McGraw–Hill, Inc. New York.
8. Panda, S.C. 2007. Farm Management and Agricultural Marketing. Kalyani Publishers. Ludhiana. India.