VIII SEMESTER

(Experiential Learning Programme/ HOT)	
Module	**Credit Hrs.**
1. Module-I	0+10
2. Module-II	0+10
Total	**0+20**

S. No.	Course code	Titles of the module	Credits
1.	AGM 451	Bio-inoculant production technology	0+10
2.	HOR 451	Hybrid Seed Production in Vegetable Crops	0+10
3.	SAC 451	On Farm Advisory for Soil Health, Water Quality & Plant Nutrition	0+10
4.	AEN 451	Commercial Beekeeping	0+10
5.	SER 451	Commercial Cocoon Production	0+10
6.	ABT 451	Commercial Plant Tissue Culture	0+10
7.	HOR452	Commercial Nursery Technology of Horticultural Crops	0+10
8.	HOR 453	Commercial Landscape Gardening	0+10
9.	PAT 451	Commercial production of Bio-control agents	0+10
10.	PAT 452	Commercial mushroom production	0+10
11.	AMP 451	Commercial broiler and layer production	0+10
12.	SST 451	Commercial seed production	0+10
13.	PBG 451	Hybrid pearl millet seed production	0+10
14.	PBG 452	Hybrid rice parental line seed production	0+10
15.	ARM 451	Managerial skills for Agribusiness	0+10
16.	AGR 451	Development of Integrated Farming system Model	0+10
17.	HOR 454	Protected cultivation of Vegetable crops	0+10
18.	ENS 451	Composting technology	0+10
19.	AGR 452	Organic Agriculture	0+10

AGM 451 Bioinoculants Production Technology (0+10)

Week	Activities
1	Biofertilizers - types, production and demand in India; Importance and contribution of biofertilizers in Agriculture and allied sectors. Economics of biofertilizer production. Calculation of commercial production cost – fixed cost- cost of building, equipments and glasswares and variable cost - raw materials, maintenance, labour cost *etc*.,
2	Exposure visit to biofertilizer production unit. Facilities and equipments required for laboratory scale, pilot scale and large scale biofertilizer production (liquid and carrier) – principles and specifications. Raw materials required-glass wares, chemicals, printed poly bags and carrier material - specifications of raw materials. Isolation, purification and characterization of nitrogenous biofertilizers – *Azotobacter, Azospirillum, Rhizobium* and *Gluconoacetobacter.*
3	Isolation and purification of nitrogenous biofertilizers – Azolla and Blue Green Algae (BGA). Screening of nitrogen fixers - plant nodulation tests for *Rhizobium*. Use of Gas Chromatography for nitrogenase assay. Nitrogenase activity by ARA (nodule and broth cultures of *Azotobacter*, *Azospirillum* and *Gluconoacetobacter*).
4	Isolation, purification and characterization of phosphate solubilizing and potassium releasing (silicate solubilizing) bacteria. Selection of efficient strains by testing their ability under *in vitro* conditions. Isolation of AM spores from soil and morphological characterization of AM spores.
5	Selection of efficient AM fungi by plant infection tests. Isolation, purification and characterization of sulphur oxidizing and zinc solubilizing microbes. Screening of efficient sulphur oxidizing and zinc solubilizing microbes.
6	Isolation, purification and characterization of plant growth promoting bacteria - Pink Pigmented Facultative Methylotrophs (PPFM) and screening of PPFM. Development of markers for easy identification-application of real time PCR in strain identification.
7	Preparation of medium and carrier material for large scale production. Mass production of *Azotobacter.*
8	Mass production of *Rhizobium.*
9	Mass production of *Azospirillum.*
10	Mass production of phosphate solubilizer.
11	Mass production of *Gluconoacetobacter* and potassium releasing bacterium (silicate solubilizing bacterium).
12	Mass production of PPFM.
13	Mass production of AM fungi, Azolla and BGA.
14	BIS standards / Fertilizer Control Order – Specifications and quality control measures for various biofertilizers. Storage and preservation of various microbial cultures – sub culturing, lyophilization *etc*., Establishment of Ideal biofertilizer unit; Shelf life and storage of biofertilizers. Constraints in mass production of various biofertilizers. Biofertilizers - Organic certification – processes to be followed – Agencies for Certification. *Rhizobium, Azospirillum* and *Azotobacter.* Quality control laboratories in India.
15	Application techniques– form, dose, method and time of application of biofertilisers – *Rhizobium, Azospirillum, Azotobacter, Gluconoacetobacter,* phosphate solubilizers, potash releasers and sulphur oxidizers, Azolla, BGA, AM fungi and PPFM. Exposure to advanced techniques in biofertilizer production - Tangential Flow Filtration, lyophilized cells production and automatic packing unit. Visit to biofertilizer inoculated fields in university, farmer's holding and interaction. Evaluation of plant response to biofertilizer application.
16	Financing - credit facilities – assistance – facility available for establishing biofertilizer production &17 units- licensing required *etc*., Formulation and presentation of a bankable project for production of fixed quantity of various biofertilizers.

References

1. Motsara, M.R., Bhattacharyya, P., and Beena Srivatsava. 2004. Biofertiliser Technology, Marketing and Usage – A source book- Cum -Glossary
2. Somani L.L., 2011. Biofertilisers: Commercial Production Technology and Quality Control Publishers: ATPA. (ISBN-10: 8183211968, ISBN-13: 978-8183211963)
3. NIIR 2012. The Complete Technology Book on Biofertilizer and Organic Farming NIIR Project Consultancy Services, New Delhi. P. 608. (ISBN: 9789381039076)
4. Reeta Khosla 2017. Biofertilizers and Biocontrol Agents for Organic Farming, Publishers: Kojo press. (ISBN-10: 8192756793,ISBN-13: 978-8192756790)

AGR 451 Development of integrated farming system model (0+10)

Conceptual understanding of IFS in the course

Farming system: concepts, scope, objectives and advantages

Cropping systems for different agro climatic zones of India and Tamil Nadu
Crop diversification and intensification in farming system perspective

Integrated Farming Systems

Enterprises selection in Integrated Farming Systems

Integrated Farming System models for wetland ecosystem
Management of different enterprises of wetland IFS

Integrated farming system models for irrigated dry land ecosystem
Management of different enterprises of irrigated dry land IFS

Integrated farming system models for dry land ecosystem
Management of different enterprises of dry land IFS

Interaction between different components of IFS
Resource recycling in integrated farming system
IFS research methodology and evaluation

Carbon foot-printing and green house gas emission studies in IFS models
Farming system characterization for up scaling IFS models to field / farm. Preparation of bankable projects in IFS under wetland eco-system.

Preparation of bankable projects in IFS under irrigated dry land ecosystem
Preparation of bankable projects in IFS under dryland ecosystem.

ABT 451 Commercial Plant Tissue Culture (0+10)

Practicals (Weekly Schedule)

1. **Basics and establishment of Plant Tissue Culture Laboratory**

Organization for a plant tissue culture laboratory - Sterilization methods -Equipments and instruments in PTC - Surface sterilization of explants - Handling tissues in aseptic conditions under laminar flow chamber

2. Medium and stock solution preparation-I

Familiarization of different chemicals- inorganic nutrients – carbon sources, vitamins and growth regulators –solidifying agents - Stock solutions preparation for MS medium and B5 medium

3. Medium and stock solution preparation-II

Stock solutions preparation for WPM medium - Medium preparation- MS medium, B5 medium, WPM medium - Sprouting of tubers in potato

4. Meristem and Micropropagation in cassava, rose and chrysanthemum

Meristem tip culture- medium preparation - Meristem tissue culture – cassava - Media preparation for micropropagation in rose and chrysanthemum - Micropropagation in rose and chrysanthemum

5. Micropropagation of banana and neem

Media preparation for micropropagation in banana, neem, eucalyptus, *Aloe vera, Phyllanthus* and potato - Micropropagation in banana and neem

6. Micropropagation of eucalyptus, *Aloe vera and Phyllanthus*

Micropropagation in eucalyptus, *Aloe vera, Phyllanthus* - Media preparation for micropropagation in sugarcane and bamboo - Inoculation of potato sprouts

7. Micropropagation of Sugarcane, bamboo and sub culturing

Micropropagation- sugarcane, Bamboo - Medium preparation for subculturing in rose, chrysanthemum, banana, neem, eucalyptus and *Phyllanthus*

8. Sub culturing -I

Medium preparation for subculturing- meristem tip culture, sugarcane and *Aloe vera,* bamboo, microtuber induction in potato - Subculturing in rose and chrysanthemum

9. Sub culturing -II

Subculturing in banana, neem and eucalyptus -**Mid semester Examination-** Subculturing in *Phyllanthus*, *Aloe vera* and cassava

10. Callus induction in *Phyllanthus and Coleus* and rooting

Subculturing in sugarcane and bamboo - Medium preparation for callus induction in *Phyllanthus* and *Coleus* - Inoculation of explants for callus induction in *Phyllanthus* and Coleus - Medium preparation for rooting in rose and chrysanthemum

11. Media preparation and inoculation for rooting of microshoots

Medium preparation for rooting in banana, neem, eucalyptus, *Aloe vera,Phyllanthus,* bamboo, cassava and sugarcane - Inoculation of micro shoots for rooting in rose, chrysanthemum, banana and neem

12. Inoculation for rooting of microshoots and hardening

Inoculation of microshoots for rooting in eucalyptus, aloe vera, phyllanthus, bamboo, cassava and sugarcane - Observations on microtuber induction in potato - Hardening chambers- mist-chamber, glasshouse, polyhouse and tunnel house - Hardening procedures, visit to any hardening facility

13. Synthetic seed preparation and Establishment of cell suspensions

Subculturing for proliferation of callus-medium preparation - Synthetic seed preparation-stocks preparation - Subculturing of callus and synthetic seed preparation. Cost-effective methods in PTC - Establishment of suspensions-medium preparation

14. Secondary metabolite production and analysis

Suspension culture in *Phyllanthus and Coleus*- Hairy root cultures with *Agrobacterium rhizogenes* - Preparation of stocks, medium for hairy root infection - Growth parameters for suspension- Fresh and dry weight, PCV and viability assay - Extraction of secondary metabolites and analysis through HPLC-GC-MS. Bioassay of secondary metabolites- anti-bacterial and anti-fungal activity.

15. Field transfer of TC plants

Field transfer of tissue culture plants – Hardening procedures and maintenance of regenerated plants.National certification system for tissue culture plants-application procedures. Visit to a field planted with TC plants. Visit to an Accredited Test Lab/National Certification Centre- NRCB, Trichy.

16. Entrepreneurship development I

Visit to a commercial tissue culture laboratory - Meeting the entrepreneur - Guest lecture from experts from financial institutions-funding opportunities.

17. Project preparation

Project preparation for Plant tissue culture - **Practical Examination**

References

Razdan, M.K. 2003. **Introduction to Plant Tissue Culture**. Enfield: Science Publishers Inc. USA

Dixon, R. A. 2003. **Plant Cell Culture – A Practical Approach**, IRL Press. Oxford. London

Gamborg OL, Phillips GC (2004) ***Plant cell tissue and organ culture. Fundamental methods.****Narosa Publishing House, New Delhi*

George E.F., Hall, M.A. and De Klerk, G.J. 2008. **Plant Propagation by Tissue Culture.Volume1.The Background**. 3rd edition.Springer. Netherlands

Robert N. Trigano and Dennis J. Gray, 2000. **Plant Tissue Culture. Concepts and laboratory exercises**. Second edition. CRC press. London.

E-References

1. *www-pub.iaea.org/mtcd/publications/pdf/te_1384_web.pdf*
2. *dbtindia.nic.in/NCS/Guideliness.pdf*
3. *dbtmicropropagation.nic.in/surveytcp.pdf*
4. www.agritechpublications.com/article.htm

AGR 452 Organic Agriculture (0 +10)

Organic nutrient and weed management

Quantification of cow dung and cow urine recovery per animal - analysis their nutrients constituents- Methods of storing of cow dung - analysis of temperature, nutrients and microbial load in different layers of manure pit -Quantification of yield and nutrient content of fodder crops grown organically- Quantification of biomass for different green manures and green leaf manures grown organically- Experiencing mulching and other techniques in weed management.

Biofertilizers preparation

Introduction to biofertilizers and equipments – Isolation of bacterial biofertilizers – Method of application of biofertilizers – Arbuscular Mycorrhizal Fungi – Production and Assessment of infective propagules – Cyanobacterial biofertilizer – PPFM and liquid bioinoculants

Organic manure preparation

Biological wastes, farm wastes: collection, segregation, pre digestion of wastes, Biocompost preparation in pit method and vermicompost bed formation - Preparation of Panchagavya, Jeevamruth and EM and characterization – Harvest of biocompost and vermicompost – Compost maturity indices – FAO standard – Enriched compost preparation – Preparation of bankable project on establishment of organic input production unit.

Eco-friendly Pest Management

Establishment of model pest repellants cafeteria - Preparation and application of herbal leaf extracts in pest management - Monitoring of insect pests through traps and lures - Fruit fly trapping survey in horticultural crops - Case study on Agro-Eco System Analysis (AESA) - Push and Pull Strategies in organic crop protection.

Non chemical diseases management

Diagnosis of disease symptoms and pathogens ,Preparation of enriched farm yard manure and methods of application of bio control agents - Cultural methods of disease management-Disease assessment and scoring - Removal of pathogens like ergot by mechanical methods- Preparation and foliar spraying of Arappu butter milk extract - Preparation and foliar spraying of pseudomonas butter milk extract- Preparation and foliar spraying of garlic vasambu extracts - Preparation and foliar spraying of cowdung 20% extract for BLB management- Preparation and foliar spraying of anti viral principles - Role of milk, curd and buttermilk in disease management.

Organic Certification and Preparation of Bankable Projects

Organic certification – Importance and scope – Procedure for obtaining certification –– Post harvest management and value addition, supply chain management -Preparation of bankable projects – Visit to Tamil Nadu Organic Certification Department and organic outlets – Visit to Nationalized Banks to learn about funding for projects.

Experiential Learning –Organic Agriculture (0 +10)

Class Schedule

1 week	Quantification of cow dung and cow urine recovery per animal and analysis their nutrients constituent. Methods of storing of cow dung and analysis of temperature, nutrients and microbial load in different layers
2 week	Quantification of yield and nutrient content of fodder crops grown organically. Quantification of biomass for different green manures and green leaf manures grown organically.
3 week	Experiencing mulching techniques in weed management
4 week	Introduction to biofertilizers, equipments and Good Laboratory practices Preparation of culture media for biofertilizers Isolation of *Rhizobium* from root nodules of leguminous plants Isolation of *Azospirillum* from roots of cereal crops/ grasses Isolation of phosphobacteria from soil Microscopic observation of biofertilizer cultures
5 week	Population assessment of bacterial biofertilizers Method of application of bacterial biofertilizers Mass production of Arbuscular Mycorrhizal Fungi Identification of AM propagules in roots and soil Mass production of *Azolla* and method of application PPFM and Liquid bioinoculants
6 week	Collection, segregation, shredding and quantification of biological wastes/ farm wastes for biocompost and vermicompost preparation and initiating the pre digestion process (15 days)
7 week	Procuring inputs for preparing the formulations of *Panchagavya*, Jeevamruth and Effective Microorganisms (EM) -EM to be prepared from mother culture obtained from progressive organic farmers for multiplication Formation of beds and digging of compost pit of required size based on the availability of the farm wastes. Filling the pit and bed for biocompost
8 week	Vermicompost process respectively. Release of earthworms onto the compost bed Monitoring the composting process for moisture and temperature for efficient composting. Sampling of partially decomposed material for determining the nutritive value especially carbon build up
9 week	Harvest of matured composts, quantification and assessment of compost maturity indices and comparing with FAO standards for marketability. Characterization of Panchagavya, Jeevamruth and EM formulations Preparation of enriched biocompost, vermicompost and FYM using *Azospirillum* and *Azotobacter* or Azophos
10 week	Establishment of model pest repellants cafeteria. Preparation and application of herbal leaf extracts in pest management.
11 week	Monitoring of insect pests through traps and lures. Fruit fly trapping survey in horticultural crops.

12 week	Case study on Agro-Eco System Analysis (AESA). Push and Pull Strategies in organic crop protection.
13 week	Preparation of a bankable project on Establishment of a pilot scale organic manure production unit for obtaining bank loans Diagnosis of disease symptoms and pathogens and cultural methods of disease management Disease assessment and scoring.
14 week	Removal of pathogens like ergot by mechanical methods. Preparation and foliar spraying of Arappu butter milk extract and fliar spraying of pseudomonas butter milk extract Preparation and foliar spraying of garlic vasambu extracts Preparation and foliar spraying of cowdung 20% extract for BLB management
15 week	Organic certification – Importance and scope Procedure for obtaining certification Post harvest management and value addition
16 week	Supply chain management in Organic Farming Exposure visit to Tamil Nadu Organic Certification Directorate and organic outlets
17 week	Preparation of bankable projects Evaluation of individual and group assignments and report submission Visit to Nationalized Banks to learn about funding for projects. **Final Practical Examination**

PBG 452 Hybrid rice: Parental line seed production technique (0+10)

Activities:

- 1st week : Studying botany of Rice, Hybrids and their development , breeding methods used in hybrid rice parental line development, Impact of Hybrid Rice in Tamil Nadu.
- 2nd week : Selection of field based upon the land with adequate fertility, drainage, irrigation, sun light and free air with adequate isolation distance (100 m distance isolation or 25 days time isolation).
- 3rd week and 4th week: Seed treatment with Carbendazim, *Pseudomonas fluorescens* and *Azospirillum*

Staggered sowing of A x B line seed production in CORH 3 rice Hybrid

CORH 3

A - Female (Male sterile) TNAU CMS 2A
B - Male (Maintainer line) TNAU CMS 2B

Staggered sowing of parents

First sowing of Male line (B1) 3 days before A line sowing – 3kg

Single sowing of the entire female (A) line seeds - 20kg and second sowing of male line (B2) 3kg on the same day

Third sowing of Male line (B3) 3 days after A line sowing – 4kg

A line seed production in CORH 3

- 5th week

Seedlings pest and disease management in nursery

Main field preparation

- 6th week

Transplanting the seedlings in the main field

A x B

Ratio - Female: Male	=	6 : 2
Seedlings/hill for Female (A) line	=	1 (with two to three tillers)
Seedlings / hill for Male (B) line	=	2-3
Spacing in Female (A) line	=	10 x 15 cm
Spacing in Male (B) line	=	30 x 15 cm
Spacing between 'A' and 'B' lines	=	20 cm

- 7th week and 8th week

Weedicide application : Three days after planting, application of Butacholor @ 2.5 litres / hectare with 50 kg sand retaining 1 cm water in the main field. After weedicide application,the water should not be drained from the field for two days

Gap filling : Within 7 - 10 days after planting.

Fertilizer application

- 9th week and 10th week

Crop protection measures to be followed

Fertilizer application (Top dressing)

Panicle initiation and flowering

Flowering: 'A' line should be earlier by one or two days.

Adjustment of flowering date

If the flowering is to be delayed, spray 2% urea solution with Knapsack sprayer to induce vegetative growth.

If the flowering is to be hastened, apply 2% DAP solution to arrest vegetative growth.

By this method 3-4 days difference in flowering can be adjusted.

Copious irrigation hastens the flowering in Male (B) line

Draining the water will delay the flowering in Male (B) line

If there is early flowering in Male (B) line than the Female (A) lines those ear heads may be jerked (removed)

❖ 11^{th} week and 12^{th} week

Fertilizer application (Top dressing)

Rogueing

Genetically different plants in both 'A' and 'B' lines should be removed periodically from tillering stage onwards

Pollen shedders in 'A' line should be removed from flowering to grain filling stage daily

GA3 application

Panicle exsertion is incomplete in 'A' line

Two times of GA3 spray with Knapsack sprayer is needed to make the complete panicle exsertion

First spray of 60g GA3 in 500 litres of water/ha at the time of 20 percent flowering

Second spray 40g in 500 litres of water/ha on the next day within 24 hours after the first spray
Dissolve GA3 first in Methyl alcohol 1g in 10 cc and then in water

Spray the solution at 8.00 to 10.00 a.m. or 4.00 to 6.00 p.m.

❖ 13^{th} week

Supplementary pollination

It is done to promote higher cross pollination.

Rope pulling or stick shaking for 10 days from 20 per cent flowering Best time is 10.00 to 1.00 a.m.

❖ 14^{th} week

Harvest and storage

Male (B) line should be harvested first and removed

Final rogueing should be done before the harvest of female (A) line

Harvested produce should be threshed, cleaned, dried and stored properly at 12% moisture.

❖ 15^{th} week

Monitoring of farmers field for hybrid performance

❖ 16^{th} week

Calculation of Economics of seed production

Deliverables

Students can learn the method of genetically pure parental line seed production techniques in rice hybrid CORH 3

The Hybrid rice seed production and parental line seed production techniques learned from this course will be much useful for the students to become entrepreneur in the future.

PBG 451 Hybrid pearl millet seed production (0+10)

Activities :

- 1st week

Studying the botany of Pearl millet, Flowering behavior and mode of pollination. Hybridization techniques, characteristics of A, B & R lines. Significance of hybrid Breeding in pearl millet. Maintenance breeding of A, B and R lines.

- 2nd week

TNAU Cumbu hybrid CO 9 seed production; (ICMA 99111 x PT 0029-30 R)
Duration 75-80 days
Selection of field based on the isolation distance (500 m)
Seed treatment
Staggered sowing : Male parent (PT 6029-30) R line sowing has to be taken up seven days earlier than female parent).

I st sowing : PT 6029 – 30 R (male parent – R line)

Seed rate 1.5 kg/ha R line

Row Ratio : 4:2 (4 A : 2 R)

Spacing : 45 x 15 cm

Fertilizer application

Herbicide application

- 3rd week

II nd sowing : ICMA 93111 (Female parent A line) After 7 days of male line sowing

Sowing of border Rows : R line - 4 Rows.

- 4th week

Thinning of seedlings in both A and R lines

- 5th week & 6th week

Weeding and irrigation

Top dressing of fertilizer

- 7th week

II nd weeding and pest and disease control measures

Monitoring of flowering and rogueing

- 8th and 9th week

- 10th week

- 11th week

Thorough rogueing of the A line and harvesting

Threshing in the a separate threshing floor

Seed cleaning

- 12th week

Germination test

Seed treatment of hybrid seed

- 13th week

Seed packing

- 14th week

- 15th week

- 16th week and 17th week Report preparation and submission

Deliverables

Students can learn the method of genetically pure hybrid seed production techniques in pearl millet.

SAC 451 On Farm Advisory for Soil Health, Water Quality and Plant Nutrition (0+10)

Practical Schedule /week

1. Identification and Selection of farm holdings growing different crops
2. Studying the land features and collection of soil samples
3. Assessment of soil physical and chemical quality indices of collected soil samples
4. Assessment of soil biological quality indices and interpretation (Dept. of Agrl. Microbiology)
5. Interpretation of analytical results of collected soil samples for their quality
6. Identifying soil constraints - Interpretation of results (Soil physics)
7. Problem solving management techniques, Calculation of ameliorants.
8. Assessing the Land suitability for agricultural, horticultural and tree crops (Dept.of RS&GIS)
9. Water sample collection, quality assessment
10. Assessing the land suitability for irrigation
11. Fertilizer prescription calculations for important crops - Nutrient equivalent basis -Soil Test Crop Response based recommendation for targeted yields
12. Deriving the nutrient requirement using DSSIFER soft ware for different crops (STCR)
13. Issue of Soil Health Card and Fertilizer prescription using DSSIFER software
14. Diagnosis of nutrient deficiencies using VDK software and corrective measures
15. Formulating the plan for the selected farm holding for the existing crops
16. Formulating the most viable farm plan for the selected farm holding and Development of Soil Constraint Management Package (SCMP)
17. Recap and Practical examination

References

1 BaruahJ.C and D.K.Patgiri. 1996. Physics and Chemistry of Soils, New Age International Publications

2 Garison Sposito, 2008. The Chemistry of Soils. Oxford University Press, USA

3 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.

4 Hessee, P.R. 1971. A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London

5 Indian Society of Soil Science 1991. Soil related constraints in crop production Bulletin No.15.lSSS, New Delhi.

6 Indian Society of Soil Science 1996. Soil management irelation to land degradation and environment. Bulletin No.17.ISSS, New Delhi.

7 Jackson, ML. 1973. Soil Chemical Analysis. Prentice Hall Pvt.Ltd

8 Mani.A.K., R.Santhi, K.M.Sellamuthu. 2007. A handbook of Laboratory Analysis.A.E.Publications, Coimbatore

9 Motsara.M.R and R.N.Roy.2008.Guide to laboratory establishment for plant nutrient analysis. Food and Agriculture organization of the United Nations.Rome.pp.220 (also available online <ftp: /ftp.fao. org/agl/ agll/docs /fpnb 19. pdf>)

10 Piper, C.S 1942. Soil and plant analysis: Inter science *Publishers,* New York.

11 Sehgal,J.2005. A text book of Pedology- Concepts and applications. Kalyani Publishers, Ludhiana, New Delhi.

12 Subramanian,S.S, G.V.Kothandaraman, S.Natarajan and P.P.Ramaswami. ed. 1987. Soil survey and land use planning for watershed management. Directorate of Soil and Crop Management Studies, TNAU, Coimbatore

13 Tandon, HLS.1994. Fertilizers, organic manures, recyclable wastes and

14 biofertilizers. Fertilizer Development and Consultant Organization, New Delhi

15 USDA 1954. Diagnosis and Improvements of Saline and Alkali Soils. (Ed) L.A.Richards. Handbook No.60. USDA Washington DC.

16 Werner Bergmann.Ed.1992.Nutritional Disorders of Plants - Development, Visual and analytical Diagnosis. Gustav Fischer Verlag Jena.Stuttgart. NewYork

E-References

1. ftp:/ftp.fao.org/agl/agll/docs/fpnb19.pdf
2. http://www.agric.gov.mt/soil-and-irrigation-water-lab
3. www.soiltesting.okstate.edu/
4. www.texasplantandsoillab.com/
5. www.ulm.edu/spal/
6. soilhealth.cals.cornell.edu/extension/.../managing_constraints.pdf
7. cnal.cals.cornell.edu/
8. http://agritech.tnau.ac.in/agriculture/agri_reosurcemgt_soil_soilcontraints.html
9. http://edis.ifas.ufl.edu/topicjertilization

HOR 451 Hybrid seed production in vegetable crops (0+10)

CONTENT

Unit I - Introduction to quality seed production, principles and practices

Scope and importance of vegetable seed industry and vegetable seed production - principles and practices of seed production - generation system of seed multiplication - pollination behaviour - 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.

Unit II - Seed production planning and pre sowing seed treatments

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 - types of nursery - media preparation for protray nursery - sowing -nursery management.

Unit III - Seed crop management and hybrid seed production techniques

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) - identification of physiological disorders and management - exposure visit to seed certification department - seed certification procedures - registration and sowing report - field inspection - field counting - visit to seed production plots.

Unit IV - Pre and post harvest operations

Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices - harvesting methods - post harvest verification – fruit grading - extraction of seeds - processing sequence

- seed drying - seed cleaning - grading - pre-storage seed treatment - seed packing - seed storage - visit to seed processing unit and seed storage godown and learning sanitation measures. Economics of hybrid seed production (cost benefit ratio) - visit to private seed industry.

Unit V - Seed testing and marketing

Seed sampling procedure and submission of samples - seed testing procedure – estimation of seed moisture - physical purity analysis - germination test - visit to grow out test field and DNA finger printing laboratory for genetic purity assessment - visit to seed retail shop - seed marketing - project preparation.

Crops: Tomato, brinjal, chillies, bhendi, and gourds.

Deliverables:

Students who complete this course will gain enough confidence to establish seed industry as a successful business venture.

References

Arya, P.S., 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.

Geetharani, P., V.Swaminathan and V.Ponnuswami. 2012. Seed Technology of Horticultural Crops. Narendra Publishing House, Delhi - 6.

Kulkarni, G.N. 2011. Principles of seed technology, Kalyani publishers, Ludhiana, New Delhi

Singh, N, and Vishal Nath, 2011. Varieties and hybrids of vegetables, Satish serial publishing house, Delhi.

Sumesh Chandra Gaur, 2013. A hand book of seed processing and marketing Agrobios (India), Jodhpur Udai R. Bishnoi and R.P.S. Kharb, 2012. Fundamentals of seed production and testing, Oxford book company, Jaipur.

Vanangamudi, K. *et al.,* 2010. Vegetable hybrid seed production and management, Agro bios (India), Jodhpur.

E-References

1. Seednet.gov.in
2. www.dare.gov.in
3. http:sfci.nic.in
4. www.iar.org.in/Directorate1.htm
5. www.apsa.org
6. www.seedassociationofindia.com
7. www.apaseed.com
8. www.apaseed.org

Hybrid seed production in vegetable crops (0+10)

Practical schedule

Crops: Tomato, brinjal, chillies, bhendi, and gourds.

Week	Classes
1.	Scope and importance of vegetable seed industry and vegetable seed production - principles and practices of seed production - generation system of seed multiplication.
2.	Pollination behaviour - tools employed in hybrid seed production - study of morphological characters of varieties, parental line and hybrids.
3.	Designing of planting ratio and border rows - physical and genetic contaminants - isolation distance.
4.	Planning of seed production - season and land selection - assessment of seed source and seed selection.
5.	Pre sowing seed invigouration treatments - dormancy breaking treatments - seed priming - pelleting - polymer coating.
6.	Practicing nursery and main field preparation - practicing the sowing of seeds in the nursery - types of nursery - media preparation for protray nursery - sowing -nursery management.
7.	Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management.
8.	Weed management - irrigation management - special cultural practices - pest and disease management.
9.	Identification and removal of off-types and volunteer plants - practicing hybridization techniques (emasculation and pollination) - Identification of physiological disorders and management.
10.	Exposure visit to seed certification department - seed certification procedures - registration and sowing report - field inspection - field counting - visit to seed production plots – project preparation.
11.	Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices - harvesting methods - project preparation - project preparation.
12.	Post harvest verification – fruit grading - extraction of seeds - processing sequence - seed drying - seed cleaning - grading - pre-storage seed treatment - seed packing - seed storage.
13.	Visit to seed processing unit and seed storage godown and learning sanitation measures - project preparation.
14.	Economics of hybrid seed production (cost benefit ratio) - visit to private seed industry.
15.	Seed sampling procedure and submission of samples - project preparation.
16.	Seed testing procedure - estimation of seed moisture - physical purity analysis - germination test - visit to grow out test field and DNA finger printing laboratory for genetic purity

	assessment.
17.	Visit to seed retail shop - seed marketing - project preparation and submission.

SST 451 Commercial seed production (0+10)

CONTENT

Unit I - Introduction to quality seed production, principles and practices

Scope and importance of seed industry and seed production - principles and practices of seed production - generation system of seed multiplication - pollination behaviour - 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.

Unit II - Seed production planning and pre sowing seed treatments

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.

Unit III - Seed crop management and hybrid seed production techniques

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 detasseling) - identification of physiological disorders and management - exposure visit to seed certification department - seed certification procedures - registration and sowing report - field inspection – field counting - visit to seed production plots.

Unit IV - Pre and post harvest operations

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 -visit to seed processing unit and seed storage godown and learning sanitation measures. Eeconomics of variety and hybrid seed production (cost benefit ratio) - visit to private seed industry.

Unit V - Seed testing and marketing

Seed sampling procedure and submission of samples - seed testing procedure - estimation of seed moisture - physical purity analysis - germination test - visit to grow out test field and DNA finger printing laboratory for genetic purity assessment - visit to seed retail shop - seed marketing - project preparation.

Crops

Cereals, pulses, oilseeds, cotton and commercially important vegetable crops.

Deliverables:

Students who complete this course will gain enough confidence to establish seed industry as a successful business venture

Reference

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

E References

1. Seednet.gov.in
2. www.iar.org.in/Directorate1.htm
3. www.apsa.org
4. www.seedassociationofindia.com
5. www.apaseed.com
6. www.apaseed.org

Commercial seed production (0+10)

Schedule of Activities

Week	Classes
1.	Scope and importance of seed industry and seed production - principles and practices of seed production - generation system of seed multiplication.
2.	Pollination behaviour - tools employed in hybrid seed production - study of morphological characters of varieties, parental line and hybrids.
3.	Designing of planting ratio and border rows - physical and genetic contaminants - isolation distance.
4.	Planning of seed production - season and land selection - assessment of seed source and seed selection.
5.	Pre sowing seed invigouration treatments - dormancy breaking treatments - seed priming - pelleting - polymer coating.
6.	Practicing nursery and main field preparation - practicing the sowing of seeds in the nursery - protray nursery - sowing - nursery management.
7.	Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management.
8.	Weed management - irrigation management - special cultural practices - pest and disease management.
9.	Identification and removal of off-types and volunteer plants - practicing hybridization techniques (emasculation and pollination and detasseling) - identification of physiological disorders and management.
10.	Exposure visit to seed certification department - seed certification procedures - registration and sowing report - field inspection - field counting - visit to seed production plots - project preparation.
11.	Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices - harvesting methods - project preparation.
12.	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.
13.	Visit to seed processing unit and seed storage godown and learning sanitation measures - project preparation.
14.	Economics of variety and hybrid seed production (cost benefit ratio) - visit to private seed industry.
15.	Seed sampling procedure and submission of samples - project preparation.
16.	Seed testing procedure - estimation of seed moisture - physical purity analysis - germination test - visit to grow out test field and DNA finger printing laboratory for genetic purity assessment.
17.	Visit to seed retail shop - seed marketing - project preparation and submission.

ENS 451 COMPOSTING TECHNOLOGY

Activities

Collection and characterization of solid-wastes – analyzing physical and chemical properties – site selection for composting – infrastructure required for compost making – processing of solid waste for composting – carbon : nitrogen ratio maintenance – selection of microbial inoculum for composting - compost bed formation – windrow method – heap method – application of microbial inoculum – recording compost heap temperature- thermophilic phase and mesophilic phase – turning of compost pile for uniform composting – moisture maintenance in compost pile – assessing reduction in carbon and nitrogen ratio – compost maturity assessment – curing of compost material – value addition through beneficial microbes - Assessing nutritive value of compost – national and international standards for compost quality parameters – project preparation for compost making facility – Marketing of compost products – working out cost benefit ratio for compost production – Record maintenance in compost making.

Deliverables/Out come

The students who are undergoing this experiential learning will have independent skill to manage large quantity of solid waste through composting technology. They know how to prepare a project on solid waste management and it will create a self enterprising activity for them.

References:

1.Kelly Smith. 2012. How to build, maintain and use a compost system. Atlantic publishers, Florida.

2. John Berry. 2014. How to make compost? A quick and easy guide. Hewel Trading, USA

3. Roland Ulrich. 2014. Creating humus on farm – The controller heat method of composting. Outskirts press

4. Augustine Afuilio, 2014. Integrated solid waste management. Hand book for Beginners, Planners, Environmentalists, Students and policy makers. Warmra Twechoprise, Nairobi, Kenya.

E -References:

1. http.//www.eartheasy.com
2. http.//www.composting council.org
3. http.//www.Epa.gov/compost
4. http.//www.Compost.css.cornnell.edu

HOR 452 Commercial Nursery Technology of Horticultural Crops (0+10)

Deliverables

Students who undergo this course will gain practical knowledge and hands on experience in different aspects of a commercial fruit nursery.

Students' attitude in leadership quality, managerial skill and professionalism will be enriched.

References

1. Sadhu, M.K. 1989. Plant Propagation. Wiley Eastern Ltd., New Delhi
2. Bose, T.K., S.K. Mitra, M. K. Sadhu and B. Mitra. 1991. Propagation of Tropical and Subtropical Horticultural crops. Naya Prakash Publishers, Culcutta, India.
3. Hartmann, H.T., D. E. Kester, F.T. davies and R. L. Grene. 2010. Plant Propagation – Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
4. Nanda, K. K and V. K. Kochhar. 1995. Vegetative Propagation of Plants. Kalyani Publishers, Ludhiana.

References

1. http://www.oer.nios.ac.in
2. http://www.sas.upenn.edu
3. http://www.tmnehs.gov.in
4. http://www.instructables.com

HOR 453 COMMERCIAL LANDSCAPE GARDENING (0 + 10)

Activities

Understanding the concept of experiential learning and identifying the broad area for experiential learning project activity in commercial Landscape Gardening - Fixing the area of interest for individual or group experiential learning project activity in commercial Landscape Gardening (Green consultancy, Green wall fixtures, Green showcases, Green wall hangings, Green furniture, Cacti buckets and flower bouquets, Green glasses, Trees indoor, Smart garden *etc*.,) - Rationale for selecting the activity in commercial Landscape Gardening and formulating the anticipated methodology for execution - Preparation of the project with budget for execution and marketing - Nurturing the students potential and innovativeness in their area of interest and facilitating the project activity (planning, development and execution) - Concept of advertising the product and developing market strategies for efficient selling - Working out the cost economics / balance sheet involved in the project - Generating a reflective report about the project and the student's potential in academic and personal development.

Deliverables

14. Entrepreneurship skill and buoyancy in handling commercial ventures in the domain of landscape gardening is assured

15. Student's attitude in leadership quality, managerial skill and professionalism will be enriched

HOR 454 PROTECTED CULTIVATION OF VEGETABLE CROPS (0 + 10)

Practical content

Understanding the concept of experiential learning and identifying the broad area for experiential learning project activity in protected cultivation in vegetable crops - Fixing the area of interest for individual or group in project activity in protected cultivation (Establishment and operation of protected structures - types of growing structures - construction of poly house and shade net house - manipulation of environmental factors - practical learning in nursery raising - growing systems - growing media - sterilization - preparation of beds- planting- and cultivation practices - harvesting practices - post harvest handling – storage - project preparation and analysis of cost economics *etc*.,) - Rationale for selecting the activity in protected cultivation and formulating the anticipated methodology for execution - Preparation of the project with budget for execution and marketing - Nurturing the students potential and innovativeness in their area of interest and facilitating the project activity (planning, development and execution) - Concept of advertising the product and developing market strategies for efficient selling - Working out the cost economics / balance sheet involved in the project - Generating a reflective report about the project and the student's potential in academic and personal development.

Crops: Tomato / Capsicum / Cucumber

1 **References**

22. Prasad, S. and U. Kumar. 2005. Green house management for horticultural crops. 2nd ed. Agrobios.
23. Tiwari, G.N. 2003. Green house technology for controlled environment . Narosa Publ. House.

References

1. Harry Tomilson,2010. The complete book on bonsai. Abbevellie press, Glasgow. Phaidon,2014. The garden book, Phaidon book, London
2. Judith blacklock,2012. The complete guide for beginners. Flower fresh publisher, U.K.
3. Nancy Norris, 2011. Miniature garden guide book. Kalmbach Publishing company, Netherlands
4. Bose.T.K, R.G. Maiti, R.S. Dhua and P.Das. 1999. Floriculture and Landscaping. Naya prakash, Calcutta. Booth. N.K. 1983. Basic elements of landscape architectural design.
5. Randhawa, G.S. and A. Mukhopadhyay, 2001. Floriculture in India. Allied Publishers Limited, New Delhi. Foja Singh, 1997. Advances in Floriculture. Media Today Pvt Ltd., New Delhi-17
6. Chattopadhyay, S.K. 2007. Commercial Floriculture. Gene-Tech Books, New Delhi

References

http://floraculture international.com
http://www.wvu.edu/~agexten/hortcult/greenhou/
http://www.umass.edu/umext/floriculture/fact_sheets/greenhouse_management.html
https://sharepoint.agriculture.purdue.edu/agriculture/flowers/GHguides.aspx
http://www.ag.auburn.edu/hort/landscape/structures.html
www.bonsaiempire.com
www.gardenweb.com
www.my-garden-school.com
www.florista.in
www.realsimple.com

PAT 451 Commercial production of Bio-control agents 0+10
(Team teaching by Entomologists, Pathologists and Economists)

Reference

1. Kennedy, J.S and Zadda Kavitha. 2006. Manual on commercial Production of biocontrol agents. Department of Agricultural Entomology, TNAU, Coimbatore. 156p
2. Gautam, R.D. 1994. Biological Pest Suppression. Westville Publishing House, New Delhi. 221 p

3. Course plan: TB: Text Book

Units / Practicals	Topics to be covered	Chapter#
1st week	Establishment of a biocontrol unit, Mass production of *Corcyra cephalonica* and *Maconellicoccus hirsutus*	Chap#1,2,3,6 (TB1)
2nd week	Mass production of parasitoids *viz*.,*Trichogramma* sp., *Chelonus blackburnii, Bracon sp*	Chap#7,8,10 (TB1)
3rd week	Mass production of parasitoids *viz., Goniozus nephanitis* and *Nesolynx thymus*	Chap#11 (TB1)
4th week	Mass production of predators *viz*., *Cryptolaemus montrouzieri* and *Chrysoperla carnea*.	Chap#13,14 (TB1)
5th week	Rearing of host insects *viz*., *Helicoverpa armigera* and *Spodoptera litura*	Chap#4,5 (TB1)
6th week	Mass production of nuclear polyhedrosis virus of *Helicoverpa armigera* and *Spodoptera litura*	Chap#15,16 (TB1)
7th week	Mass production of entomopathogenic fungi *viz*. *Metarhizium anisopliae*, *Beauveria bassiana* and *Verticillium lecanii*	Chap#18,19,20 (TB1)
8th week	Processing and standardization of microbial pathogens	Chap#21 (TB1)

E References

1. http://www. mycologia. Org
2. http://www.nysaes. cornell.edu
3. http://www. Eduwebs.org/bugs/mealybug_destroyers.htm
4. http:// plant disease.ippc.orst.adv/articles
5. http:// www.nbaii.res.in

PRACTICAL SYLLABUS

Unit 3:

Importance of biological control in plant disease management – Handling of equipments – sterilization techniques –Preparation of media

Collection of soil sample and Isolation of antagonists - *Trichoderma, Chaetomium, Beauveria, Pseudomonas fluorescens,* and *Bacillus subtilis* - Maintenance of pure cultures - Morphological and molecular characterization of antagonists

Unit 4

Keys for the identification of lab contaminants - Assessing the efficacy *in vitro* - mode of action of antagonists - Fermentation systems and different kinds of formulations - Mass multiplication

Methods of delivery of biocontrol agents - Bio efficacy against plant diseases – Container content compatibility - packaging methods and shelf life studies of bio control agents -Guidelines and requirements to establish a commercial bio control lab - energy requirements to establish a commercial

bio control lab

Unit 5

Legal issues involved in the establishment of commercial bio control lab and registration (Small scale and large scale) - Cost Analysis and project preparation - Principles of enterprise management. Exposure visit to commercial bio control units

PRACTICAL SCHEDULE

9 week

1. Bio-control agents and their significance in plant disease management
2. Safety procedures for handling of equipments (Autoclave, Laminar Air Flow Chamber, Hot air oven, pH meter)
3. Safety procedures for handling of equipments (Electronic balance, Fermentor, Distillation unit, Spectrophotometer, Microscopes and Spiral Kneader)
4. Good laboratory practices of a bio control lab
5. Sterilization techniques

10 week

6. Preparation of PDA and Rose Bengal agar medium
7. Preparation of *Trichoderma* selective medium,
8. Preparation of Kings B medium and Nutrient Agar medium
9. Preparation of Actinomycetes and *Chaetomium* selective medium.

10. Collection of soil samples and isolation of *Trichoderma, Beauveria* and *Chaetomium* **11 week**

11. Collection of soil samples and isolation of *Pseudomonas fluorescens* and *Bacillus subtilis* and maintenance of pure cultures of biocontrol agents
12. Morphological and molecular characterization of *Trichoderma*
13. Morphological and molecular characterization of *Pseudomonas fluorescens*
14. Morphological and molecular characterization of *Bacillus subtilis*

12 week

15. Keys for the identification of lab contaminants (*Salmonella, Shigella, Vibrio, Aspergillus, Penicillium, Rhizopus* etc.,)

16. Assessing the efficacy of *Trichoderma* under *in vitro* condition.

17. Assessing the efficacy of *Pseudomonas and Bacillus* under *in vitro* condition.
18. Studies on the mode of action of *Trichoderma* against soil-borne, foliar and Post harvest pathogens
19. Studies on mode of action of *Pseudomonas and Bacillus* against soil-borne, foliar and Post harvest pathogens

13 week

20. Fermentation systems
21. Different kinds of formulations- solid , liquid oil invert formulation etc.
22. Mass multiplication of *Trichoderma*
23. Mass multiplication of *Trichoderma*
24. Quality analysis of *Trichoderma*

14 week

25. Mass multiplication of *Pseudomonas*
26. Mass multiplication of Bacillus
27. Quality analysis of *Pseudomonas and Bacillus*
28. Methods of delivery of bio control agents - *Trichoderma*
29. Methods of delivery of bio control agents - *Pseudomonas and Bacillus*

15 week

30. Bioefficacy of *Trichoderma* against plant diseases
31. Bioefficacy of *Pseudomonas and Bacillus* against plant diseases
32. Biocontrol agents in pipeline –*Chaetomium*
33. Biocontrol agents- *Beauveria*
34. Container content compatibility, packaging methods and shelf life studies of bio control agents.
35. Guidelines and requirements to establish a commercial bio control lab

16 week

36. Studies on energy requirements to establish a commercial bio control lab
37. Legal issues involved in the establishment of commercial bio control lab and registration (Small scale and large scale).
38. Legal issues involved in the establishment of commercial bio control lab and registration (Small scale and large scale).
39. Exposure visit to commercial bio control units
40. Exposure visit to commercial bio control units

17 week

41. Cost Analysis and project preparation: Principles of enterprise management.
42. Financial management – Agricultural Finance – Source of finance– Acquisition – Ratio analysis.

Economics of Mass Production of Biocontrol agents

Mass Production of *Trichoderma viride* talc formulation (500kg for 30 students)

S. No.	**Particulars**	**Quantity**	**Amount (Rs.)**
I.Non-Recurring or Capital Investment *			
1.	Fermentor – 100 lit	1	6,00,000
2.	Autoclave	1	40,000
3.	Hot air Oven	1	25,000
4.	Laminar Air flow Chamber-2’/3’/4’	1	60,000
5.	Electronic Balance	1	10,000
6.	Racks and Cabinet	1	15,000
7.	Plastic tray and glasswares	1	20,000
8.	Sealing machine	1	3000
9.	Refrigerator	1	20,000
10.	Gas connection, Cooker and burner	1	5,000
		Total	**7,98,000**

S. No.	**Particulars**	**Quantity**	**Amount (Rs.)**
II. Recurring or Working Expenditure			
1.	Talc Powder	500kgs	7500
2.	Chemicals		2500
3.	Polybags		750
4.	Electricity and gas refilling		1000
5.	Labour charges		5000
6.	Miscellaneous expenditures		2000
		Total	**18,750.00**

III. Income		
1.	500 kgs of product @Rs. 75/-	37,500.00
2.	Total Expenditure	18,750.00
	Net Profit Rs.	**18,750.00**

* **Non-Recurring:** One time investment

Mass Production of *Pseudomonas fluorescens* talc formulation (1000kg for 30 students)

S. No.	**Particulars**	**Quantity**	**Amount (Rs.)**
I.Non-Recurring or Capital Investment			
1.	Fermentor	1	3,00,000
2.	Autoclave	1	40,000
3.	Hot air Oven	1	25,000
4.	Laminar Air flow Chamber	1	60,000
5.	Electronic Balance	1	10,000
6.	Racks and Cabinet	1	15,000
7.	Plastic tray and glasswares	1	20,000
8.	Sealing machine	1	3000
9.	Refrigerator	1	20,000
10.	Gas connection, Cooker and burner	1	5,000
		Total	**4,98,000**

S. No.	**Particulars**	**Quantity**	**Amount (Rs.)**
II. Recurring or Working Expenditure			
1.	Talc Powder	1000kgs	15000
2.	Chemicals		5000
3.	Polybags		1500
4.	Electricity and gas refilling		2000
5.	Labour charges		10000
6.	Miscellaneous expenditures		5000
		Total	**38,500.00**

III. Income		
1.	1000 kgs of product @Rs. 75/-	75,000.00
2.	Total Expenditure	38,500.00
	Net Profit Rs.	**36,500.00**

* **Non-Recurring:** One time investment

REFERENCE

1. Baker, K.F. and Cook, R.J. 1974. Biological control of plant pathogens. W.H. Freeman and Co. San Francisco, U.S.A.
2. Chet, I. 1987. Innovative approaches to plant disease control, John wiley and Sons, New York.
3. Dinakaran, D, G.Arjunan & G.Karthikeyan 2003. Biological control of crop diseases.
4. Papavizas, G.C. 1985. *Trichoderma* and *Gliocladium* : biology, ecology and potential for biocontrol. Annu. Rev. Phytopathol. 23 : 23-54.
5. Maheswari ,D.K and R.C Dubey 2008 .Potential micro organisms for sustainable agriculture. I.K International Publishing House Pvt. Lts , New Delhi
6. Prakasam, V., Raguchander, T. and Prabakar, K. 1998. Plant Disease Management. AE Publications, Coimbatore, India.

7. Ahamed S and Narain U 2007 . Eco friendly management of plant diseases. Daya Publishing house , New Delhi
8. Utkhede, R.S. and Gupta, V.K. 1996. Management of soil borne diseases. Kalyani Publishers, New Delhi.

PAT 452 COMMERCIAL MUSHROOM PRODUCTION (0+10)

(Team Teaching)

Unit 1 : Different types of mushroom , Morphology **- Edible and poisonous type - edible mushrooms- *Pleurotus*, *Agaricus*, *Volvariella* and *Calocybe* –** nutritional values - and pharmacological values**-preparation of** culture media**-** pure culture techniques**- sterilizing techniques-media - glassware - maintenance of culture**

Unit 2: Mother spawn **production-type of spawn-Multiplication of bed spawn –** Substrates for mushroom cultivation **and their preparation -mushroom cultivation techniques for *Agaricus,***

Pleurotus, Calocybe and Volvariella*- maintenance of spawn running and cropping room-harvest-packing and storage of *Pleurotus, Agaricus* and *Calocybe.

Unit 3 : Problems in cultivation **of *Agaricus, Pleurotus, Calocybe and Volvariella* – pests, diseases and weed moulds, abiotic disorders – management strategies –- Biodegradation of coir pith - cost estimation**

Unit 4 : Post harvest technology **of *Agaricus, Pleurotus, Calocybe and Volvariella* – methods of preservation –Drying: solar, cabinet, fluidized bed and freeze drying – Packing methods and storage - Controlled atmospheric storage- modified atmospheric storage and canning – Cost analysis.**

Unit 5 : Mushroom recipes of ***Agaricus, Pleurotus, Calocybe and Volvariella* - Cooking methods- value added products – instant food mixes –Cost analysis. Project preparation- principles of mushroom farm enterprise management – cost estimation**

Practical schedule

1 week

Studying the general characters of mushrooms

Different types of mushrooms and their morphology

Identification of edible and poisonous mushrooms

Morphological characters of *Pleurotus, Agaricus, Volvariella and Calocybe*

Equipments required for culture media preparation and tissue culture - their operation

2 week

Equipments required for spawn preparation - their operation

Equipments required for substrate sterilization - their operation

Preparation of different types of culture media- Potato Dextrose Agar (PDA) , Oats meal agar (OMA), Malt extract Agar medium (MEA)

Pure culture technique –Tissue isolation methodology

Pure culture technique **–Tissue isolation in PDA, OMA and MEA medium 3 week**

Sub culturing of fungal cultures and maintenance.

Spawn preparation- laboratory requirements, essentials required for mother spawn and bed spawn preparation and their usage.

Oyster mushroom: mother spawn preparation – Cooking of cholam grains , packing in polybags and autoclaving

Oyster mushroom: mother spawn preparation - inoculation

Oyster mushroom: first generation bed spawn preparation - Cooking of cholam, packing in polybags and autoclaving

4 week

Oyster mushroom: first generation bed spawn preparation - inoculation

Observe the spawn contaminants.

Oyster mushroom: second generation bed spawn preparation – Cooking of cholam, packing in polybags and autoclaving

Oyster mushroom: second generation bed spawn preparation - inoculation

Management of contaminants in mother spawn and bed spawn

5 week

Oyster mushroom cultivation – essentials required, cropping room requirement

Oyster mushroom: preparation of substrates for bed preparation

Oyster mushroom – Bed preparation

Oyster mushroom – Maintenance of beds, harvest and storing

Oyster mushroom – pest and their management

6 week

Oyster mushroom – moulds and disease management

Visit to oyster mushroom farm (spawn lab and mushroom farm)

Visit to ulavar sandai markets (Farmers' Market) and observing the marketing pattern of oyster mushroom

Milky mushroom: mother spawn preparation – Cooking of cholam grains, packing in polybags and autoclaving

Milky mushroom: mother spawn preparation - **inoculation 7 week**

Milky mushroom: first generation bed spawn preparation – Cooking of cholam, packing in polybags and autoclaving

Observing the spawn contaminants, their management

Milky mushroom: first generation bed spawn preparation - inoculation

Milky mushroom: second generation bed spawn preparation – Cooking of cholam, packing in polybags and autoclaving

Milky mushroom: second generation bed spawn preparation - inoculation **8 week**

Milky mushroom cultivation – essentials required, cropping room requirement

Milky mushroom:– substrates for bed preparation

Milky mushroom – Bed preparation

Milky mushroom- casing

Milky mushroom – Maintenance of beds, harvest and storing **9 week**

Milky mushroom – pest and their management Milky mushroom – moulds and disease management

Visit to Milky mushroom farm (spawn lab and mushroom farm)

Visit to ulavar sandai, markets and observing the marketing pattern of milky mushroom Button mushroom: visiting units and learning – tissue isolation, spawn preparation

10 week

Button mushroom: visiting units and learning compost preparation

Button mushroom: visiting units and learning: cropping, harvest and storage

Visit to ulavar sandai, markets and observing the marketing pattern of button mushroom

Paddy straw mushroom: tissue isolation

Paddy straw mushroom**: spawn preparation**

11 week

Paddy straw mushroom: Substrate preparation for beds

Paddy straw mushroom: bed preparation

Paddy straw mushroom cultivation – cropping room requirement, Maintenance of beds, harvest and storing

Paddy straw mushroom – pest and disease management

Abiotic disorders and their management

12 week

Integrated pest and disease management in Mushrooms Biodegradation of agrowastes using mushroom spawn Biodegradation of agrowastes using mushroom spawn- continuation Mushroom as a component in Integrated Farming System Interaction with successful spawn producers – TNAU community radio

13 week

Interaction with successful mushroom producers- TNAU community radio
Short term post harvest processing of oyster mushroom
Long term post harvest processing of oyster mushroom
Packing methods of oyster mushrooms
Short term post harvest processing of milky mushroom **14 week**

Long term post harvest processing of milky mushroom
Packing methods of milky mushrooms
Short term post harvest processing of button mushroom
Long term post harvest processing of button mushroom
Packing methods of button mushrooms

15 week

Canning of button mushroom
Recipe and value added products from oyster mushroom
Recipe and value added products from oyster mushroom continued
Recipe and value added products from milky mushroom
Recipe and value added products from milky mushroom continued

16 week

Recipe and value added products from button mushroom
Recipe and value added products from button mushroom continued
Recipe and value added products from paddy straw mushroom
Project preparation on oyster -spawn production and economics
Project preparation on oyster mushroom production and cost estimation

17 week

Project preparation on milky spawn production and cost estimation
Project preparation on milky mushroom production and cost estimation
Project preparation on button -spawn production and cost estimation
Project preparation on button - mushroom production and cost estimation
Practical examination

BUDGET

Economics of Spawn Production (100 spawn bags per day) for oyster and milky mushroom mother spawn and bed spawn

Total working days for spawn: 25

Sl.No.	Item	Quantity	Rate (Rs.)	Total (Rs.)
	Recurring cost (100 spawn x 25 days)			
1.	Polypropylene bags	18 kg	120/kg	14,400
2.	**Cholam grain**	**700 Kg**	**30/kg**	**21,000**
3.	**Calcium carbonate (commercial grade)**	**50**	**25/kg**	**1,250**
4.	**Non-absorbent cotton (400 g rolls)**	**100**	**80/roll**	**8,000**
5.	**Fungicides & Fumigants**	**--**	**--**	**3,000**
6.	**Electricity & Fuel**	**--**	**--**	**20,000**
7.	**Labour @ 2 women per day for 25 days**	**2 nos**	**190/person**	**9,500**
8.	**Glass wares and chemicals for preparing mother spawn**	**--**	**5,000**	**5,000**

9.	**Miscellaneous**	**--**	**--**	**2,000**
	Total			84,150
	Overall total			84,150

Economics of Oyster mushroom production and milky mushroom (each 5 Kg/day)

Total working days: 10

Sl.No.	Item	Quantity	Rate (Rs.)	Total (Rs.)
	Recurring Cost			
1.	**Paddy straw**	**100 kg**	**5/kg**	**5,000**
2.	**Spawn**	**-**	**-**	**-**
3.	**Polythene bags for bed & packing**	**2 kg**	**120/kg**	**240**
4.	**Fungicides, Fumigants & Chemicals**	**--**	**--**	**5000**
5.	**Labour @ 2 Per day**	**2**	**190 /day**	**3,800**
6.	**Miscellaneous (gunny bags, rope,racks)**	**--**		**6000**
II.	**Non recurring-Oyster Mushroom Shed**	**800 sq.ft.**	**75,000**	**75,000**
			Total (Rs.)	95,040

REFERENCES

Agarwal, R.K. and C.L.Jandaik.1986. Mushroom cultivation in India. Indian Mushroom Growers Association, Solan, Himachal Pradesh.p-83.

Bahl, N.1988. Hand book of Mushroom II Edn. Oxford & IBM Publishing Co. New Delhi.

Reference books- further reading

Marimuthu, T., A.S Krishnamoorthy, K.Sivaprakasam and R.Jeyarajan, 1989. Oyster Mushroom Production. The Vijay Books. Sivakasi, India.P.57.

A.S Krishnamoorthy, Marimuthu, T., and S. Nakkeran . 2005 . Mushroom Biotechnology ,The Vijay Books. Sivakasi, India., Pub.ODL, TNAU, Cbe-3

Pathak,V.N. Nagendra Yadav and Maneeskas Gaur.2000.Mushroom production and processing Technology. Agribios (India) Ltd., New Delhi

E-REFERENCES

1. www.mushroomcouncil.com/grow /grow.html
2. www.krishiworld.com/html/mushroom.html
3. www.gmushrooms.com /pots.html.
4. www.mushworld.com /home/
5. www.mushroomcouncil.org

AMP 451 Commercial broiler and layer production (0+10)

	Unit – I - Introduction
	Poultry Industry in India - Current status of broiler and layer industry – Scope of broiler and layer production in India - Introduction to Broilers and Layers – Commercial strains of broilers and layers.
	Unit – II – Housing Management
	Housing management – Location and layout of commercial broiler and layer farm – Preparation of poultry house - Equipments used in broiler and layer farm - Different system of Management - Deep litter system, Cage system of management, Raised housing - Litter management - Preparation of brooder house – Brooder Management –Chick management – Grower management – Layer management -Summer management of broiler -Winter management of broiler – Lighting management – Common procedures followed in broiler and layer farm.
	Unit – III – Feeding Management
	Water – Requirement, quality analysis and its maintenance - Feeding Management of broilers and layers – Types of feed – Feed ingredients – Quality assessment of feed ingredients and feed – Additive and supplementation of additives - Storage of feed-Feeding Methods – Nutrient requirement of different stages of broilers and layers – Various standards for broilers and layers - Feed formulation – Least cost formulation –Preparation of compound feed –Components in feed mill –Feed mill operations - Hatchery Management – Hatchery layout and design – Hatcher and Setter – Collection and handling of egg – Setting and hatching of eggs and chicks quality assessment.
	Unit – IV – Flock Health Management
	Common disease of broilers and layers – Control and Prevention - Medication and Vaccination in broilers and layers – Different vaccination methods – Cold chain for vaccine – Vaccination schedule for broilers and layers -Postmortem inspection –Waste management -Disposal of dead birds and Manure management - Biosecurity measures.
	Unit – V – Processing and Marketing
	Processing of broilers - Slaughtering of broilers and cut up parts of broilers – Evaluation of egg for its quality - Record maintenance- Marketing Channels in broilers and layers - Export of egg and poultry meat - Integration method of broilers marketing–Team teaching along with Department of Economics on Economics of broiler and layers farming and Project preparation for broiler and layer farm unit for bank loan–Role of NECC and BCC in marketing of poultry and its products - Visit to commercial broiler farm, layer farm, feed plant, hatchery unit and processing plant.

Practical schedule

Week	Topic to be covered
1	Current status of broiler and layer industry Scope of broiler and layer production in India Commercial strains of broilers and layers Location and layout of commercial broiler and layer farm Preparation of poultry house
2	Equipments used in broiler and layer farm Different system of Management Deep litter system Cage system of management, Raised housing Litter management

3	Preparation of brooder house Brooder Management, Grower management and Layer management Summer management of broiler and layer Winter management of broiler and layer Lighting management
4	Common procedures followed in broiler and layer farm. Water – Requirement Quality analysis and its maintenance Feeding Management of broilers and layers Types of feed
5	Feed ingredients Quality assessment of feed ingredients and feed Additive and supplementation of additives Storage of feed-Feeding Methods Nutrient requirement of different stages of broilers and layers
6	Various standards for broilers and layers Feed formulation Least cost formulation Preparation of compound feed Components in feed mill
7	Feed mill operations Hatchery Management Hatchery layout and design Hatcher and Setter Collection and handling of egg
8	Setting and hatching of eggs and chicks quality assessment Common disease of broilers and layers Control and Prevention Medication and Vaccination in broilers and layers Different vaccination methods
9	Cold chain for vaccine Vaccination schedule for broilers and layers Postmortem inspection Disposal of waste -dead birds and manure
10	Biosecurity measures.
11	Processing of broilers Slaughtering of broilers and cut up parts of broilers

12	Evaluation of egg for its quality Record maintenance Marketing Channels in broilers and layers
13	Export of egg and poultry meat Integration method of broilers marketing
14	Team teaching along with Department of Economics on Economics of broiler and layers farming and Project preparation for broiler and layer farm unit for bank loan
15	Role of NECC and BCC in marketing of poultry and its products
16	Visit to commercial broiler farm, layer farm, feed plant, hatchery unit and processing plant
17	Examination

AEN 451 Commercial Beekeeping (0+10)

Activities

Honey bee species, castes, social biology and communication in honey bees - Bee pasturage and preparation of bee floral calendar - Honey bees for crop pollination and seed production. - Stingless bees, little bees, rock bees conservation and honey harvest - Beehives, beekeeping equipments specification and uses, visit to manufacturing unit - Hiving feral Indian bee colony, site selection for apiary, visit to migratory bee keeping sites, visit to commercial cerana bee farm, - Honey extraction, processing, purity testing and value addition, visit to honey processing unit - Hive inspection, maintenance of hive records, management in nectar flow season, dearth period, management of swarming, absconding and laying workers - Dividing, uniting bee colonies, artificial feeding, protecting bees from pesticides - Insect, mite and bird enemies of honeybees, brood and adult diseases - Mass queen rearing and production of mating nucleus, visit to beekeeping society - Methods of collection of bees wax, bee pollen, propolis, bee venom, royal jelly - Visit to commercial mellifera bee farm - Marketing and economics of honey and bee products, preparation of bee keeping projects for bank funding

Reference

1. Atwal, A.S. 2013. Mellifera Bee Keeping and Pollination. *Kalyani Publishers, Ludhiana*. 394 p.
2. Ted Hooper, 1991. Guide to Bees and Honey (Thrid Edition), *BAS printers ltd. Over Wallop, Hampshire* 271 p.
3. Roger A. Morse, 1994. The new complete guide to beekeeping. *The Countryman Press, Woodstock, Vermont*. 207p.
4. Thomas D. Seeley. 1995. The Wisdom of the Hive, Harvard University Press, Cambridge, 295p.

Sl. No.	Practical classes	Activity	Ref Book
1.	1-10	Honey bee species, castes, social biology and communication in honey bees	Chapters 3,5,6 and 10 of TB Chapters 2 to 5 of RB 1 Chapter 2,10 of RB 4
2.	11-20	Bee pasturage and preparation of bee floral calendar	Chapter 11 of TB Chapter 12 of RB 1 Chapter 10 of RB 2
3.	21-30	Honey bees for crop pollination and seed production.	Chapter 17 and 18 of TB Chapter 15 of RB 1
4.	31-40	Stingless bees, little bees, rock bees conservation and honey harvest	Chapter 5 of TB Chapter 2 of RB 1
5.	41-50	Beehives, beekeeping equipments specification and uses, visit to manufacturing unit	Chapter 9 of TB Chapter 1 of RB 1 Chapter 4 of RB 2 Chapter 1 of RB 3 Chapter 4 of RB 4
6.	51-70	Hiving feral Indian bee colony, site selection for apiary, visit to migratory bee keeping sites, visit to commercial cerana bee farm	Chapter 8 of TB Chapter 1 and 8 of RB 1 Chapter 2 of RB 3
7.	71-80	Honey extraction, processing, purity testing and value addition, visit to honey processing unit	Chapter 12, 20, 29 of TB Chapter 10 of RB 1 Chapter 11 of RB 2 Chapter 5 of RB 3
8.	81-100	Hive inspection, maintenance of hive records, management in nectar flow season, dearth period, management of swarming, absconding and laying workers	Chapter 12 of TB Chapter 6, 9 of RB 1 Chapter 7 of RB 2 Chapter 3 to 7 of RB 3
9.	101-120	Dividing, uniting bee colonies, artificial feeding, protecting bees from pesticides	Chapter 12, 14, 25 of TB Chapter 9 of RB 1
10.	121-130	Insect, mite and bird enemies of honeybees, brood and adult diseases	Chapter 21 of TB Chapter 13 of RB 1 Chapter 8 of RB 3 Chapter 9 of RB 2
11.	131-140	Mass queen rearing and production of mating nucleus, visit to beekeeping society	Chapter 16, 22 of TB Chapter 10 of RB 1 Chapter 8 of RB 2
12.	141-150	Methods of collection of bees wax, bee pollen, propolis, bee venom, royal jelly - Visit to commercial mellifera bee farm	Chapter 19 of TB Chapter 14 of RB 1
13.	151-170	Marketing and economics of honey and bee products, preparation of bee keeping projects for bank funding	Chapter 28, 29 of TB Chapter 14 of RB 1

E- Reference

i. http://agritech.tnau.ac.in/farm_enterprises/fe_apiculture_home.html http://agdev.anr.udel.edu/maarec/ http://www.aragriculture.org/insects/beekeeping.htm http://tiwanabeefarm.com/
ii. http://beekeeping.com/
iii. http://www.apimondia.com/en

SER 451 Commercial Cocoon Production (0+10)

UNIT I : MULBERRY PRODUCTION AND MANAGEMENT

- Area and distribution of mulberry –Popular Varieties – climatic requirements and soils
- Propagation of nursery - Selection of planting material - Nursery bed Preparation - planting - management – Economics.
- Main field preparation - manuring – planting - Irrigation –Weeding- fertilizers – Intercropping – Training and pruning. Shoot harvest - Transporting - preservation – Economics - project preparation.
- Pruning methods –farm machinery implements.
- Insect pests and diseases of mulberry –management.

UNIT II: SILKWORM REARING AND MANAGEMENT

- Authorized Silkworm Races – crossbreed and bivoltine. Rearing houses – plan and maintenance. Rearing appliances - disinfection.
- Agencies involved in egg production - procurement - transportation - preservation– incubation - black boxing – hatching. Brushing of eggs – rearing of chawki worms – leaf selection – feeding – moulting - bed cleaning - bed disinfectants.
- Chawki Garden – maintenance and management
- Estimation of population of chawki - establishing Chawki Rearing Centres - Record maintenance – Transport - Fixation of rate. Visit to Chawki Rearing Centre.
- Late age rearing – tray and shoot rearing methods - leaf selection – feeding - spacing - bed cleaning
- Moulting care - bed disinfectants. Mounting and mountages. Spinning care and Harvesting.
- Calculation of Effective rate of rearing - Transporting and marketing of cocoons- Economics of rearing silkworms.
- Project preparation for establishing Late age rearing centres. Large scale sericulture farming and contract farming.

Unit III: Silk Reeling

- Physical and commercial properties of cocoons and silk. Cocoon sorting - defective cocoons - cocoon drying - stifling – cooking - brushing - reeling machines - parts and their functions.
- Study of silk reeling - re-reeling - Skein preparation – packing.
- Eri silk spinning – spinning - methods.
- Sampling and testing procedure for winding, size, strength test, condition cohesion and seriplane test. Standards for grading raw silk. Economics of establishing reeling units. Visit to silk reeling units automatic silk reeling units.

PRACTICAL SCHEDULE (WEEKLY)

Week	Syllabus to be covered and Expected Learning experience
1	Area and distribution of mulberry – Popular Varieties – climatic requirements and soil requirement. Preparation of nursery - planting material - manure application.
2	Nursery management – irrigation, weeding, fertilizer application and plant protection. Economics of nursery management.
3	Main field preparation, manuring - Planting methods - Irrigation – Weeding – Intercropping
4	Training and pruning the mulberry crop. Chawki rearing garden - Pruning methods – schedule of operations. Visit to Chawki rearing garden.
5	Late age silkworm rearing - Harvest of leaf and shoot- methods of harvest. Transporting – preservation of leaves and shoots – methods. Visit to Late age silkworm rearing garden - Calculation of brushing capacity.
6.	Farm machinery implements – mulberry pruner, stem cutter and power weeder. Insect pests and diseases of mulberry –natural enemies- IPM. Economics of Mulberry leaf production. Preparation of project proposals.
7.	Authorized Silkworm Races –crossbreed and bivoltine silkworm rearing. Requisites, inspection and selection of site for rearing house.
8.	Rearing houses – plan and maintenance. Rearing appliances – Disinfection. Agencies involved in egg production - procurement of eggs. Transportation – preservation of eggs – incubation.
9.	Black boxing of eggs. - hatching - estimation of hatching percentage. Brushing of eggs – practicing brushing. Rearing of chawki worms – methods. Leaf selection and feeding for young age silkworms.
10.	Moulting, Bed cleaning and bed disinfectants for chawki worms. Estimation of population of chawki worms. Establishing Chawki Rearing Centres. Record maintenance and logistics at Chawki Rearing Centres. Transport of Chawki worms. Visit to Chawki Rearing Centre.
11.	Late age rearing – tray and shoot rearing methods. Leaf selection and feeding for late age silkworms. Spacing of late age worms and bed cleaning.
12.	Moulting care, application of bed disinfectants and its importance. Mounting of worms and mountages. Spinning care and Harvesting.
13.	Calculation of Effective rate of rearing. Maintenance of rearing records, rearing environment for successful rearing. Transporting and marketing of cocoons. Economics of rearing silkworms and maintenance of rearing records.
14	Project preparation for establishing Late age rearing centres. Large scale sericulture farming and contract farming. Visit to Chawki Rearing Centre and late age rearing centres.

15	Physical and commercial properties of cocoons and silk. Study of cocoon sorting – defective cocoons - drying - stifling - cooking – brushing. Study of reeling machines parts and their functions. Study of silk reeling - re-reeling - Skein preparation - packing.
16	Study of tasar and muga cocoons – characteristics - cooking and reeling. Study of eri silk spinning - methods of spinning. Sampling and testing procedure for winding, size, strength test. Sampling and testing procedures for condition cohesion and seriplane test.
17	Standards for grading raw silk. Economics of establishing reeling units. Visit to cocoon market and silk reeling units.

References

- Dandin S.B. Jayant Jayswal and K. Giridhar. 2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore.
- Krishnaswami,S., M.N. Narasimhanna, S.K Suryanarayan and S.Kumararaj. 1978. Sericulture Manual 2 – Silkworm Rearing . FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organisation of the United Nations, Rome, 131 p.
- Somashekar, T.H. and K. Kawakami. 2003. Manual on Bivoltine Silk Reeling Technology. Central Silk Board, Bangalore. 122 p.

E- References

1. www.silkbase.org
2. www.papilo.ab.a.u.tokyo.ac.jp

ARM 451 MANAGERIAL SKILLS FOR AGRIBUSINESS (0+10)

Week 1

1. Sectors of Agribusiness – Seed, Fertilizer, PP Chemicals, Poultry, Bio inputs, Food Processing, Nursery, Logistics, Warehousing, Retail,Consultancy etc
2. Discussion on Agribusiness – Input sector
3. Discussion onAgribusiness – Processing sector
4. Discussion onAgribusiness – Service sector
5. Presentation on identified agribusiness sector – growth and future directions

1. Institutions promoting agribusiness in India
2. Government schemes promoting Agribusiness – Start up India, Make in India
3. Visit to District Industries Centre
4. Visit to MSME
5. Presentation on promotional schemes for identified agribusiness sector

Week 3

1. Business incubation – Types, Process
2. Business incubation models
3. Visit to Directorate of Agribusiness Development
4. Discussion with the TNAU incubatees
5. Visit to an Agribusiness firm

1. Functions of management
2. Functional areas of management - Operations
3. Functional areas of management – Human resources
4. Functional areas of management - Marketing
5. Functional areas of management - Finance

1. Location decision for a business
2. Layout – Goods and Services
3. Demand forecasting
4. Planning the operations
5. Scheduling the operations

Week 6

1. Inventory management decisions
2. Warehousing management
3. Transportation management
4. Packaging management
5. Presentation of plan of operations

Week 7

1. Market segmentation
2. Targeting and positioning
3. Marketing mix – 4Ps
4. Product - Features, brand name, uses
5. Place – Distribution strategies

Week 8

1. Price – Pricing strategies
2. Promotion – Advertising and Sales promotion

3. Planning display, preparation of floor layout plan
4. Preparation of a newspaper advertisement, selection of advertising media
5. Visit to retail outlets to understand the retail formats

Week 9

1. Visit to local shandy
2. Visit to Farmers market
3. Visit to Regulated market
4. Market survey –
5. Presentation on the survey conducted

Week 10

1. Forms of business organization
2. Farmer Producer Organizations
3. Visit to FPO
4. Financial Assistance for promoting FPOs
5. Presentation on the activities carried out by FPO

Week 11

1. Human Relations skills required for business
2. Leadership – Good and Bad cases
3. Communication– Verbal and written communication strategies
4. Emotions – Emotional Intelligence
5. Business Etiquettes

1. Human Resource Management Policy of Firms
2. Human Resource Planning
3. Recruitment and Selection
4. Training
5. Negotiation

1. Company Vision and Mission statement
2. SWOT / TOWS Analysis
3. BCG / Portfolio Matrix
4. Levels of Management
5. Company – Strategy formulation

Week 14

1. Source of funds
2. Capital Budgeting Techniques
3. Analyzing Financial Statements
4. Analyzing Financial Statements
5. Discussion on a Case Study

Week 15

1. Business Plan – components, types
2. Preparation of model business plan
3. Preparation of model business plan
4. Presentation of business plan
5. Presentation of business plan

Week 16

1. Entrepreneur – Qualities, Types of Entrepreneurship
2. Institutes promoting Entrepreneurship
3. Writing Biography of an agribusiness entrepreneur
4. Writing Biography of an agribusiness entrepreneur
5. Finding Entrepreneurial competency level

Week 17

Term paper presentation and Evaluation
Conducting Final Practical Examination