# ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

**Programme: B.Sc. Honours in Sericulture (Major)**

**w.e.f. AY 2023-24**

**COURSE STRUCTURE**

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | I | 1 | Introduction to Classical Biology | 3+2 | 4 |
| | | 2 | Introduction to Applied Biology | 3+2 | 4 |
| | II | 3 | Biology And Physiology Of Mulberry | 3 | 3 |
| | | | Biology And Physiology Of Mulberry Practical Course | 2 | 1 |
| | | 4 | Mulberry Production Technology | 3 | 3 |
| | | | Mulberry Production Technology Practical Course | 2 | 1 |
| II | III | 5 | Cytogenetics And Breeding Of Mulberry | 3 | 3 |
| | | | Cytogenetics And Breeding Of Mulberry Practical Course | 2 | 1 |
| | | 6 | Pathalogy of Mulberry & Ipm | 3 | 3 |
| | | | Pathalogy of Mulberry & Ipm Practical Course | 2 | 1 |
| | | 7 | Biology And Physiology of Silkworm | 3 | 3 |
| | | | Biology And Physiology of Silkworm Practical Course | 2 | 1 |
| | | 8 | Silkworm Rearing &Cocoon Production Technology | 3 | 3 |
| | | | Silkworm Rearing &Cocoon Production Technology Practical Course | 2 | 1 |
| | IV | 9 | Cytogenetics And Breeding of silkworm | 3 | 3 |
| | | | Cytogenetics And Breeding of silkworm Practical Course | 2 | 1 |
| | | 10 | Silkworm Seed Production And Seed Organization | 3 | 3 |
| | | | Silkworm Seed Production And Seed Organization Practical Course | 2 | 1 |
| | | 11 | Silkworm Diseases & Ipm | 3 | 3 |
| | | | Silkworm Diseases & Ipm Practical Course | 2 | 1 |
| III | V | 12 | Vanya Sericulture (Non Mulberry) Sericulture | 3 | 3 |
| | | | Vanya Sericulture (Non Mulberry) Sericulture Practical Course | 2 | 1 |
| | | 13 | Organic Farming And Mechanization | 3 | 3 |
| | | | Organic Farming And Mechanization Practical Course | 2 | 1 |
| | | 14 | Post-Harvest Cocoon Processing Technology (OR) Sericultural Engineering | 3 | 3 |
| | | | Post-Harvest Cocoon Processing | 2 | 1 |

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| | | | Technology (OR) Sericultural Engineering Practical Course | | |
| | | 15 | Silk Fibre Technology, Extension & Economics (OR) Value Added Products In Sericulture | 3 | 3 |
| | | | Silk Fibre Technology, Extension & Economics (OR) Value Added Products In Sericulture Practical Course | 2 | 1 |
| | VI | Semester Internship/Apprenticeship with 12 Credits | | | |
| IV | VII | 16 | Soil and water management (OR) Mulberry and silkworm crop Protection | 3 | 3 |
| | | | Soil and water management (OR) Mulberry and silkworm crop Protection Practical Course | 2 | 1 |
| | | 17 | Entrepreneurial opportunities in Sericulture (OR) Mechanization in Sericulture | 3 | 3 |
| | | | Entrepreneurial opportunities in Sericulture (OR) Mechanization in Sericulture Practical Course | 2 | 1 |
| | | 18 | Value addition through by product utilization in sericulture (OR) Sericulture economics, extension and management | 3 | 3 |
| | | | Value addition through by product utilization in sericulture (OR) Sericulture economics, extension and management Practical Course | 2 | 1 |
| | | **SEC** | | | |
| | | 19 | Mulberry Nursery Raising (OR) Chawki Rearing Technology | 3 | 3 |
| | | | Mulberry Nursery Raising (OR) Chawki Rearing Technology Practical Course | 2 | 1 |
| | | 20 | Silkworm seed production (OR) Management of Seri- Clinics | 3 | 3 |
| | | | Silkworm seed production (OR) Management of Seri- Clinics Practical Course | 2 | 1 |
| | VIII | 21 | Scenario of sericulture industry (OR) Biochemistry | 3 | 3 |
| | | | Scenario of sericulture industry (OR) Biochemistry Practical Course | 2 | 1 |
| | | 22 | Molecular Biology (OR) Seri-Biotechnology | 3 | 3 |
| | | | Molecular Biology (OR) Seri-Biotechnology Practical Course | 2 | 1 |
| | | 23 | Bioinformatics and Biostatistics (OR) Tissue culture, genetic engineering and Research | 3 | 3 |

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| | | | methodology | | |
| | | | Bioinformatics and Biostatistics (OR) Tissue culture, genetic engineering and Research methodology Practical Course | 2 | 1 |
| | | **SEC** | | | |
| | | 24 | Seri-Handicrafts (OR) Non-mulberry Sericulture | 3 | 3 |
| | | | Seri-Handicrafts (OR) Non-mulberry Sericulture | 2 | 1 |
| | | 25 | Silk fabric designing, dyeing and printing (OR) Raw silk testing and grading | 3 | 3 |
| | | | Silk fabric designing, dyeing and printing (OR) Raw silk testing and grading Practical Course | 2 | 1 |

**SEMESTER-I**

## COURSE 1: INTRODUCTION TO CLASSICAL BIOLOGY

Theory Credits: 4 5 hrs/week

**Learning objectives**

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

**Learning Outcomes**

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

**Unit 1: Introduction to systematics, taxonomy and ecology.**

1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.

1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.

1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.

1.4. Pollution and climate change.

**Unit 2: Essentials of Botany.**

2.1. The classification of plant kingdom.

2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).

2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.

2.4 Mushroom cultivation, floriculture and landscaping.

**Unit 3: Essentials of Zoology**

3.1. The classification of Kingdom Animalia and Chordata.

3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders

3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)

3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

**Unit 4: Cell biology, Genetics and Evolution**

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3. Central Dogma of Molecular Biology.

4.4. Origin of life

**Unit 5: Essentials of chemistry**

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of chemistry

5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4. Green chemistry

**References**

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.

2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.

3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.

4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.

5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.

6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

**ACTIVITIES:**

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

**SEMESTER-I**

## COURSE 2: INTRODUCTION TO APPLIED BIOLOGY

Theory Credits: 4 5 hrs/week

### Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

### Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

**Unit 1: Essentials of Microbiology and Immunology**

1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.

1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.

1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.

1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

**Unit 2: Essentials of Biochemistry**

2.1. Biomolecules I – Carbohydrates, Lipids.

2.2. Biomolecules II – Amino acids & Proteins.

2.3. Biomolecules III – Nucleic acids -DNA and RNA.

2.4. Basics of Metabolism – Anabolism and catabolism.

**Unit 3: Essentials of Biotechnology**

3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.

3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

**Unit 4: Analytical Tools and techniques in biology – Applications**

4.1. Applications in forensics – PCR and DNA fingerprinting

4.2. Immunological techniques – Immunoblotting and ELISA.

4.3. Monoclonal antibodies – Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

**Unit 5: Biostatistics and Bioinformatics**

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

**REFERENCES**

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.

8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.

10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

**ACTIVITIES**

1. Identification of given organism as harmful or beneficial.

2. Observation of microorganisms from house dust under microscope.

3. Finding microorganism from pond water.

4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene’
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastesand hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE**: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty.In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

**SEMESTER-II**

**COURSE 3: BIOLOGY AND PHYSIOLOGY OF MULBERRY**

Theory Credits: 3 3 hrs/week

**I.** Theory:

| | |
|---|---|
| Unit-1: GEOGRAPHIC DISTRIBUTION OF MULBERRY AND GENOTYPES : 8Hrs. | |
| 1 | History of Sericulture |
| 2 | World Raw Silk Production |
| 3 | Employment Potentiality |
| 4 | GermPlasm and Cultivated Varieties of Mulberry . |
| Unit-2: CLASSIFICATION &TAXONOMY : 10Hrs | |
| 1 | Systematic Position Of Mulberry in Plant Kingdom |
| 2 | Morphology and Characteristics of Mulberry Leaf,Branches and Roots |
| 3 | Floral biology of Mulberry |
| 4 | Morphology and Characteristics of Flowers and Seeds |
| Unit-3: ANATOMY OF MULBERRY: 8Hrs. | |
| 1 | Types of Tissue Systems |
| 2 | Anatomy of Root (Primary & Secondary Structures) |
| 3 | Anatomy of Stem (Primary & Secondary Structures) |
| 4 | Anatomy of Petiole and leaf. |
| Unit-4: PHYSIOLOGY OF MULBERRY 10Hrs. | |
| 1 | Importance of physiology in agriculture.<br>Plant-water relations: Structure, properties and functions of water; concept of diffusion, osmosis and water potential; Water balance of plants: Water in soil; Water absorption and translocation in plant; soil-plant-atmosphere continuum; Theories explaining water translocation. |
| 2 | Transpiration: Significance of Transpiration; transpiration in relation to crop productivity, Stomatal physiology, Concept of water use efficiency. |
| 3 | Photosynthesis: Brief Account of Photosynthesis- Mechanism of carbon fixation by $C_3$, $C_4$ and CAM pathway and their significance in relation to leaf quality and productivity-Chemical Composition of Mulberry leaf. |
| 4 | Respiration: Significance; Respiratory metabolism, Alternative respiration, Factors regulating respiratory rates.<br>Seed dormancy and viability: Basic concepts, seed germination and seedling vigour.<br>Stress Physiology: Plant responses to abiotic stresses; Key concepts and definition; acclimation and adaptation mechanisms. |
| Unit-5: GROWTH REGULATORS 9Hrs. | |
| 1 | Plant Growth and Development: Concept of plant growth and morphogenesis; Growth and yield parameters and their measurements. |
| 2 | Hormones and plant growth regulators in modulating crop growth |
| 3 | Physiological importance of Auxins, GA, Cytokinin, ABA, Ethylene, Brassinosteroids and strigolactones |
| 4 | Applications of growth regulators in Agriculture &Sericulture. |

**SEMESTER-II**

## COURSE 3: BIOLOGY AND PHYSIOLOGY OF MULBERRY

Practical Credits: 1 2 hrs/week

1. Taxonomy: Botanical description of Mulberry of Family: Moraceae.
2. Anatomy:
   - oT.S. primary and secondary roots.
   - oT.S of stems of Mulberry.
   - oT.S of Leaf.
   - oT.S of petiole.
3. Physiology
   A. Apical Dominance
   B. Separation of Chlorophyll Pigments

References: ipni.org(International Plant name Index)


1. Bongale, U.D (1995) Fertilizers in mulberry cultivation. Pushpa Sree Publications, Thalaghattapura, Bangalore.
2. Dokuhon, Z.S (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co, Pvt. Ltd, New Delhi, Calcutta.
3. Guptta, R.K & Mittal, R.K (1983) Bibliography of Indian Weeds. Associated Pub. Co. New Dehli.
4. Hasao Aruga (1994) Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co, Pvt. Ltd, New Delhi.
5. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
6. Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
7. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
8. Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
9. A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central Silk Board, Bangalore-68, India. 2005.
10. Rajanna L, Das P.K, Ravindra S, Bhogesha K, Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology.2005
11. .Sericulture Manual – 1 (Mulberry cultivation) (1972)Food and Agriculture Organization of the United Nations, Rome.
12. Lecturers on Sericulture-Edited by G.Boraiah, SBS Publishers Distributors, BANGALORE
13. Comprehensive Sericulture Manual-M.Madan Mohan Rao, B.S.Publications, HYDERABAD.
14. Patti sankethika vignana sasthram-Developed by APSSRDI, Kirikera
15. Pattu parisrama-Telugu academy
16. Photosynthesis and plant physiology

**SEMESTER-II**

**COURSE 4: MULBERRY PRODUCTION TECHNOLOGY**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: INFLUENCE OF AGRO CLIMATIC FACTORS ON GROWTH AND DEVELOPMENT OF MULBERRY 8 Hrs | |
| 1 | Climate |
| 2 | Soil and its components, properties, fertility and productivity and their management, |
| 3 | Soil Types |
| 4 | Rain fall-Light-Elevation |
| Unit-2: MULBERRY PROPAGATION: 10Hrs | |
| 1 | Asexual Propagation and mechanism of Regeneration<br>Cutting Method.<br>Grafting Methods- Stem, Bud and root grafting. |
| 2 | Layering Methods-Simple Layering, Air Layering, Trench Layering. |
| 3 | Sexual Propagation<br>Propagation through seeds and seedlings preparation |
| 4 | Nursery Technology & Economics |
| Unit-3: MULBERRY AGRONOMY -I 8Hrs. | |
| 1 | Establishment of Mulberry Field.<br>Mulberry cultivation- Selection and Preparation of the Land |
| 2 | Planting material.<br>Methods of Planting-a) Pit system, b) Row system |
| 3 | Irrigation methods- Flatbed method, Basin method, Furrow method, Sprinkler or Over head method, Drip irrigation. |
| 4 | Manuring. |
| Unit-4: MULBERRY AGRONOMY- II 10Hrs. | |
| 1 | Inter Cultivation and Weeding, Systematic position of Common weeds of mulberry garden, Preventive & Control measures. Integrated Weed Control |
| 2 | Methods of Pruning- Low cut, High cut, and Middle cut, Head and non-head type of pruning. |
| 3 | Methods of leaf harvest- leaf picking, Branch harvest and Whole shoot harvest |
| 4 | Prolonged Preservation of Mulberry-Estimated yield of Mulberry |
| Unit-5: MECHANIZATION IN MORICULTURE 9Hrs. | |
| 1 | Role of mechanization in sericulture-Definition and scope |
| 2 | Mechanization in Mulberry Cultivation - Land preparation for new mulberry plantation-Machines for making pits- Tractor operated sub-soiler- Tractor Operated Auger Digger, Mulberry Cutting Preparation Machine. |
| 3 | Intercultural operations- Machines for inter-cultural operations-- Power Rotavator-Cultivator and Weeder- Power Rotavator- Cultivator and Weeder<br>Spraying of Chemicals in Mulberry Garden- Power Operated Sprayer for application of chemicals |
| 4 | Mulberry Pruning and Shoot Harvesting -Knapsack Mulberry Pruner cum Harvester-Shoot Chorusing Machine<br>Irrigation-Rain-guns, Micro Irrigation equipments-Sprinkler irrigation, Drip irrigation |

**SEMESTER-II**

**COURSE 4: MULBERRY PRODUCTION TECHNOLOGY**

Practical Credits: 1 2 hrs/week

1. MULBERRY PROPAGATION:
   Stem cutting
   Nursery Preparation.
   Bud Grafting– Root Grafting - Layering.
2. Collection of Mulberry seeds for Germplasm development.
3. Land Preparation and mulberry plantation.
4. Inter cultivation of mulberry.
5. Morphology and systematic position of Common weeds of Mulberry.

References:


1. Bongale, U.D (1995) Fertilizers in mulberry cultivation. Pushpa Sree Publications, Thalaghattapura, Bangalore.
2. Dokuhon, Z.S (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co, Pvt. Ltd, New Delhi, Calcutta.
3. Guptta, R.K & Mittal, R.K (1983) Bibliography of Indian Weeds. Associated Pub. Co. New Dehli.
4. Hasao Aruga (1994) Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co, Pvt. Ltd, New Delhi.
5. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
6. Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
7. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
8. Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
9. A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central Silk Board, Bangalore-68, India. 2005.
10. Rajanna L, Das P.K, Ravindra S, Bhogesha K, Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology.2005
11. .Sericulture Manual – 1 (Mulberry cultivation) (1972)Food and Agriculture Organization of the United Nations, Rome.
12. Lecturers on Sericulture-Edited by G.Boraiah, SBS Publishers Distributors, BANGALORE
13. Comprehensive Sericulture Manual-M.Madan Mohan Rao, B.S.Publications, HYDERABAD.
14. Patti sankethika vignana sasthram-Developed by APSSRDI, Kirikera
15. Pattu parisrama-Telugu academy
16. Photosynthesis and plant physiology

**SEMESTER-III**

**COURSE 5: CYTOGENETICS AND BREEDING OF MULBERRY**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: EMBRYOLOGY OF MULBERRY | 8Hrs. |
| 1 | Microsporogenesis- Development of microspores- Megasporogenesis- Development of megaspores. |
| 2 | Fertilization- Fruit seed development |
| 3 | Embryo Development |
| 4 | Polyembryony- Parthenogenesis- Parthenocarpy |
| Unit-2: CYTOLOGY: | 10Hrs |
| 1 | Cytological aspects of Mulberry |
| 2 | Cell and its organelle- Chromosomes & Structure and function of DNA |
| 3 | Cell Division-Mitosis |
| 4 | Cell Division- Meiosis |
| Unit-3: GENETICS | 8Hrs |
| 1 | Pre- and Post-mendelian concepts of heredity, Mendelian principles of heredity. Types of dominance, epistatic interactions with examples |
| 2 | Germplasm sources, geographical distribution and exploration -Conservation and role of germplasm in crop improvement |
| 3 | Multiple alleles, Pleiotropism, Sex determination and sex linkage, sex limited and sex influenced traits, Inheritance of economic characters (quantitative and qualitative characters). Objectives and pre-requisites of breeding- |
| 4 | Centers involved in crop improvement programme of host plants of silkworms. Inheritance of economic characters (quantitative and qualitative characters). Objectives and pre-requisites of Breeding |
| Unit-4: BREEDING OF MULBERRY | 10Hrs. |
| 1 | Methods of Breeding, viz., Introduction and Acclimatisation, Methods of Selection in Mulberry. Hybridization, Heterosis Breeding, Breeding Methods for Self and Cross Pollinated crops, Backcross, Population Improvement |
| 2 | Mutation breeding- polyploid breeding |
| 3 | Breeding for resistance to biotic and abiotic factors - drought, diseases, pests, salinity and alkalinity |
| 4 | Breeding for leaf quality. Evaluation and statistical approach for yield test in mulberry. Varietal multiplication and dissemination |
| Unit-5: BIOTECHNOLOGY IN MULBERRY | 9Hrs. |
| 1 | Concept of Plant Biotechnology- History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement – Totipotency and Morphogenesis |
| 2 | Nutritional requirements of *in-vitro* cultures; Techniques of i*n-vitro* cultures; Micro-propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Endosperm Culture and its applications |
| 3 | Genetic engineering: Restriction enzymes; vectors for gene transfer- Gene cloning, direct and indirect method of gene transfer, Transgenic plants and their applications |
| 4 | Blotting techniques- DNA finger printing, DNA based markers- RFLP, AFLP, RAPD, SSR and DNA probes. Marker-assisted selection and its recent advances |

**SEMESTER-III**

**COURSE 5: CYTOGENETICS AND BREEDING OF MULBERRY**

Practical Credits: 1 2 hrs/week

1. Micro and megasporogenesis and fertilization in mulberry,squashing and smearing techniques in Mulberry.
2. Karyomorphology and idiogram in some host plants of silkworms.
3. Identification of different Mulberry genotypes
4. Requirements for plant tissue culture laboratory; Techniques in plant tissue culture; Media components and preparations, Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant regeneration; Micro- propagation of important crops, Anther, Embryo and Endosperm culture; Hardening/ Acclimatization of regenerated plants;

References:


Text Books:

1. Pattu parisrama-Telugu academy
2. Photosynthesis and plant physiology New Central Book Agency Pvt. Ltd., Kolkata
3. A.V.S.S. Sambamurty (2007) Molecular Genetics,Narosa Publishing House,New Delhi
4. S. C. Rastogi (2008) Cell Biology,New Age International (P) Ltd. Publishers, New Delhi
5. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
6. B. D. Singh (2008) Genetics,Kalyani Publishers, Ludhiana
7. Cooper, G.M. & R.E. Hausman (2009) The Cell – A Molecular Approach, A.S.M. Press, Washington
8. Becker, W.M., L.J. Kleinsmith& J. Hardin (2007) The World of Cell, Pearson, Education, Inc., New York
9. De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
10. Robert H. Tamarin (2002) Principles of Genetics, Tata McGraw –Hill Publishing Company Limited, New Delhi.
11. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) Principles of Genetics, John Wiley & Sons Inc., New York
12. Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) DNA Science: A First Course, I.K.International Pvt. Ltd., New Delhi Lecturers on Sericulture-Edited by G.Boraiah, SBS Publishers Distributors, BANGALORE
13. Comprehensive Sericulture Manual-M.Madan Mohan Rao, B.S.Publications, HYDERABAD.
14. Patti sankethika vignana sasthram-Developed by APSSRDI, Kirikera
15. Pattu parisrama-Telugu academy
16. Photosynthesis and plant physiology
17. Shantharam, S. and Montgomery, J.F (1999) Biotechnology, Biosafety and Biodiversity, Science Publisher, Inc. USA.
18. Sharma, A.K and Sharma, A (1970) Chromosome Technique: theory and Practice. Butterworth and Co., London University Park Press, Baltimore.
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**SEMESTER-III**

**COURSE 6: PATHALOGY OF MULBERRY &IPM**

Theory Credits: 3 3 hrs/week

I. Syllabus of Theory:

| | |
|---|---|
| Unit-1: FUNDAMENTALS OF PLANT PATHOLOGY | 8Hrs |
| 1 | Cause and classification of plant diseases |
| 2 | Important plant pathogenic organisms, fungi, bacteria, fastidious vascular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them |
| 3 | Diseases and symptoms due to abiotic agents |
| 4 | Importance of plant diseases, scope and objectives of Plant Pathology |
| Unit-2: FOLIAR DISEASES. | 10Hrs |
| 1 | Fungal Diseases-Powdery mildew , leaf spot, Rust , Root Rot,Twig Blight.-Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| 2 | Bacterial Diseases-Bacterial leaf blight- Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| 3 | Viral Diseases- Mosaic Disease, Mycoplasma Disease, Dwarf Disease- Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| 4 | Tukra- Etiology-Epidemology-Pathogenicity-Symptoms-Diagnosos-Control |
| Unit-3: STEM & ROOT DISEASES | 8Hrs. |
| 1 | Stem Diseases- Trunk rot-Dogare blight - Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| 2 | Dwarf; D.Stem Canker- Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| 3 | Nematode Disease- Root Rot- Etiology-Epidemology-pathogenicity-Symptoms-Diagnosis-Control |
| 4 | Root Knot disease- Etiology-Epidemology-pathogenicity-Symptoms-Diagnosos-Control |
| Unit-4: PREVENTION AND CONTROL OF DISEASES & INM | 10Hrs. |
| 1 | Principles and methods of plant disease management: Avoidance of the pathogen: Choice of geographical area, selection of field and planting stock. |
| 2 | Integrated Nutrient management-Micronutrients, Macro nutrients and Mineral Deficiency |
| 3 | Eradication: Cultural and physical methods of eradication and inoculum reduction. Biological methods: Crops rotation, use of trap crops, plant and plant products, use of biological control agents, their mass multiplication mechanisms of biocontrol. |
| 4 | Breeding for disease resistance: Types of resistance, Development of resistant varieties, induced resistance. Protection chemical methods: Nature, classification, mode of action and formulations of fungicides, bactericides antibiotics and nematicides; methods of applications of chemicals. Application of biotechnology in plant disease management |
| Unit-5: PESTS OF MULBERRY & IPM | 9Hrs. |
| 1 | Identification of different types of leaf eating caterpillars-Lepidoptera:Bihar hairy caterpillar,Cut worm,Leaf Roller, |
| 2 | Hemiptera: Mealybug,Jassids, Scale Insects<br>Coleoptera: Stem Girdle beetle and stem borer |
| 3 | Orthoptera- Grass hopper: Thysanoptera –Thrips<br>Isoptera -Termites:Acarina- Mites |
| 4 | Integrated Pest Management[IPM]in Mulberry |

**SEMESTER-III**

**COURSE 6: PATHALOGY OF MULBERRY &IPM**

Practical Credits: 1 2 hrs/week

1. Study of symptoms, etiology and life cycle/disease cycle of the diseases of *Morus alba, Ricinus communis, Manihot utilisima, Michilius champaka, Zizypus* spp., *Quarcus* spp., *Machilus bombycina, Shorea robhusta, Ailanthus* spp., and other hosts of silkworms.
2. Study of fungicides, bactericides, nematicides and methods of applications. Isolation, mass multiplication of Biocontrol agents and their bioassay.
3. Study of plant protection equipments.

(Submission of 15 well preserved disease specimens and 15 semi-permanent slides depicting different plant pathogens).

References:


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1. Lecturers on Sericulture-Edited by G.Boraiah, SBS Publishers Distributors, BANGALORE
2. Comprehensive Sericulture Manual-M.Madan Mohan Rao, B.S.Publications, HYDERABAD.
3. Patti sankethika vignana sasthram-Developed by APSSRDI, Kirikera
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5. Chopra, V.L (1985). Plant Breeding: Theory and Practice. Oxford &IBH Publishing Co, Pvt. Ltd. New Delhi.
6. Darlington, C.D. and Wylie, A.P (1970). Handling of chrosomes. George Allen and Unwin Ltd, London.
7. Gupta, P.K (1995). Cytogenesis. Rastogi Publication, Meerut.
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9 A.Bayly, Indian Society and the Making of the British Empire

9. History of India, 2nd Part, Telugu Academy


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**SEMESTER-III**

**COURSE 7: BIOLOGY AND PHYSIOLOGY OF SILKWORM**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit.1 SYSTEMATICS & SILKWORM BIODIVERSITY | 8 Hrs |
| 1 | Systematic position of Mulberry and Non mulberry silkworms in the animal kingdom. |
| 2 | Kinds of Silkworms–Classification Based on Votinism, Moultinism & Geographical Origin |
| 3 | Biology of mulberry silkworm, popular polyvoltine & bivoltine breeds. |
| 4 | Geographical distribution Of Mulberry and Non Mulberry Silkworms. |
| Unit-2: SILKWORM MORPHOGENESIS | 10Hrs |
| 1 | Life cycle (Holometabola) of silkworm –<br>Egg stage, Larva stage, Chrysalis and Moth stage |
| 2 | Meteorological and Environmental Conditions. |
| 3 | Silkworm Feeds- Elements of Mulberry Leaf-Utilization of leaf Nutrients-Mulberry Leaf Selection |
| 4 | Artificial Feeds-Composition Of Artificial Diet-Frequency of Feeds-Quality Of the Diet |
| Unit-3: SILKWORM ANATOMY AND PHYSIOLOGY | 10 Hrs |
| 1 | Morphology of Physiological Systems<br>Digestive System, Excretory System of Larva |
| 2 | Respiratory, Circulatory and Central Nervous System of Larvae |
| 3 | Glandular System-Salivary Glands-Exuvial Glands-tracheal Glands-Silk Glands |
| 4 | Reproductive system in silkworm larva and moth. |
| Unit-4: NEURO PHYSIOLOGY AND SENSORY PHYSIOLOGY | 10Hrs. |
| 1 | Neurophysiology: Structure of the neuron – maintenance of resting potential – generation ofaction potential – conduction of nerve impulse – structure of synapse – synaptic transmissionneurotransmitters |
| 2 | Physiology of silkworm nervous system during metamorphosis. |
| 3 | Sensory physiology: Structure of photo, chemo, and mechano receptors in insects- |
| 4 | Physiology of photoreception, chemoreception, and mechano reception. |
| Unit-5: ENDOCRINOLOGY | 9Hrs. |
| 1 | Introduction, Structure and functions of Endocrine Glands (Brain, Corpora allatum |
| 2 | Prothoracic gland, Corpora cardiaca & Sub oesophageal ganglion). |
| 3 | Brief account of juvenile hormones, Ecdysone and Diapause Hormones. |
| 4 | Male and Female Accessory Glands-Scent Glands, Pheromones |

**SEMESTER-III**

**COURSE 7: BIOLOGY AND PHYSIOLOGY OF SILKWORM**

Practical Credits: 1 2 hrs/week

1. Biology of silkworms:

    1. Morphology and life cycle of silkworms.
    2. Comparative stages of egg, larva.
    3. Male pupa, Female pupa, Male moth and Female moth.
    4. Digestive system and silk glands of silkworm.
    5. Female Reproductive system and Nervous system.

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References


1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India
3. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd. Calcutta.
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13. Rajan, R.K. Hemanth Raju 2005, Text Book on silkworm rearing, Central Silk Board, Bangalore.
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**SEMESTER-III**

**COURSE 8: SILKWORM REARING TECHNOLOGY&COCOON PRODUCTION**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1:INCUBATION AND PRESERVATION OF SILKWORM EGGS | |
| 1 | Preparatory Work for Incubation of Silkworm Egg |
| 2 | Development of Silkworm Embryo |
| 3 | Environmental conditions for Incubation |
| 4 | Technical Management in Incubation &Preservation of eggs for initiation of rearing |
| UNIT-2: THE SILKWORM AND THE ENVIRONMENT 10hrs | |
| 1 | Introduction of silkworm rearing |
| 2 | Rearing Equipment - Rearing stand, Rearing trays, Ant wells, Paraffin papers, Foam rubber pads, Chopsticks, Feathers, Chopping boards, Leaf chambers, Cleaning nets, Mountages |
| 3 | Disinfection of rearing house - Methods, Eco-friendly disinfectants-Precautions during disinfection |
| 4 | Rearing and impact of environmental factors. |
| Unit-3: CHAWKI SILKWORM REARING 10 Hrs | |
| 1 | Mode of rearing of Chawki worms |
| 2 | Methods of rearing of young larvae-Paraffin paper, Box rearing, Co-operative rearing |
| 3 | Brushing, leaf selection for different instars, frequency and quantum of feeding. Care at Moulting /Spacing of worm- young age silkworm feeds/feeding methods/selection of mulberry leaf |
| 4 | Bed cleaning & Spacing- Moulting- care &manangement-Environment |
| Unit-4: METHODS OF ADULT SILKWORM REARING 10HRS. | |
| 1 | Mode of rearing grown worms- Shelf / Floor/Shallow ditch/Outdoor/Open air/Ground rearing |
| 2 | Rearing techniques for grown worms-Ventilation/ Utilization of leaf/ Selection of leaf/Uses of harmones/ Prevention &Control of enemies |
| 3 | Mounting-Mountages/Arrangement for Mounting/Methods of Mounting/Environment/Measures to prevent formation of poor quality cocoons/Non-cocooning Silkworms &Preventative measures |
| 4 | Harvesting of Cocoons-Methods |
| Unit-5: ECONOMICS OF COCOON PRODUCTION 9HRS. | |
| 1 | Leaf cocoon ratio |
| 2 | Economics of silkworm rearing |

**SEMESTER-III**

**COURSE 8: SILKWORM REARING TECHNOLOGY&COCOON PRODUCTION**

Practical Credits: 1 2 hrs/week

1.Model rearing house.

Biology of Polyvoltine and Bivoltine silkworms.

Popular breeds of silkworms Plan of rearing house. Rearing appliances.

Disinfection.

Incubation. Brushing.

Leaf preservation.

Chawki and late age rearing.

Bed cleaning and Spacing. Bed disinfection,

Rearing of popular silkworm hybrids and maintenance of rearing records.

Planning of small and large scale silkworm rearings based on facilities, management of diseases and natural enemies.

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REFERENCES:


1.Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A

2.Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India

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9. Techniques of Silkworm rearing in the tropics. Economic and Social commission of Asia and the Pacific. United Nations, New York. 1993.

10. Veda, K. Nagai, I., Horikomi, M (1997) Silkworm Rearing (Translated from Japanese. Oxford & IBH publishing co., Co., Pvt. Ltd. New Delhi.

11. Wu Pang-Chuan and Chen Da-Chuang. (1994) Silkworm rearing. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.

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13. Rajan, R.K. Hemanth Raju 2005, Text Book on silkworm rearing, Central Silk Board, Bangalore.
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**SEMESTER-IV**

**COURSE 9: CYTOGENETICS AND BREEDING OF SILKWORM**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: CYTOLOGY | 8 Hrs |
| 1 | Utlra Structure Organization of Cell Organells-Golgi complex/Endoplasmic Reticulum/Nucleus/ Nuclear Envelop/Mitochondria /Chloroplast/Lysosomes / Ribosomes |
| 2 | Somatic Cell division-Mitosis |
| 3 | Reproductive Cell division-Meiosis |
| 4 | Chromosome Number in Mulberry and Non-Mulberry Silkworms. |
| Unit-2: GAMETOGENESIS&SEX DETERMINATION | 10Hrs |
| 1 | Oogenesis |
| 2 | Spermatogenesis and Fertilization. |
| 3 | Structure and Chemical Composition of Chromosome and Nucleic acids- Types of Chromosomes |
| 4 | Sex determination in Silkworms- Role of Z and W Chromosomes |
| Unit-3: DEVELOPMENTAL BIOLOGY | 8 Hrs |
| 1 | Structure of a Typical Insect Egg |
| 2 | Membrane Organization of Egg |
| 3 | Development of Polarity, Cleavage, Blastoderm and Blastokinesis |
| 4 | Appendage formation and Organogenesis of Silkworm |
| Unit-4: GENETICS | 10Hrs. |
| 1 | Concepts and principles of genetics- Laws of inheritance- Introduction/ Gene and Environment Phenocopy/Interaction of genotype with environment and Special reference to silkworms |
| 2 | Linkage-Linkage Maps/Linkage groups |
| 3 | Crossing Over- factors influencing crossing over |
| 4 | Parthenogenesis with reference to silkworm-types and methods, induction of parthenogenesis-Merits and limitations |
| Unit-5 BREEDING OF SILKWORM | 9Hrs. |
| 1 | Aim of Breeding, Inbreeding, Out breeding, Inbreeding Depression-Consequence of Homozygocity-Cross Breeding |
| 2 | Silkworm improvement through mass selection, pure line selection, bulk method, back cross method and line breeding. |
| 3 | Hybridization- Heterosis, genetic basis for Heterosis, Manifestation of heterosis/ Heterosis in different crossing systems. |
| 4 | Mutation Breeding-Polyplody Breeding/ Sex Limited races - General and specific combining ability |

**SEMESTER-IV**

**COURSE 9: CYTOGENETICS AND BREEDING OF SILKWORM**

Practical Credits: 1 2 hrs/week

I. SILKWORM BREEDING

1. Characteristics of silkworm breeds/ races
2. Evaluation of heterosis of different combinations
3. Individual selection and family selection
4. Identification of mutants: eggs larva and moth.
5. Maintenance of germplasm, Characterization and documentation

II. Observation and description of racial characters of egg, larva, pupa, cocoon and adult stages in different voltine groups of B. Mori.

Mutants of silkworm B.mori.

(a) Larval mutants – Usra, Zebra and Knobbed.
(b) Egg colour mutants – Red and White
(c) Egg colour mutants – White eye
(d) Cocoon colour mutants – Orange and White.

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REFERENCES:


1. CHRISTOPHER Howe. (1995). Gene Cloning and Manipulation Cambridge Univ. Press.
2. Goldsmith, M and Wilkinson, A.S. (1996) Molecular model system in Lepidopterons. Cambridge Press, London.
3. Hiratsuka. (1999) Silkworm Breeding Oxford & IBH publishing Co, Pvt. Ltd. New Delhi. Calcutta.
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5. Sreeramreddy (ed), G. (1998). Silkworm Breeding. IBM Publishers, New Delhi.
6. Strickberger, M.W.(1996). GENETICS. Prentice-Hall of India, New Delhi.
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**SEMESTER-IV**

**COURSE 10: SILKWORM SEED PRODUCTION AND SEED ORGANIZATION**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: PRINCIPLES OF SILKWORM SEED TECHNOLOGY | 8 Hrs |
| 1 | Indian sericulture scenario in egg production |
| 2 | Importance of quality silkworm seed in sericultural industry |
| 3 | Enumeration of seed legislation act. |
| 4 | Role of Central Silk Board(CSB) |
| Unit-2: GRAINAGES AND MANAGEMENT | 10Hrs |
| 1 | Grainage introduction- Grainage system in A.P |
| 2 | Model Grainage - Grainage Equipment- description, Utilization and Maintenance |
| 3 | Management of industrial grainages. Maintenance of records in grainages. |
| 4 | Economics of egg production, factors economising the cost of production |
| Unit-3: SILKWORM SEED COCOON PROCESSING | 8 Hrs |
| 1 | Processing of Hybrid Disease free egg layings-<br>Disinfection of grainage - P1 Seed cocoon procurement and transportation of seed cocoons - Cocoon Sorting and Cocoon arrangements |
| 2 | Sex Separation, Moth Emergence & Synchronization of moth emergence |
| 3 | Pairing & De – pairing /Oviposition/Refrigeration of Male moths |
| 4 | Pebrine Spore Identification Test-Pupal gut examination/Moth Examination-<br>(Individual, Sampling and Mass Moth examination |
| Unit-4: 3 TIER SEED ORGANIZATION | 10Hrs. |
| 1 | Evolution of Seed organization-Seed areas, special features of seed areas and seed cocoon transaction |
| 2 | P3- Basic Seed Forms/Maintenance of Breeders stock |
| 3 | P2-Silkworm Seed Multiplication farms |
| 4 | P1-Parent Seed Cocoon Production Centre |
| Unit-5 HIBERNATION AND PRESERVATION TECHNIQUES | 9Hrs. |
| 1 | Small scale production of hibernating and non-hibernating eggs in loose forms and on egg sheets. |
| 2 | Standards for quality eggs- different hibernation schedules |
| 3 | Artificial hatching - Hot and Cold Acid Treatment - Postponement of hatching by Chilling |
| 4 | Preservation and handling of eggs- Incubation of Eggs. |

**SEMESTER-IV**

**COURSE 10: SILKWORM SEED PRODUCTION AND SEED ORGANIZATION**

Practical Credits: 1 2 hrs/week

1. Model grainage equipment: Wooden Stand, Bamboo tray, Ant wells, Thermometer, Hygro meter, cellules, Moth crushing set, Microscope, Acid treatment equipment.
2. Sexing of pupae and moth, Moth emergence, Preparation of loose eggs, Preparation of disease free layings.
3. Moth examination for Pebrine, acid treatment (Hot acid and cold acid treatment).
4. Identification of different types of eggs: Hybernative and Non-hybernative eggs, fertilized and unfertilized and dead eggs. Counting of eggs and hatching percentage

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

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REFERENCE


1. Anon. (1972). Manual on Sericulture.. Vol. II Silkworm Rearing FAO, Agriculture Services. Bulletin No. 72/2,Rome, Italy.
2. Narasimhanna and Ullal (1978). Handbook of silkworm egg production, CSB Publications,
3. Ullal and Narasimhanna (1978). Handbook of practical sericulture, CSB Publications, Bangalore.
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8. Chapman, R.F. (1992). The Insects: Structure and functions.
9. Agrell, I.P.S (1964). Physiological and Biochemical changes during insect development. Academic Press, NewYork.
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**SEMESTER-IV**

**COURSE 11: SILKWORM DISEASES & IPM**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1:BASIC CONCEPTS OF SILKWORM DISEASES 8 Hrs | |
| 1 | Varieties of Silkworm diseases |
| 2 | Etiology of Silkworm Diseases |
| 3 | The Spread of Silkworm Diseases- Inter-relationship of Pathogen-Host & Environment |
| 4 | Pathogenecity –Disease resistance-Environment |
| Unit-2: INTRODUCTION OF PARASITISM,COMMENSALISM,SYMBIOSIS AND PARASITE RELATIONSHIP 10Hrs | |
| 1 | Introduction of Parasitism, Commensalism, Symbiosis and Parasite relationship. |
| 2 | Pathogenicity: phenomenon of by Fungi, Bacteria, Viruses, molicutes and nematodes. |
| 3 | Pathogenesis: Penetration and colonization. Role of enzymes, toxins and environment in disease development and their classification |
| 4 | Introduction to principles of plant disease management |
| Unit-3: VIRAL DISEASES & BACTERIAL DISEASES 8 Hrs | |
| 1 | Nuclear polyhedrosis-Cytoplasmic Polyhedrosis |
| 2 | Infectious Flacherie- Control of Viral diseases |
| 3 | Bacterial Septicemia-Gastroenteric Diseases |
| 4 | Bacterial Toxicosis-Control of Bacterial Diseases |
| Unit-4: FUNGAL DISEASES &PROTOZOAN DISEASES 10Hrs. | |
| 1 | White Muscardine-Etiology-pathogenesis-Spread-Symptoms-Diagnosis-Prevention |
| 2 | Green Muscardine &Black Muscardine Diseases |
| 3 | Aspergillosis-Control of Fungal diseases |
| 4 | Pebrine Disease-Miscellaneous Protozoan Diseases |
| **Unit-5 INTEGRATED CONTROL OF SILKWORM DISEASES AND PEST MANAGEMENT 9Hrs.** | |
| 1 | Diseases caused by Arthropods-Exorisra,Pediculoides&Sturmia sps-Life cycle-Symptoms-diagnosis-Control. |
| 2 | Predators-Poisoning by Agriculture Chemicals-Organo phosphorus,Organo chlorine, Organo Nitrogen-Insecticides of Plant origin & factory exhaust Gases |
| 3 | Integrated Pest management IPM |
| 4 | Impact of insect crop pests on silkworm. Impact of biological pest control on sericulture. |

**SEMESTER-IV**

**COURSE 11: SILKWORM DISEASES & IPM**

Practical Credits: 1 2 hrs/week

Practical : Study of gross pathology of different diseases.

Effect of different insecticides on silkworms, Causal agents of infectious diseases &symptoms,

Isolation and culturing of silkworm pathogens.

Preparation of permanent slides,

Infectivity techniques, Cross infectivity,

Determination of LC50 and ET50, Silkworm breeds and instars susceptibility,

Histopathological techniques, Patho-physiological techniques,

Preventive measures of infectious diseases, Disinfection & hygiene.

Acquaintance with various laboratory equipments and microscopy.

Study of symptoms of various plant diseases caused by fungi, viruses, bacteria, nematodes and mollicutes.

Field visit to get acquaint with disease symptom.

Collection and preservation of diseased specimens.

Study of morphology of fungi, viruses, bacteria, nematodes and phytoplasma.

Study of life cycle / disease cycle of major fungal, bacterial, viral, nematode and phanerogamic parasites diseases.

Macroscopic and microscopic examination of plant pathogens including staining techniques for bacteria

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REFERENCE


Hand book of pests and disease control of mulberry and silkworm; United Nation Publication, Bangkok,Thailand (1990).

Microbial control of insect and mites. Ed. H.D. Burges and N.W. Hussey; Academic press London.(1971).

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Govindan, R . and T.K. Narayanaswamy, Devaiah (1998). Principles and silkworm pathology- text book.
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**SEMESTER-V**

**COURSE 12: VANYA SERICULTURE(NON MULBERRY) SERICULTURE & VALUE ADDITIONS**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: STATUS OF VANYA SILKS AND STATISTICS OF SERICULTURE INDUSTRY- | 8 Hrs |
| 1 | Global production of non-mulberry silks, their scope and impact on the socio-economic conditions of tribals. |
| 2 | Distribution of non-mulberry silk yielding insects and non-insects and their classification. |
| 3 | Different types of voltinism and characterisation of different stages of tropical and temperate tasar, eri and muga silkwoms. |
| Unit-2: HOST PLANT CULTIVATION OF VANYA SILKWORMS | 10Hrs |
| 1 | Host plants of vanya silkworms- Distribution and Economic importance. |
| 2 | Taxonomy and systematics of non mulberry silkworm host plants- Botanical description of primary & Secondery host plants of tasar, eri and muga silkworms *viz*., terminalia, quarcus, Som and Soalu and castor, tapioca and kessaru. |
| 3 | Cultivation practices of primary food plants of Tasar,Muga &Eri Silkworms - *Terminalia arjuna, T. tomentosa. Shorearobusta*)- *Persia (machilus)bombycina; Litseapolyantha*-castor and kessaru- Cultivation practices of secondary food plants -Cassasva, Payam, Tapioca, Kesseru), |
| 4 | Pests and diseases of food plants of Tasar Muga and Eri and their managment |
| Unit-3: REARING &EGG PRODUCTION TECHNOLOGY OF VANYASILKWORMS | 8 Hrs |
| 1 | Traditional and improved methods of temperate and tropical tasar, eri and muga silkworm rearing. |
| 2 | Egg production technology of Non Mulberry Silkworms |
| 3 | Natural enemies and other problems in non-mulberry silk cocoon production |
| Unit-4: COCOON REELING AND ECONOMICS OF VANYA SERICULTURE | 10 hrs |
| 1 | Cocoon Reeling and spinning of vanya silkworms |
| 2 | Marketing of Non mulberry silk cocoons. |
| 3 | Economics of tasar, eri and muga culture. |
| 4 | Recent developments in non-mulberry sericulture |
| Unit-5 GENERAL ACCOUNT OF BY PRODUCTS/VALUE ADDED PRODUCTS IN SERICULTURE 9Hrs. | |
| 1 | Value added products from mulberry Sector Mulberry induces fairness, Pharmaceutical Therapeuticvalue of mulberry: Stem, Root, Fruit, Medicinal values of mulberry. |
| 2 | Value added products from silkworm Rearing Sector<br>Value addition to silkworm pupae-Paints and Varnishes/ Utility of silkworm pupae as food and medicine/ As an animal feed/Silkworm pupa as astronaut food/ Silkworm Pupal Oil |
| 3 | Silk reeling waste utilization for value addition and sericin and its use-use of sericin in cosmetics/Sericin-A Bio-Molecule of value/Sericin as a textile finishes to silk. |
| 4 | Grainage wastes and value addition-Versatile fashionable Handicrafts from silk waste. Non-mulberry sericulture waste utilization for value addition-Spun silk, Jharcrafts/ importance of silk quilts, by products from vanya silks and its utility. |

**SEMESTER-V**

**COURSE 12: VANYA SERICULTURE(NON MULBERRY) SERICULTURE & VALUE ADDITIONS**

Practical Credits: 1 2 hrs/week

Study of host plants and life stages of different non-mulberry silkworms.

Natural enemies of non-mulberry silkworms. Rearing of non-mulberry silkworms (eri & tasar).

Field visit for collection of non-mulberry silkworm stages.

REFERENCES


1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India
3. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd. Calcutta.
4. Jolly, M.S. Chowdhuty, S.N and Sen. (1975). Non-Mulberry Sericulture in India. Central Silk Board, Bombay, India.
5. Jolly, M.S (1998). Tasar Culture. Central Silk Board, Bangalore, India.
6. Sarkar, D.C. (1998) Eri Culture. Central Silk Board, Bangalore
7. Wu Pang-Chuan and Chen Da-Chuang. (1994) Silkworm rearing. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi
8. Proceedings of the 20th Congress of the International Sericulture Commission-2005. Volume-2. Published by Central Silk Board, Bangalore-68, India.
8. Hasao Aruga (1994). Principles of Sericulture (Translated from Japanese ) Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.


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**SEMESTER-V**

**COURSE 13: ORGANIC FARMING AND MECHANIZATION**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1: ORGANIC FARMING | 8 Hrs |
| 1 | Objectives-Organic inputs &Techniques - Organic Farming System-scope, importance and concept/ factors affecting types of Organic farming, |
| 2 | Objectives-Organic inputs &Techniques. Bio Fertilizers –Plant nutrients – Definition and Scope of Biofertilizers – Types of Bio Fertilizers –Rhizobium-Azotobacter-Cyano bacteria-Azolla-PSM-AM fungi-SSB-PGPRB- Mass Production of Bio fertilizers-Method of preparation |
| 3 | Application of biofertiizers-N2 fixing-phosphate solubilizing,Phosphate mobilizingBio fertilizers. |
| 4 | Liquid Bio fertilizers-Charecteristics-Methodology-value of Technology-Constraints in Bio fertilizer technology-Economics |
| Unit-2: GREEN MANURING | 10Hrs |
| 1 | Green Manuring- Definition and Scope of green manuring-Green manure crops-Cropping systems-Plant species suitable for green manures. |
| 2 | Manures Vs Fertilizers –Types of Green manures |
| 3 | production of green manures |
| 4 | Application of green manures |
| Unit-3: VERMICOMPOST TECHNOLOGY | 8 Hrs |
| 1 | Vermicompost Technology:- Definition and Scope of Vermicompost technology. |
| 2 | Types of Earth worms used in vermicomposting. |
| 3 | Methods of preparation of Vermicompost –a) At Farmers level and 2) commercial production of vermicompost. |
| 4 | Care during production of vermicompost – application of vermicompost for different crops – Vemiwash – definition , Preparation and application. |
| Unit-4: BIOPESTICIDES | 10Hrs. |
| 1 | Biopesticides – Definition and Scope of Biopesticides . |
| 2 | Types of Biopesticides |
| 3 | Botanical origin Biopesticides -Microbial origin- Nanotech origin |
| 4 | Methods of Preparation of Bio pesticides – Application of Bio pesticides. |
| Unit-5 MECHANIZATION IN SERICULTURE | 9Hrs. |
| 1 | Mechanization in Sericulture- Definition and scope. |
| 2 | Machines used in Moriculture |
| 3 | Machines used in Rearing of Silkworms |
| 4 | Management and maintenance of Machinery used in sericulture-Economics |

## SEMESTER-V

## COURSE 13: ORGANIC FARMING AND MECHANIZATION

Practical Credits: 1 2 hrs/week

1. Visit of organic farms to study the various components and their utilization;

2. Preparation of enrich compost, vermicompost, Pancha Gavya, Jeevaamrutham ,Herbal pesticides

3. Bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management;

4. Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

REFERENCES


1. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
2. Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
3. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
4. Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
5. A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central SilkBoard, Bangalore-68, India. 2005.

**SEMESTER-V**

**COURSE 14: COCOON &SILK PROCESSING TECHNOLOGY**

Theory Credits: 3 3 hrs/week

Syllabus :

| | |
|---|---|
| Unit-1: TEXTILE FIBRES | 8 Hrs |
| 1 | Introduction to textile fibers, classification of textile fibers, basic requirement of textile fibers. |
| 2 | Physical and chemical properties of silk and uses. |
| 3 | Comparative properties of natural, regenerated and synthetic fibers- vegetable fibers, protein fibers, regenerated celluloses, regenerated protein fibers, polyamide fibers, polyester fibers, poly olefin fibers, vinyl fibers, high performance fibers, inorganic fiber and end users. |
| 4 | Identification of fibres – Burning, microscopic and solubility tests |
| Unit-2: GRADING AND MARKETING | 10Hrs |
| 1 | Different cocoon breeds (MV, B.V, U.V& Non Mulberry Cocoons)- Physical and Commercial Cocoon Characteristics. |
| 2 | Cocoon testing – methods followed in Japan and its practicability to Indian conditions-Grading of cocoons, Visual inspection, Selection- Assessment of Cocoon by Filament length – Filament denier – Non breakable filament length-Estimated Renditta and Raw Silk percentage – shell ratio. |
| 3 | Cocoon sorting Objectives and Methods. Defective cocoons – Types -defective cocoon percentage |
| 4 | purchase of cocoons in the open auction, preservation of cocoons, transportation, determination Marketing-and price fixation |
| Unit-3: POST COCOON PROCESSES | 8 Hrs |
| 1 | Cocoon Stifling-Sun drying-Barrel-Hot air Oven method |
| 2 | Cocoon cooking &Brushing -Mono pan, three pan and pressurized cocoon cooking |
| 3 | Reeling and Re-reeling |
| 4 | Packing different skeins, book making and bundling |
| Unit-4: RAWSILK TESTING & GRADING | 10Hrs. |
| 1 | Raw silk Properties and uses, |
| 2 | Silk Examination and quality control International and ISI standards, marketing of silk yarn, Silk Exchange. |
| 3 | SILK THROWING<br>Objectives, Types and methods, winding-doubling-twisting setting of twist, rewinding.<br>Types of twisted yarns-singles, organzine, tram, crepe, voile, georgette. Blended yarns. |
| 4 | SILK WEAVING-Preparatory processes-Preparation of warp and weft-Different machinery employed in small scale and organized sectors. Handloom, powerloom-shutte looms shuttles looms.Weaving process and its mechanism.Special loom attachments-Dobby, Jacquard, Pile, Leno. Fabrics-Different types.<br>Silk knitting: Introduction to knitting warp and weft knit structures, knitting machines |

| UNIT-5 SILK DYEING,MARKETING ,PLANNING AND MANAGEMENT 9HRS | |
|---|---|
| 1 | Degumming –objectives, methods of degumming-hot water extraction, soap, soap-soda, enzymatic, acid, amines-Degumming process. |
| 2 | Bleaching-objectives, methods, process, whitening agents. Dyeing-Dye classificaytion-Acid, basic, azoic, direct, disperse, moedant, premetallized, reactive, sulphur, vat.-Natural dyes-importance, application on silk.-General theory of dyeing silk. -Process of dyeing yarn and fabric-Evaluation of colour matching.-Computer colour matching.Printing-objectives, auxiliaries, printing methods-block printing, screen printing, discharge printing, batik, roller, rotary printing. |
| 3 | SPUN SILK YARN. Introduction to spinning, importance of silk spinning w.r.t. wastes and non-mulberry cocoons. Processing of silk wastes for yarn spinning-hand spinning-mill spinning.Processes in spun silk mills-degumming-dressing-preparatory-spinning-finishing. Spinning of non mulberry cocoons. |
| 4 | MARKETING OF SILK MATERIALS-PLANNING AND MANAGEMENT-Factors to be considered before setting up of silk reeling, throwing, weaving, dyeing, printing and spinning, units-Availability of raw material-water source-labour, marketing facility, source of gunds, staff, maintenance |

**SEMESTER-V**

## COURSE 14: COCOON &SILK PROCESSING TECHNOLOGY

Practical Credits: 1 2 hrs/week

1. Categorization of different types of cocoons- good and defective cocoons- calculation of percentage of each type .

2. Cocoon stifling- different methods and determination of degree of drying. 1Pract.

3. Reeling water: Determination of total and permanent hardness, alkalinity and pH. 1Pract.

4. Cocoon cooking- different methods. 1Pract.

5. Determination of commercial characters of cocoon-average cocoon weight, shell weight, shell percentage or shell ratio, average filament length, reelability, raw silk recovery percentage, renditta and denier; reeling on epprouvette. 2Pract.

6. Identification of silk, cotton, wool and synthetic fibre (viscose/nylon/polyester) by physical method- flame and microscopic test, chemical and confirmatory tests. 2Pract.

7. Study of charaka, cottage basin, multi-end silk reeling machine, automatic and semi-automatic reeling machine-practical demonstration. (Visit to private reeling unit and filature). 1Pract.

8. Degumming of raw silk by soap & soda wash method and estimation of sericin and fibroin percentage. 1Pract.

9. Study of silk fabric manufacturing unit- Power & handloom. Identification of Weaving defects (Visit only) 1Pract.

10. Bleaching of silk fibres. 1Pract.

11. Silk dyeing to obtain different shades using acid dye stuff. 2Pract.

12. Identification of different types of silk waste; floss, cooker, reeler, basin refuse and re-reeling waste, dupion silk. 1Pract.

13. Pupal oil extractionPhysical and commercial properties of cocoons.

REFERENCES


1. Gohl, E.P.G. and Vilensky, L.D. 1987. Textile science, CBS Publishers and Distributors, Delhi, India.
2. Grayson and Martin. 1984. Encyclopedia of Textiles, fibers and Non woven fabrics, John Wiley and sons, New York.
3. Kadolph, S.P. and Langford, A.C. 1998. Textiles. Prentic hall Inc, New Jersey USA.
4. Mishra, S.P 2000. A Text book of fiber science and technology. New Age International Publishers, New Delhi.
5. Moncrieff, P.W. 1988. Manmade fibres, 6th ed. Newness Butterworth‟s, London.
6. Trotman, E.R. 1984. Dyeing and chemical Technology of Texttile fibers. John Wiley and sons, New York.
7. Venkatraman, K. 1971. The chemistry of synthetic dyes. Vol. I & II, Academic Press, London.

**SEMESTER-V**

**COURSE 14: SERICULTURAL ENGINEERING**

Theory Credits: 3 3 hrs/week

I. Theory:

| | |
|---|---|
| Unit-1:SERICULTURE FARM MACHINERY AND POWER 8 Hrs | |
| 1 | Status of Farm Power in India, Sources of Farm Power |
| 2 | Familiarization with Primary and Secondary Tillage implement, Implement for hill Sericulture, implement for intercultural operations |
| 3 | Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples. |
| 4 | Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment. |
| Unit-2: 10Hrs MANAGEMENT OF SERICULTURAL MACHINERIES AND EQUIPMENTS 10 Hrs | |
| 1 | Study of hand tools, Primary and Secondary tillage implements, intercultural implements, used in mulberry gardens |
| 2 | Mulberry harvesting and chopping machines. Introduction to environment engineering-Psychrometric parameters and process, study of rearing houses and equipment. Low cost ventilation techniques. |
| 3 | Study of mountages and mounting sheds. Revolving mountages- cocoon stifling structures. Cocoon driers. Cocoon sorting machines-riddling-deflossing machines. Cocoon cooking and Brushing machines. |
| Unit-3: MANAGEMENT OF INDUSTRIAL MACHINERIES AND EQUIPMENTS - 8 HRS | |
| 1 | Reeling machines – charaka, cottage basin and filature basins- automatic reeling machines-re-reeling machines. Boilers for production of steam design and planning filature and cotton basin units. Permeation chambers – sophisticated testing equipments |
| 2 | Tasar and muga reeling machines. Silk twisting and throwing equipment. |
| 3 | Non-Mulberry cocoon reeling machines. Maintenance of machineries. |
| Unit-4 MANAGEMENT OF RENEWABLE ENERGY 10Hrs. | |
| 1 | Classification of energy sources, contribution of these of sources in Sericultural sector |
| 2 | Familiarization with biomass utilization for biofuel production and their application, |
| 3 | Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and bio oil production and their utilization as bioenergy resource using Sericulture Biomass |
| UNIT- 5 RESOURCE MANAGEMENT 9HrS. | |
| 1 | Watershed in India |
| 2 | Concept, objective, principles and components of watershed management– |
| 3 | significance of water recharging technologies.Water harvesting: importance, its techniques, |
| 4 | Efficient utilization of water,Factors affecting watershed management. |

**SEMESTER-V**

**COURSE 14: SERICULTURAL ENGINEERING**

Practical Credits: 1 2 hrs/week

Sericultural Machineries and Equipments &Display

Crop Farming Systems

Field demonstration on construction of water harvesting structures.

Biogas plant establishment and production

Visit to rainfed research station/watershed.

Studies on climate classification,

Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.

Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.

Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.

Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation.

Studies on cultural practices for mitigating moisture stress.

REFERENCES:


1. Rajapurohit and Govindaraju (1980). Employment generation in Sericulture, Ashish Publication. New Delhi. Charsley SR(1982): Culture and Sericulture Academic Press Inc; New York, USA
2. Sanjay Sinha (1984): Development of India Silk, Oxford & IBH Publishing, Co Pvt Ltd, New Delhi.
3. Aziz, A. and Hanumappa, H.G (1985): Silk industry- Problems and prospects, Ashish Publishing House New Delhi. Hanumappa, H.G. (1986). „‟Sericulture for rural development‟‟.
4. Gopal (1991): Demand and supply Prospects for high quality raw silk. Oxford & IBH
5. Ramanna, D.V (1992) “Economics of Sericulture and silk industry” Deep & Deep publication, New Delhi. Kahlon and Singh (1984). „‟Farm Management‟‟‟‟
6. Changappa (1994): “Strategies for export of Indian silk in the changing environment” in Global Silk Scenario-2001, Oxford and IBH
7. Hanumappa , H.G. (1993). Sericulture Society and Economy. Ashish Publishing House New Delhi
8. Puttaraju H.P. (1997). Roshme Krushi hagu Graminabhivrudhi )in Kannada). Bangalore University Prasaranga, Bangalore, India.
9. Puttaraju, H.P.(1997) Reshme Krushi Hagu Graminabhivrudhi (in Karnnada). Bangalore University Prasaranga, Bangalore, India.

**SEMESTER-V**

**COURSE 15: ECONOMICS OF SILK INDUSTRY**

Theory Credits: 3 3 hrs/week

**1.** Theory:

| | |
|---|---|
| Unit-1: SERICULTURE SCENARIO IN INDIA- 8 Hrs | |
| 1 | History and region wise pattern of growth Sericulture in Andhra Pradesh, Recent trends, development programmes, problems and prospects. |
| 2 | Infrastructure development -Grainages, TSC, Cocoon markets. Silk exchange, institutional finance, R&D base, filature, weaving factories and spun silk mills. |
| 3 | Principles of farm management cost concepts and cost computation techniques. Law of diminishing marginal returns as applied to sericulture. |
| Unit-2: ECONOMICS OF MULBERRY CULTIVATION AND SILKWORM REARING 10Hrs | |
| 1 | Costs & returns under rain fed and irrigated conditions, leaf -cocoon ratio. |
| 2 | Cost benefit ratio of improved sericulture practices vis - a- vis traditional practices |
| 3 | Income and employment generation in sericulture vis- a- vis other competitive crops |
| 4 | Economics of seed production |
| Unit-3: COST AND RETURNS 8 Hrs | |
| 1 | Cocoon-Dfls ratio |
| 2 | Economics of silk reeling |
| 3 | Comparative economics between charaka, cottage basin and multi-end basin. |
| 4 | Economic viability of filature in public sector of Andhra Pradesh Silk by -products; their nature, extent and re-Utilization (value addition) |
| Unit-4: ECONOMICS OF SILK WEAVING 10Hrs. | |
| 1 | Comparative economics between hand loom and power loom |
| 2 | Value addition due printing, dyeing and finishing |
| 3 | Economics of tasar Eri and Muga cultivation |
| Unit-5 EXPORTS OF SILK PRODUCTS 9Hrs. | |
| 1 | Extent, composition, and direction of India silk trade.<br>b. Export and import policies. |
| 2 | Impact of silk import on domestic silk industry.<br>Impact of WTO on sericulture industry. |
| 3 | Environmental issues in sericulture industry. |
| 4 | Entrepreneurship development- identification of potential entrepreneurial activities in sericulture from egg production to weaving.<br>Project evaluation techniques. |

**SEMESTER-V**

**COURSE 15: ECONOMICS OF SILK INDUSTRY**

Practical Credits: 1 2 hrs/week

1. Rearing appliances used in rearing and seed preparation of Mulberry silkworms (Drawing / sketches). 3Pract.
2. Taxonomic features of Mulberry and Non Mulberry food plants (Terminalia arjuna, Terminalia catapa, Ricinus communis, Michelia champaca, Quercus sp., Bauhinia vareigata and Manihot utilissima) 4Pract.
3. Life cycle and morphology of egg, larva, pupa, cocoon and moths of different mulberry silkworms.
4. Preparation of audio visual aids- Charts, hand outs, pamphlets- film shows – arranging and conducting of panel discussion with the rearers. 1Pract.
5. Visit to rearers‟ house and panel discussion with farmers. 1Pract.
6. Visit to TSC and CRC. 1Pract.
7. Presentation of statistical data- Bar chart and graph, pie chart of raw silk, cocoon, area under mulberry cultivation, import And exports. 1Pract.
8. Field/Institute Visit.

REFERENCES:


1. Rajapurohit and Govindaraju (1980). Employment generation in Sericulture,

   Ashish Publication. New Delhi. Charsley SR(1982): Culture and Sericulture

   Academic Press Inc; New York, USA

2. Sanjay Sinha (1984): Development of India Silk, Oxford & IBH Publishing, Co Pvt Ltd, New Delhi.

3. Aziz, A. and Hanumappa, H.G (1985): Silk industry- Problems and prospects,

   Ashish Publishing House New Delhi. Hanumappa, H.G. (1986). „‟Sericulture for

   rural development‟‟.

4. Gopal (1991): Demand and supply Prospects for high quality raw silk. Oxford & IBH

5. Ramanna, D.V (1992) “Economics of Sericulture and silk industry” Deep

   & Deep publication, New Delhi. Kahlon and Singh (1984). „‟Farm

   Management‟‟‟‟

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7. Hanumappa , H.G. (1993). Sericulture Society and Economy. Ashish Publishing House New Delhi

8. Puttaraju H.P. (1997). Roshme Krushi hagu Graminabhivrudhi )in Kannada). Bangalore University Prasaranga, Bangalore, India.

**SEMESTER-V**

**COURSE 15: VALUE ADDED PRODUCTS IN SERICULTURE**

Theory Credits: 3 3 hrs/week

I Theory

| | |
|---|---|
| UNIT-1: GENERAL ACCOUNT OF BY PRODUCTS IN SERICULTURE 8 HRS | |
| 1 | Importance and Scope of Mulberry Sericulture value added/by product industry in India |
| 2 | Non-mulberry sericulture waste utilization for value addition: Spun silk, Jharcrafts, importance of silk quilts, by products from vanya silks and its utility |
| 3 | Entrepreneurship development in by-products of Sericulture |
| UNIT-2: PHARMACEUTICAL VALUE 10HRS | |
| 1 | Mulberry Leaf chemical composition |
| 2 | Animal Feed importance, Mulberry Leaf Anti-oxidation and Anti-aging, Mulberry Leaf Extract in: reducing Blood Glucose, Reducing Blood Pressure, Reducing Blood Fat, Strengthening Blood vessel and Heart, Improving Blood Circulation, |
| 3 | Mulberry Tea: Health benefits of mulberry tea, Fights Diabetes, Weight Loss, Fights Atherosclerosis. |
| 4 | Silkworm powder for diabetes control Value addition to silkworm pupae: Paints and Varnishes, Utility of silkworm pupae as food and medicine, As an animal feed, Silkworm pupa as astronaut food, Silkworm Pupal Oil |
| UNIT-3: VALUE ADDED PRODUCTS OF MULBERRY AND RECYCLING TECHNOLOGY 8 HRS | |
| 1 | Value addition to mulberry fruit: Multipurpose uses of mulberry fruit, Mulberry Fruit Jam, Mulberry fruit Syrup, Mulberry fruit Chutney, Mulberry fruit Juice |
| 2 | Value added products from mulberry stem: Adhesive from Waste Mulberry stem, Mulberry as fodder and fuel, Mulberry wood art, Mulberry root art, Utilization of mulberry twigs for basket making |
| 3 | Recycling technology of sericultural waste: Preparation of compost from sericulture waste, Silkworm larval litter for biogas generation, Vermi composting of Sericulture Waste |
| UNIT-4 VALUE ADDED PRODUCTS OF COCOON 10 Hrs | |
| 1 | By products in grainage: cut / pierced cocoons a potential material for value addition, , |
| 2 | Process of making of cocoon crafts : cocoon sorting, cleaning, dyeing with fabric, natural and food dyes, learning about different equipment / tools required for cocoon craft making, Design, |
| 3 | Development and Diversification of Cocoon crafts : hands on learning the skill and art of making Cocoon crafts |
| 4 | Integrating Agri, Horti wastes in cocoon crafts and value addition, learning the entrepreneurial skills of Cocoon crafts.<br>Grainage wastes and value addition: Versatile fashionable Handicrafts from silk waste. |
| UNIT-5 VALUE ADDED PRODUCTS OF SILK 9HRS. | |
| 1 | Silk reeling waste utilization for value addition and sericin and its use: use of sericin in cosmetics, Sericin-A Bio-Molecule of value, Sericin as a textile finishes to silk, Sericin finish for polyester, Sericin finishes for cotton and other fibres |
| 2 | Value Adding Potentials and Prospects for Silk– types of silk wastes – spun silk- noil yarn and its utility. |
| 3 | Application of silk protein fibroin and Sericin as a biomaterial and other Seri-by-products- pharmaceutical application- biomedical application- cosmetic application |
| 4 | Utility of silk waste for preparation of silk bangles, necklaces, Anklets, earrings, finger rings etc.,Utility of silk border/waste cloth in making ladies purses, Hand bags, vanity bags, office files other usable materials. |

**SEMESTER-VI**

**COURSE 15: VALUE ADDED PRODUCTS IN SERICULTURE**

Practical Credits: 1 2 hrs/week

1. Identification of wastes in different phases of Sericulture:
   a. Mulberry cultivation
   b. Silkworm rearing & Seed production
   c. Silk reeling and Weaving
   d. Silk cocoon handicrafts preparation
2. Demonstration on
   a. Vermicompost preparation using Sericulture waste
   b. Mushroom cultivation using silkworm rearing waste
3. Preparation of mulberry tea using leaf
   Mulberry jam preparation using mulberry fruit
   Recipes from mulberry leaf
   Preparation of Handi crafts made out of Silk and Cocoon

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REFERENCES:


1. Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.
2. Plant Molecular biology by D. Grierson & S.N. Covey Blackie, London
3. Recombinant DNA (2nd Ed.) Watson J.D Gilmanm, workowski J. and Zoller M. Scientific American Books, 1992.
4. Lecturers on Sericulture-Edited by G.Boraiah, SBS Publishers Distributors, BANGALORE
5. Comprehensive Sericulture Manual-M.Madan Mohan Rao, B.S.Publications, HYDERABAD.
6. Patti sankethika vignana sasthram-Developed by APSSRDI, Kirikera
7. Pattu parisrama-Telugu academy
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## SEMESTER-VII

## COURSE 16: SOIL AND WATER MANAGEMENT

Theory Credits: 3 3 hrs/week

**SOIL MANAGEMENT:**

**Learning Outcomes**

- Study of soil and water management provides basic knowledge of soils, its types and suitability to different types of crops and also provides the knowledge of reclamation and enrichment of soils.
- Study of water management part gives knowledge about soil moisture content, water quality, importance of water analysis and methods of water management.

### UNIT-I

1. Soil Properties: Soil physical properties: Colour, Texture, Soil structure, factors affecting the formation of soil, Adhesion and Cohesion phenomenon, Soil porosity and soil consistency.
2. Soil Chemistry: Soil Colloids, Ion Exchange Phenomenon, Soil reaction
3. Reclamation and management of acidic and alkaline Soils and Quality of Irrigation water.

### UNIT-II

1. Availability of Major, Minor and Secondary Nutrients.
2. Soil organisms: Classification of soil organisms, Microbial interactions, Soil plant interactions, Microbes and soil fertility, Microbial population in soil.
3. Soil organic matter: Composition and source of organic matter, Carbon cycle, Humus, Organic matter decomposition, and nutrient mineralization, Factors affecting the population

### UNIT – III

**WATER MANAGEMENT:**

1. Soil water: Structure of water, Classification of soil water, Moisture retention in soil: Energy concept of soil water, Soil water potential.
2. Soil moisture constants and their relationship, Measurement of soil water content, Movement of water in soils, Permeability and infiltration
3. Management of water resources - concept of environmental water management - Concept of Integrated Water Resources Management (IWRM) .

### UNIT – IV

1. Basic Techniques for Water Analyses - rainfall analysis - soil water content analysis.
2. Evaporation, transpiration and evapotranspiration, runoff analysis.
3. Methods of water management-Rainwater Harvesting. Groundwater recharge, Artificial groundwater recharge.

UNIT-V

1. Water management through efficient irrigation methods- Sewage Treatment Plant-water resource management
2. Micro irrigation methods to Conserve water.
3. Biofertilizers: Meaning, types of biofertilizers and its role in enrichment of soils.

## SEMESTER-VII

## COURSE 16: SOIL AND WATER MANAGEMENT

Practical Credits: 1 2 hrs/week

### SOIL MANAGEMENT

1. Study of soil profile in field.
2. Study of soil sampling tools, collection of representative soil sample, its processing and storage.
3. Determination of soil density, moisture content and porosity.
4. Determination of soil texture by feel and Bouyoucos Methods.
5. Determination of soil pH and electrical conductivity.
6. Estimation of organic matter content of soil

### WATER MANAGEMENT

1. Study of soil moisture measuring instruments and measurement.
2. Determination of soil moisture by Volumetric and Gravimetric methods..
3. Scheduling irrigation and measurement of irrigation efficiency and water use efficiency.
4. Determination of field capacity of soil and permanent wilting point.
5. Analysis of quality of water.
6. Practical use of micro irrigation systems and fertigation.

**References:**


1. Allen, G. R., Pereira, L.S., Raes, D., and Smith, M. (1998). "Crop evapotranspiration", Guidelines for computing crop water requirements. FAO, Irrigation and Drainage paper 56.
2. Bhaktikul, K. (1996). Hydrology for Environmentalist. Course lecture-note. Faculty of Environment and Resource Studies Mahidol University. (in Thai)
3. Bhaktikul, K. (2001). ″The Development of a Genetic Algorithm for Real Time Water Allocation and Water Scheduling in Complex Irrigation Systems″. PhD Thesis, School of Civil and Environmental Engineering, The University of Edinburgh, UK.
4. Israelsen, O.W., and Hansen,V.E. (1962). Irrigation Principles and Practices, John Wiley and Sons Inc., USA.
5. Mays, L.W. (1996). Water resources handbook, McGraw-Hill. 3 4 4
6. Linsley, R.K., Franzini, J.B. (1979) Water-resource engineering, third edition, McGraw-Hill.
7. Taesombat, W.(1988). Applied Hydrology. Department of Irrigation Engineering, Faculty of Engineering, Kasetsart University. (in Thai).

## SEMESTER-VII

## COURSE 16: MULBERRY AND SILKWORM CROP PROTECTION

Theory Credits: 3 3 hrs/week

**Learning outcomes**

- Students will understand and could able to identify different diseases and pests of mulberry and their effective management.
- To impart skills to diagnose the silkworm diseases and pests on silkworm *Bombyx mori* and managerial skills
- It is helpful to prevent the occurrence of the disease and pests and to protect qualitative and quantitative characters of cocoon crops.

### UNIT –I

**Diseases of Mulberry**

1. General account of mulberry diseases - Foliar diseases - Root diseases and stem diseases – causes – symptoms-Preventive & control measures
2. Nematodes infesting mulberry-their occurrence, distribution, crop loss, preventive/control measures

### UNIT- II

**Pests of Mulberry**

1. Insect pests of mulberry: Leaf hoppers, scale insects, mealy bugs, white flies, hairy caterpillars, leaf cutters, termites-their distribution.
2. Signs of attack, crop losses and preventive/control measures.

### UNIT –III

**Silkworm diseases and its Management**

1. Silkworm diseases: Types of disease – Etiology – pathogenesis – predisposing factors-Viral diseases – Nuclear polyhedrosis – cytoplasmic polyhedrosis – infectious flacherie – Densonucleosis – Causative agents – Symptoms – Tissue damages – Management of viral diseases.
2. Bacterial diseases – Bacterial diseases of digestive tract-Bacterial septicaemia – Toxicosis – Causative agents-symptomology– Management of bacterial diseases
3. Fungal diseases: White muscardine – Types – Causative agents – Life Cycle – symptoms –Management of fungal diseases –
4. Protozoan diseases: Pebrine – History Causative agent – Life Cycle – Mode of Transmission – Symptoms – Management of protozoan disease.

### UNIT-IV

**Pests & predators of Silkworm**

1. Pests of Silkworm: Uzi fly – morphology and life –cycle of the parasitoid – Tissue damage – Extent of crop loss – management of Uzi fly menace – Dermestid beetles – Life Cycle and control .
2. Rats – Squirrels – Lizards – Management of predators - Integrated pest management (IPM) and other methods.

## UNIT-V

## Integrated pest and Disease management (IDPM)

1. Integrated pest management (IPM) in Mulberry.
2. Integrated Disease management in Mulberry
3. Integrated pest management (IPM) in silkworm.
4. Integrated Disease management in silkworm
5. Important bio control agents of pests of mulberry and silkworm and their significance.

## SEMESTER-VII

## COURSE 16: MULBERRY AND SILKWORM CROP PROTECTION

Theory Credits: 3 3 hrs/week

1. Diseases of Mulberry: Fungal, bacterial and viral (students are expected to submit herbaria of different foliar diseases)-Histopathological studies-identification and characterization of different pathogens (Submission of three to five permanent slides)
2. Pests of mulberry: tukra-wingless grass hoppers-jassids-other important local pests and their seasonal occurrence-biological control agents of pests
3. Crop protection equipment: dusters, sprayers and fumigants
4. Identification of natural antagonists of pests of mulberry (Field study).
5. Identification of Silkworm diseases and pests- symptoms at larval stage- pebrine, graserie, flacherie and muscardine.
6. Culturing and staining of bacteria and fungi.
7. Crop protection equipment: Dusters, sprayers etc. Disinfectants and Bed Disinfectants - other chemicals.

**References:**


**1.** Mulberry Crop Protection -Concepts & Approaches (2013) Tribhuwan Singh, Pramod Kumar Singh

**2.** Silkworm Crop Protection: Concept and Approaches (2011) Mohammad Ashraf Khan, Madan Mohan Bhat, Tribhuwan Singh, Daya Publishing House.

**3.** Sericulture Industry: An Overview (2016) G.Savithri, P. Sujathamma and P. Neeraja, M/s AGROBIOS (INDIA)

## SEMESTER-VII

## COURSE 17: ENTREPRENEURIAL OPPORTUNITIE IN SERICULTURE

Theory Credits: 3 3 hrs/week

**Learning outcomes**

- It will make the students to understand self-employment and entrepreneurial opportunities in sericulture industry
- This will encourage the students to become entrepreneurs by selecting any segment of sericulture

### UNIT-I:

**Introduction to Sericulture**

1. General Introduction to Sericulture and its distribution in India. Insect and non-insect fauna producing silk; types of silk produced in India.
2. Scope of Sericulture in India, employment potential and income generation.
3. An introduction to Entrepreneurship in sericulture- Meaning and Importance- Factors influencing entrepreneurship - Psychological factors, Social factors, Economic factor, Environmental factors - Characteristics of an entrepreneur

### UNIT-II:

**Entrepreneurship in Mulberry Production**

1. Mulberry cultivation practices under irrigated and rainfed conditions and schedule of package of practices
2. Mulberry Nursery raising- schedule of package of practices
3. Entrepreneurship development in mulberry cultivation

### UNIT- III:

**Entrepreneurship in silkworm seed production**

1. Grainage operations: Grainage building, Procurement and preservation of seed cocoons, sexing, moth emergence, mating, oviposition.
2. Preparation of sheet and loose egg preparation, surface sterilization of eggs, packing and sale of eggs. Entrepreneurship development in silkworm egg production.
3. Mother moth examination: Importance and types of Mother moth examination for the production of Disease Free Layings (DFLs)

### UNIT-IV:

**Entrepreneurship in Chawki rearing and Cocoon production Technology**

1. Transportation and incubation of eggs, disinfection, brushing, young age silkworm rearing - environmental requirements, feeding, cleaning, spacing, care during moulting-distribution of chawki worms
2. Late-age rearing, environmental requirements, feeding, cleaning, spacing, care during moult, mounting and spinning, cocoon harvesting, transportation, marketing and cocoon markets.
3. Entrepreneurship development in silkworm rearing – chawki rearing Units.

## UNIT-V:

**Entrepreneurship in Silk reeling**

1. Cocoon assessment – Stifling- Storage cooking-Brushing-Reeling of raw silk-Charka reeling-cottage basin - multiend reeling Defective cocoons – dupion silk production.
2. Entrepreneurship development in silk reeling –. Charka reeling-cottage basin - multiend reeling

## SEMESTER-VII

## COURSE 17: ENTREPRENEURIAL OPPORTUNITIE IN SERICULTURE

Practical Credits: 1 2 hrs/week

**Practicals:**

1. Raising of Nurseries and establishment of mulberry garen.
2. Silkworm Seed Production Centres
3. Chawki rearing Units
4. Cocoon Production Units
5. Silk reeling Units
6. Submission of Report on entrepreneurial skills learned

**References:**

1. Sericulture Industry: An Overview (2016) G.Savithri, P. Sujathamma and P. Neeraja, M/s AGROBIOS (INDIA)

**SEMESTER-VII**

**COURSE 17: MECHANIZATION IN SERICULTURE**

Theory Credits: 3 3 hrs/week

**Learning Outcomes**:

- Mechanization should contribute to sustainable increase in yields.
- Acquire sound knowledge on different components of sericulture industry,
- Gain skills with hands on training on mulberry cultivation and carry forward to field.
- Gain skills with hands on training on post Cocoon technology.

**Unit-I**

**Role of mechanization in agriculture:**

1. Introduction - Objectives- Scope of mechanization.
2. Impact of mechanization on productivity -Sustainability in Sericulture- .
3. Social consideration to farm mechanization-Techniques and technologies for mechanisation in mulberry sericulture.
4. Role of Research Institutes in mechanization.

**Unit-II**

**Role of mechanization in sericulture:**

1. Sources of farm power and mechanization- Comparison of Human power-Animal power-Mechanical power-Electrical power.
2. Sericultural mechanization-farm mechanization-Use of different machines in place of Sericulture implements-Seri cultural machinery-Seri cultural equipment.
3. Benefits of farm mechanization-Present status of mechanization in Sericulture Industry-Limiting factors in farm mechanization-Bottlenecks in Indian Sericulture farm mechanization system-Suggestions for further improvement.

**Unit-III**

**Mechanisation in Mulberry Cultivation-**

1. Land preparation for new mulberry plantation- Machines for making pits- Tractor operated sub-soiler- Tractor Operated Auger Digger, Mulberry Cutting Preparation Machine.
2. Intercultural operations- Machines for inter-cultural operations-- Power Rotavator-Cultivator and Weeder- Power Rotavator- Cultivator and Weeder
3. Spraying of Chemicals in Mulberry Garden- Power Operated Sprayer for application of chemicals
4. Mulberry Pruning and Shoot Harvesting -Knapsack Mulberry Pruner cum Harvester-Shoot Chorusing Machine
5. Irrigation-Rain-guns, Micro Irrigation equipments-Sprinkler irrigation, Drip irrigation

**Unit-IV**

**Mechanization in Silkworm rearing:**

1. Silkworm rearing house disinfection-Sprayers, Semi-humidifier cum heater.
2. Leaf chopping-Chawki Leaf Chopper
3. Young Age Silkworm Rearing-Dusting Machine and battery operated duster
4. Mechanical Silkworm Picking Equipment and matured silkworm separator:

## Unit-V

**Mechanization in Post Cocoon Sector.**

1. Silkworm Mounting-Rotary Mountage.
2. Cocoon Harvester, Cocoon De-flosser and cocoon riddler.
3. Disinfection-Plastic Tray Washing Machine
4. Silk Reeling- semi-automatic and automatic reeling machines.
5. Cost-variation of manual and mechanized methods in sericulture.

## SEMESTER-VII

## COURSE 17: MECHANIZATION IN SERICULTURE

Practical Credits: 1 2 hrs/week

1. Identification of different machines used in sericulture.
2. Hands on training in using different mechanization methods.
3. Visit to different seri-farms following mechanized methods.
4. Calculation of cost-variance in manual and mechanized methods.

**References:**


1. Ananthanarayanan SK. Silk Reeling. Biotech Books,Delhi-110035, 2012, 83-87
2. Anonymous. Seri business-A users guide: Farm sector,Pub. Member secretary, CSB, Bangalore, 2003, 332p.
3. Bindroo BB, Kishur MV. R & D Advancements in Indian Sericulture Proceedings of the Golden Jubilee National conference Sericulture Innovations: Before and Beyond.Technologies Developed by CSRTI Mysore. Golden Jubilee Publications, 2011.
4. Bindroo BB, Verma S. Sericulture Technologies-Developed by CSRTI Mysore, 2014.
5. Dandin SB, Verma S. Mechanization in sericulture –Need & scope. Indian Silk. 2002; 41(1):9-12.
6. Dandin SB, Verma S. Workshop on mechanization in sericulture. Indian Silk. 2002; 40(12):27-28..
7. Gowda RVP, Murthy ANN, Muniraju E. Development of design methodology for mechanized harvesting and pruning of shrubs. Indian Journal of Science and Technology. 2011; 4(2):101-106.
8. Lingaiah K, Iyengar BK. Design data hand book, vol. I,chapter 1 & 2, Suma publishers, Bangalore, India, 2006, 28-62.
9. Muniraju E, Mundkur R. Directory of sericulture technologies, KSSRDI, Bangalore, 2008, 1100p.
10. Ramakant. Mechanization of mulberry cultivation in Japan. Indian Silk. 1996; .12. Sanchez MD. World distribution and utilization of mulberry potential for animal feeding, animal production office. Animal production and health division. FAO, Rome, Italy, 2008, 1.
11. Singh GB. Mechanization in silkworm rearing. Indian Silk. 1995; 35(2):21-25.
12. Verma S, Dandin SB. Mechanization in sericulture, publication. Director, CSRTI, Mysore. p. 78 and beitz. Irvine, California. 2006; 1:7

**SEMESTER-VII**

## COURSE 18: VALUE ADDITION THROUGH BY PRODUCT UTILIZATION IN SERICULTURE

Theory Credits: 3 3 hrs/week

**Learning Outcomes**

- This paper imparts idea of value addition in sericulture industry.
- This paper provides knowledge of utilization of various by-products to earn additional income.

**UNIT-I:**

**Value added products of Mulberry**

1. Value-adding Potentials in mulberry: Chemical composition of mulberry leaf and fruit
2. *Nutritional value of mulberry – recipes from leaf and fruit-health benefits- medicinal value of mulberry* leaf, mulberry fruit, mulberry stem and root- pharmaceutical utility- mulberry leaf for animal and poultry feed – industrial exploitation of mulberry and other uses.

**UNIT-II:**

**Value added products of Cocoon**

1. Seed and cocoon production - value-adding potentials in seed and cocoon production: Silk moths- pierced cocoons –utilization of Bed refuge –-vermi compost preparation from silkworm rearing waste-Mushroom cultivation using silkworm rearing waste.
2. Silkworm larvae for human consumption- nutrition value-cocoon and silk art craft application - Silkworm as biotechnological and laboratory tool

**UNIT-III:**

**Value added products of Silk**

1. Silk production - Value-Adding Potentials and Prospects for Silk– types of silk wastes – spun silk- noil yarn and its utility .
2. Silk worm pupae as food material and its nutritional value - pupal oil extraction and its uses - defective and double cocoons for production of dupion silk

**UNIT-VI:**

**Silk proteins applications**

1. Silk fibre and value addition: application of silk protein fibroin and Sericin as a biomaterial.
2. Seri-by-products-multidirectional applications of natural fibre, silk-dietary application-pharmaceutical application- biomedical application- cosmetic application

**UNIT-V:**

**Value added products of Vanya silks**

1. Vanya silk production and value addition: medicinal uses of tasar,muga and eri food plants -Tasar food plants for agro-forestry.

2. Other uses -wild silkworms for human consumption- nutrition value- vanya silk waste management.

**SEMESTER-VII**

## COURSE 18: VALUE ADDITION THROUGH BY PRODUCT UTILIZATION IN SERICULTURE

Practical Credits: 1 2 hrs/week

1. Identification of wastes in different phases of Sericulture:
   a. Mulberry cultivation
   b. Silkworm rearing & Seed production
   c. Silk reeling and Weaving
   d. Silk cocoon handicrafts preparation
2. Demonstration on
   a. Vermi-compost preparation using Sericulture waste
   b. Mushroom cultivation using silkworm rearing waste
3. Preparation of mulberry tea using leaf

   Mulberry jam preparation using mulberry fruit

   Recipes from mulberry leaf
4. Visits to Dupion reeling units

   Spun silk and Noil yarn production unit

Reference

Sericulture Industry: An Overview (2016) G.Savithri, P. Sujathamma and P. Neeraja, M/s AGROBIOS (INDIA)

## SEMESTER-VII

## COURSE 18: SERICULTURE, EXTENSION, ECONOMICS AND MANAGEMENT

Theory Credits: 3 3 hrs/week

**Learning outcomes**

- The paper imparts principles and Methods of transfer of technology and skills, which will provide confidence among the students to take the advanced technology to the field level
- This paper provides the opportunity to the students to understand Sericulture holistically and provides entrepreneurial orientation.

### UNIT-I:

**Sericulture Extension**

1. Introductions to Extension education-meaning-principles of extension education.
2. Classification of various extension teaching methods-scope and limitation of each methods- individual, group and mass contact methods- Demonstrations-audio-visual aids-tours-field visits etc.,
3. Concept and functions of communication.

### UNIT-II:

**Farm management**

1. Meaning and scope of management-importance of management-planning- organising-staffing- Directing- motivating- controlling- coordination-communication.
2. Concept of farm management- basic principles of farm management
3. Sericulture farm management-management of mulberry garden-Chawki rearing and cocoon production

### UNIT-III:

**Sericulture industry –Importance**

1. Employment potential in Sericulture.
2. Impact of advanced technology in the development of Sericulture industry.
3. Marketing of cocoons and silk –History – functions of regulated markets. Exports and imports of silk goods.

### UNIT-IV:

**Economics of Sericulture Industry-I**

1. Economics of mulberry cultivation and Nursery raising
2. Economics of Chawki Rearing
3. Economics of cocoon production

## UNIT-V:

**Economics of Sericulture Industry-II**

1. Economics of seed production
2. Economics of silk production on
    i. Charkha
    ii. Cottage basin
    iii. Multiend reeling basin

**SEMESTER-VII**

**COURSE 18: SERICULTURE, EXTENSION, ECONOMICS AND MANAGEMENT**

Practical Credits: 1 2 hrs/week

1. Visits to surrounding Sericulture villages to observe various package of practices followed by different farmers
2. Visit to Chawki Rearing Units, Rearing Units of the farmers, Grainages, cocoon markets, Reeling Units
3. Visit to Private entrepreneurs
4. Submission of Report on the visits
5. Preparation and submission of different teaching aids: Posters, Charts, flash cards models etc.

**References**

Sericulture Extension (2013) Amardev singh, Shamim Ahmad Bandey and Suraj Parkash, Biotech Books, India

A Text Book of Farm Management, Production and Resource Economics (2021) - R.K.Rout

## SEMESTER-VII

## COURSE 19: MULBERRY NURSERY

Theory Credits: 3 3 hrs/week

**Learning Outcomes:**

On successful completion of this course students will be able to;

- Understand the importance of a plant nursery and basic infrastructure to establish it.
- Acquire knowledge of the basic material, tools and techniques required for nursery.
- Demonstrate expertise related to various practices in Mulberry nursery.
- Comprehend knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.

### Unit-I

**INTRODUCTION TO MULBERRY NURSERY:**

1. Importance of nursery-Selection of the nursery site
2. Location-Topography of land-Soil-Water-Drainage/
3. Transportation-Labour-Protection from animals-Market needs and size-

### Unit-II

**CLIMATIC FACTORS:**

1. Role of light, temperature.
2. Wind velocity, attitude, rainfall and relative humidity in mulberry growth and Development.

### Unit-III

**MULBERRY VARIETIES:**

1. Mulberry varieties suitable for various climatic conditions.
2. Establishment of nursery-Selection of site.
3. Methods of propagation-importance of vegetative Propagation through Cuttings.

### Unit-IV

**RAISING OF MULBERRY NURSERY AND ITS MANAGEMENT:**

1. Suitable season for raising nursery-Land preparation.
2. Nursery bed preparation -Selection of Material for sapling Preparation- Pre-treatment of cuttings- Nursery planting in beds-Irrigation.
3. Nursery management- -Control of Pests and diseases-Uprooting and Transportation.

### Unit-V

**ENTREPRENEURSHIP DEVELOPMENT PROGRAMME (EDP) – Mulberry Nursery :**

1. Emergence and objectives of EDP - Essential qualities to become an entrepreneur - selection of a potential entrepreneur.
2. EDP in raising mulberry saplings (Kisan nursery).
3. Economics of nursery development, pricing and record maintenance.

## SEMESTER-VII

## COURSE 19: MULBERRY NURSERY

Practical | Credits: 1 | 2 hrs/week

1. Nursery Bed Preparation
2. Mulberry varieties
3. Stem cutting Preparation.
4. Visit to Mulberry Germplasm bank.
5. Visit to Nurseries
6. Cost-Benefit ratio

**REFERENCES:**


1. Dandin, S.B., Sarkar, A. and Balakrishna, R. 2002. *Large scale production of mulberry saplings (Kisan Nursery)*. Technical Booklet-2. Central Sericultural Research & Training Institute, Mysore. Page. 1-8.
2. Magadum, S. and Singh, S. 2021. *Variability studies in mulberry germplasm for leaf quality characters under Jammu region*. The Pharma Innovation Journal, SP-10(12): 1986-1989 Suggested Co-curricular activities (6 Hrs.)
3. Ratha Krishnan, M., et.al. (2014) *Plant nursery management : Principles and practices*, Central Arid Zone Research Institute (ICAR), Jodhpur, Rjasthan
4. Kumar, N., (1997) *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil.
5. KumarMishra, K., N.K. Mishra and Satish Chand (1994) *Plant Propagation*, John Wiley & Sons, New Jersey.

**SEMESTER-VII**

**COURSE 19: CHAWKI REARING TECHNOLOGY**

Theory Credits: 3 3 hrs/week

**Learning Outcomes**

- Chawki rearing concept provides healthy, vigorous and resistant young age silkworms essential for the production of good quality of cocoons.
- This course provides full-fledged knowledge in Package of Practices for Chawki Mulberry garden and technology required for chawki rearing.
- The students also gain the good entrepreneurial skills to maintain a commercial chawki rearing Centre.

**UNIT – I**

1. Introduction to Chawki Rearing – significance of Chawki rearing.
2. Package of Practices for Chawki Mulberry Garden – Advantages of Exclusive Chawki Garden Soil selection-Mulberry varieties for chawki rearing-Preparation of land- Plant spacing- Application of Manures-Fertilizers-frequency of Irrigation-pruning-Top clipping-number of crops.

**UNIT-II**

1. Chawki Rearing House - appliances and equipments - Disinfection and Hygiene Maintenance-disinfectants and Bed disinfectants for Chawki rearing
2. Procurement of silkworm seed – transportation -Handling of Silkworm Eggs
3. Incubation of Silkworm Eggs - Black Boxing of Silkworm Eggs -Brushing of newly hatched silkworms - Characteristics of chawki worms

**UNIT - III**

1. Environmental conditions for Chawki Rearing-Optimum Temperature-Relative Humidity- Air –Light and maintenance of Environmental conditions for chawki rearing.
2. Feeding-Methods of leaf harvest-transportation of leaf-selection of leaf –preservation - frequency of feeding-quantity of feed required

**UNIT -IV**

1. Moulting- Identification and care during pre-moulting, Moulting and post-moulting larvae-care during pre-moulting, Moulting and post-moulting stages
2. Spacing of Silkworms-significance of spacing-spacing for chawki worms
3. Bed Cleaning–importance of silkworm bed cleaning-methods of bed cleaning-frequency of bed cleaning.

**UNIT-V**

1. Chawki Certification - Quantification of Missing Larvae- Quantification of Larval Uniformity- Assessment of Growth of Larvae- Health Status of Larvae-
2. Transportation of Chawki- time for transportation of chawki worms to the farmers
3. CRC Registration -Eligibility Criteria for Registration- Procedure of Registration and Grant of Certificate- Registration Process- Inspection Process Responsibility of Registered CRCs

## SEMESTER-VII

## COURSE 19: CHAWKI REARING TECHNOLOGY

Practical Credits: 1 2 hrs/week

1. Appliances and equipmens for chawki rearing.
2. Disinfection and Hygiene Maintenance-disinfectants and Bed disinfectants.
3. Handling of Silkworm Eggs - Incubation of Silkworm Eggs - Black Boxing -Brushing of newly hatched silkworms.
4. Feeding-Methods of leaf harvest-transportation of leaf-selection of leaf –preservation.
5. Moulting care- Spacing of Silkworms-Bed Cleaning

**Reference books**


1. Commercial Chawki Rearing (2015) by V Sivaprasad M T Himantharaj Satish Verma T Mogili Published Central Sericultural Research & Training Institute (CSRTI) ISO 9001:2008 Certified Central Silk Board, Ministry of Textiles : Govt. of India Manandavadi Road, Srirampura Mysuru-570008, India.
2. Comprehensive Sericulture Silkworm Rearing and Silk Rearing (2017) Chawla N K, Indian Books and Periodicals ISBN 9789383026517.
3. A Textbook on Sericulture Rearing and Management of Silkworm (2023) Jyothi Das, I I P Iterative International Publishers, ISBN-13 : 978-9357470001

**SEMESTER-VII**

## COURSE 20: SILKWORM SEED PRODUCTION TECHNOLOGY

Theory Credits: 3 3 hrs/week

**Learning Outcomes:**

After successful completion of this course, the student will be able to understand:

- Indian sericulture scenario in egg production.
- Seed Multiplication
- Preparation for Egg Production.
- Bivoltine seed production, importance and characteristic features
- Economics and self-employability

### UNIT-I

### SILKWORM 3 TIER SEED ORGANIZATION

1. Research Institutes-P4 stations-Evolution of new breeds-Breeders Stock maintenance.
2. Basic seed Forms-P3 stations-Structure-Role- Procedure for Stock maintenance and Multiplication-Selection Criteria.
3. Seed Multiplication Forms- P2 stations-Structure-Role- procedure -Selection Criteria.
4. Parent Seed Cocoon Production-P1 Centres- BV/MV Seed areas-Selected Seed Rearers.

### UNIT-II

### SILKWORM SEED REARING AND SEED PRODUCTION IN P3 GRAINAGES

1. Preparation for pure race Cellular rearing in P3stations-Disinfection-Incubation Environment- Quality and quantity of Leaf –Bed Cleaning and Spacing-Mounting-Harvesting of Seed Cocoons
2. DFL Preparation-Selection of Seed Cocoons for Breeding-Visual selection-individual Selection- Seed Preparation in P3 Grainages.

### UNIT-III

### GRAINAGES-SILKWORM EGG PROUCTION.1

1. Grainage introduction, Grainage system in A.P., Model Grainage,
2. Grainage Equipment,
3. Grainage Activity: Procurement and transportation of P1-seed cocoons, Preliminary Examinations, Pupal Test, Selection and Sorting of Seed Cocoons, Sexing.

### UNIT-IV

### SILKWORM EGG PROUCTION.2

1. Preservation of Seed cocoons, Moth Emergence and Synchronization, Coupling and decoupling, Oviposition, Refrigeration of Male moths, Moth Examination.
2. Environmental conditions, Hybrid egg production, Egg Disinfection.

### UNIT-V

**PRESERVATION AND HANDLING OF EGGS**

1. Embryology.
2. Preservation of Bivoltine and Multivoltine Silkworm eggs
3. Artificial hatching, Hot and Cold Acid Treatment.
4. Cold Storage and Hibernation schedules .

**SEMESTER-VII**

## COURSE 20: SILKWORM SEED PRODUCTION TECHNOLOGY

Practical Credits: 1 2 hrs/week

1. Identification of model grainage equipment: Wooden Stand, Bamboo tray, Ant wells, Thermometer, Hygro meter, cellules, Moth crushing set, Microscope, Acid treatment equipment.
2. Sexing of pupae and moth, Moth emergence, Preparation of loose eggs, Preparation of disease free layings.
3. Moth examination for Pebrine, acid treatment (Hot acid and cold acid treatment).
4. Identification of different types of eggs: Hybernative and Non-hybernative eggs, fertilized and unfertilized and dead eggs.
5. Calculation of hatching percentage.

**References:**


**1.** Anon. (1972). Manual on Sericulture.. Vol. II Silkworm Rearing FAO, Agriculture Services. Bulletin No. 72/2, Rome, Italy.

**2.** Narasimhanna and Ullal (1978). Handbook of silkworm egg production, CSB Publications.

**3.** Ullal and Narasimhanna (1978). Handbook of practical sericulture, CSB Publications, Bangalore

4. Wang San-Wing (1994). Silkworm seed production Vol. III Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Narasimhanna. M.N. (1998). Manual on Silkworm egg Production. CSB., Govt. of India, Bangalore
6. Silkworm egg production, (Translated from Japanese), (1997), Oxford & IBH Publishing Co. New Delhi

**SEMESTER-VII**

**COURSE 20: MANAGEMENT OF SERI-CLINICS**

Theory Credits: 3 3 hrs/week

**Learning outcome:**

- Students can identify the various requirements of sericulture industry.
- Students can establish Seri clinics keeping in view of requirements of sericulture farmers.

**UNIT-I**

1. **Assistance in Soil health management**: Soil: Organic matter, soil pH, Reclamation of soils, Soil microorganisms in relation to mulberry plants. Mineral nutrition - Role of micro and macro nutrients, their deficiencies and management. **Diagnosis of Soils** – Collection of soil samples for testing – Corrective measures based on test results for mulberry cultivation
2. **Guidance in Mulberry cultivation technology**: Cultivation of mulberry with new technology- agro economical aspects - utilization of slopy and other unsuitable lands for mulberry tree plantation through rain harvesting, mechanization to reduce labour cost.
3. **Plant spacing and its use** - Inter cultivation - Mulching, manuring and pruning - Trimming of mulberry plants - Harvesting of shoots. Package of recommended practices for mulberry cultivation.

**UNIT-II**

1. **Guidance in establishment of mulberry nursery:** Selection of best suitable new varieties of mulberry and its multiplication in commercial nurseries.
2. Supply of healthy and new productive saplings suitable to different climatic conditions.
3. Guidance in establishing new mulberry garden with best spacing methods.

**UNIT III**

1. **Mulberry Plant diseases Management** - Foliar Diseases, Stem Diseases, Root Diseases- Prevention and Control of Mulberry Diseases

2. **Mulberry Pest Management**: Identification of different types of mulberry pests, Nature of damage, Preventive and control measures – Mechanical, Chemical and Bio-control methods. - Integrated Pest Management methods.
3. **Mulberry disease diagnosis** – Identification of nutritive deficiency symptoms – various pests attack, their symptoms and to suggest best prevention and control measures. Supply of biocontrol agents

**UNIT-IV**

1. **To suggest the best maintenance methods of hygiene during silkworm rearing**: Disinfection and its importance in silkworm rearing with available eco-friendly disinfectants - Frequencies and methods of disinfection. Hygiene maintenance at various stages / environmental conditions. -Precautions during disinfection.
2. **To adopt best rearing technology of silkworms:** To construct suitable rearing houses – basic requirements – supply of disinfectants and equipment required for incubation – black boxing - hatching – brushing of young age silkworm rearing – Management of environmental conditions required for young age silkworm rearing,
3. **Rearing late age silkworms with best economical and productive methods** – Supply of equipment and disinfectants required for leaf preservation, to maintain optimum temperature and humidity suitable at different stages /seasons, "seed crop and industrial rearing, different types of mountages.

## UNIT-V

1. **Identification of silkworm diseases-** Guidance in identification, prevention and controlling Viral, bacterial, fungal and protozoan diseases of silkworm, .
2. **Identification of Silkworm pests and predators**: Guidance in identification, prevention and controlling different types of pests and predators – Life Cycles - Nature of Damage.
3. **Silkworm disease diagnosis**: Identification of silkworm diseases based on typical symptoms, microscopic examination and through bio-technological tools and suggesting suitable prevention and control methods: Physical or Mechanical methods, Chemical methods, biological methods. Supply of biocontrol agents.

## SEMESTER-VII

## COURSE 20: MANAGEMENT OF SERI-CLINICS

Practical Credits: 1 2 hrs/week

1. Estimation of soil pH
2. Estimation of microorganisms in soil and water samples.
3. Identification of best suitable mulberry and silkworm races.
4. Identification of different pests and diseases of mulberry and silkworm-prevention and control measures.
5. Microscopic examination of disease-causing pathogens and through various biotechnological tools.
6. Identification of various biocontrol agents.

## SEMESTER-VIII

## COURSE 21: SCENARIO OF SERICULTURE INDUSTRY

Theory Credits: 3 3 hrs/week

**Learning Outcomes**

- After studying this paper students gets clear picture of sericulture industry and also gains the knowledge of Global silk production.
- Students also understand the role of various organizations in development of sericulture in India.

### Unit-I

1. Introduction to Sericulture-Origin and history of Sericulture- Silk road, spread of Sericulture to Europe, South Korea, Japan, India and other countries.

2. Sericulture map of India and World.

3. Components of Sericulture required in development of sericulture industry.

### UNIT -II

1. Sericultural practices in tropical and temperate climatic zones of India.
2. Present Status of Sericulture in the world: India's position.
3. Distribution of Sericulture in India.

### UNIT-III

1. Production and Foreign exchange through export of silk textiles in India.
2. Global Silk production.
3. Mulberry and non-mulberry raw silk production in India.

### UNIT-IV

1. Employment generation in sericulture-empowerment of women in sericulture.

2. Entrepreneurship Development Programs (EDP) in sericulture.

3. Various schemes ( State and Central) supporting the development sericulture industry.

### UNIT -V

1. Organizational setup of sericulture at Central and state level.
2. Role of State Government, NGOs, Universities and other agencies in the growth and development of Sericulture
3. Role of Central Silk Board in promoting Sericulture.

## SEMESTER-VIII

## COURSE 21: SCENARIO OF SERICULTURE INDUSTRY

Practical Credits: 1 2 hrs/week

1. Study and observation of components of sericulture.
2. Data collection on present status of sericulture in India and World.
3. Study and observation entrepreneurship opportunities in sericulture.
4. Visit to State and Central institutions to study various schemes and its implementation.

**Reference books:**


1. Sericulture and Rural Development" by G Sandhya Rani. ...
2. Sericulture and Silk Production: A handbook (Small-Scale Textiles Series)" by Prabha Shekar and Martin Hardingham.
3. Sericulture and Pest Management" by A Jadhav and T V Sathe.
4. An Introduction to Sericulture Author(s) :M. Madan Mohan Rao...

## SEMESTER-VIII

## COURSE 21: BIOCHEMISTRY

Theory Credits: 3 3 hrs/week

**Learning Outcomes:**

- Students will analyze the structural and functional relationship of carbohydrates, proteins and lipids and their significance.
- Students will use the biochemical techniques to plan and carryout experiments

### UNIT-I:

**Carbohydrates and Pathways**

1. Classification and Biological function of Carbohydrates
2. Structure of monosaccharides, disaccharides and polysaccharides
3. Physical and chemical properties of Carbohydrates
4. Pathways of metabolism of glucose-Glycogenesis-Glycogenolysis-Glycolysis-citric acid cycle-Gluconeogenesis-HMP pathway-Uronic acid pathway

### UNIT-II:

**Proteins, amino acids and Nucleic acids**

1. Proteins-Classification and properties-silk proteins
2. Aminoacids-Classification and properties
3. Metabolism of Amino acids:Transamination of amino acids, Deamination of amino acids- Oxidative and non-oxidative deamination, Urea cycle

### Unit-III:

**Lipids and Fatty acids**

1. Lipids-Classification and properties
2. Biosynthesis of Fatty acids and Biological function of Fatty acids
3. Biosynthesis of long chain fatty acids
4. Biosynthesis of unsaturated fatty acid

### UNIT-IV:

**Enzyme and its Mechanism**

1. Enzymes-Nomenclature and Classification
2. Mechanism of enzyme action-Lock and Key hypothesis-induced fit theory, Proximation theory.
3. Enzyme kinetics-Michaeli'sMenten equation
4. Factors affecting enzyme activity

### UNIT-V

1. Nucleic aacids -types and functions
2. Nitrogen bases, Nucleosides and Nucleotides

## SEMESTER-VIII

## COURSE 21: BIOCHEMISTRY

Practical Credits: 1 2 hrs/week

1. Estimation of Carbohydrates
2. Estimation of proteins in silk gland of silkworm larva.
3. Estimation of total free amino acids in silkworm tissues.
4. Estimation of ammonia in silkworm excreta.
5. Estimation of uric acid in silkworm excreta.
6. Estimation of urea in silkworm excreta.
7. Estimation of glutamine in silkworm excreta

**Reference Books:**


1. Biochemical calculations.I.H.Segel, 2nd Ed., John Wiley & Sons.
2. Biochemistry. D. Voet& J.G. Voet, J.Wiley& Sons.
3. Enzyme Kinetics. I.W. Segil.
4. Enzyme Kinetics. D.V. Roberties, Cambridge University Press.
5. Harper's Biochemistry. Robert K. Murrey, Peter A. Mayer, D.K. Granner, V.W. Rodwell, Lange Medical.

**SEMESTER-VIII**

**COURSE 22: MOLECULAR BIOLOGY**

Theory Credits: 3 3 hrs/week

**Learning Outcomes:**

- To develop the student to understand the structure of gene and chromosome, recombinant DNA technology, process of transcription and translation.
- Student can understand the gene expression and how to control the gene expression at transcription and translation level

**UNIT- I**

**Structure of DNA and mitochondrial genome**

1. Watson and Crick Model of DNA, Types of DNA
2. Properties of DNA(C-value paradox, Cot value)
1. Structure of gene (Cistron, Muton, Recon, Cis-trans test)
2. Nuclear and mitochondrial genome, mitochondrial and maternal Inheritance

**UNIT- II**

**DNA replication**

3. Replication in Prokaryotes and Eukaryotes; Unit of replication, replication origin, replication fork and enzymology-types of replication.
2. Post replicational modifications in Prokaryotes and Eukaryotes
3. Mechanism of Inhibitors in replication
4. DNA damage and repair mechanisms in Prokaryotes and Eukaryotes

**UNIT- III**

**Transcription**

1. Structure and function of different types of RNA
2. Transcription in Prokaryotes and molecular mechanisms involved in Transcription (RNA Polymerases, promoters, initiation, elongation and termination of RNA synthesis)
3. Transcription in Eukaryotes and molecular mechanisms involved in Transcription (RNA Polymerases, promoters, initiation, elongation and termination of RNA synthesis).
4. Pre-transcriptional and Post transcriptional modification in Prokaryotes and Eukaryotes and Transcriptional Inhibitors.

**UNIT - IV**

**Translation**

1. Translation in Prokaryotes and molecular mechanisms involved in Translation: Enzymes, initiation, elongation and termination of Protein synthesis
2. Translation in Eukaryotes and molecular mechanisms involved in Translation: Enzymes, initiation, elongation and termination of Protein

synthesis

3. Translational proof-reading, translational inhibitors
4. Post- translational modification of proteins.

## UNIT- V

**Gene expression**

1. Control of gene expression at transcription and translation level
2. Regulating the expression of phages and viruses,
3. Regulating the expression of prokaryotic and eukaryotic genes.
4. Role of chromatin in gene expression and gene silencing.

## SEMESTER-VIII

## COURSE 22: MOLECULAR BIOLOGY

Practical Credits: 1 2 hrs/week

1. Isolation of DNA in given sample.
2. Estimation of DNA by Diphenylamine method.
3. Isolation and estimation of plasmid DNA
4. Extraction of RNA from Dry yeast
5. Estimation of RNA by Orcinol method
6. Determination of melting point/ thermal denaturation of DNA.
7. Southern blotting

**References:**


1. Cooper, G. M. (2015). The cell, A Molecular Approach(7th Ed) ASM press, Washington, D.C.

2. Darnell, J. Lodish, H. and Baltimore, D. (2007). Molecular Cell Biology, 6th edition, Freeman, New York.

3. Derobertis, E. D. P. and Derobertis, E.M.F. (2011). Essentials of Cell and Molecular
4. Biology(8th Ed) Hold Saunders – Philadelphia.

5. Karp G. (2013). Cell and Molecular Biology. Concepts and Experiments, 7th Editon John Wiley and Sons, Inc. New York, Brisbane, Toronto.

6. Loewy, A. G. ,Siekevitz, P, Menningee, J. R. , and Allant, J. A. N. (1999). Cell structure and Functions.An integrated Approach 3rd edition. Saunders College Publishing, Philadelphia, London.

**7.** David Freifelder (1993) Molecular Biology.

**SEMESTER-VIII**

**COURSE 22: SERI BIOTECHNOLOGY**

Theory Credits: 3 3 hrs/week

**Learning Outcomes**

- To understand the principles of biotechnology.
- To understand the cell tissue and organ culture techniques.
- To acquaint with the molecular marker aided breeding techniques

**UNIT – I**

1. **BIOTECHNOLOGY** – Scope – Importance – Different branches of Biotechnology.
2. **GENETIC ENGINEERING** :Molecular vectors – Cloning – shuttle – expression - binary vectors – plasmids – virus.
3. Enzymes – Restriction endonucleases - types and utility in gene cloning and mapping.

**UNIT – II**

1. **MOLECULAR CLONNING TECHNIQUES**: cDNA synthesis - Joining of DNA fragments to vectors - Introducing of recombinant molecules into selected host cells (transformation) - Screening techniques – Western – Northern - Southern Blotting - Genomic and c DNA Libraries.
2. **RECOMBINANT DNA TECHNOLOGY:** Polymer chain reaction technology - PCR techniques in biotechnology and genetic engineering -Gene tagging and DNA finger printing.
3. Development of disease resistance in silkworms through transgenic technology.

**UNIT – III**

1. **RESTRICTION ENZYMES ANALYSIS** – RFLP and RAPD profiles for identification of DNA genetic material.
2. **IMMUNITY** – Mechanism of antigen – antibody reactions – defense mechanisms.Cell mediated immunity in silkworms – phagocytosis.
3. Anti bacterial – anti viral factors and induced resistance.

**UNIT – IV**

1. **SEROLOGICAL TECHNIQUES** – Principles and application of serological tests used in identification of Pathogenic agents - Precipitation tests – Ring test – Single and double diffusion test – Agglutination tests.
2. Immuno fluorescence test - Enzyme linked Immunosorbent Assay (ELISA) – Western blotting method - Bio-insecticides – Engineered Baculaviruses.
3. Molecular tools of lepidopteron development biology and physiology - Potential agents for insect control - bacillus thurengiensis gene.

**UNIT-V**

1. **BIOFERTILIZERS** – Nitrogen fixation and Mass production of bio-fertilizers - diazotrophic micro-organisms blue green algae and Azolla –Micorhizae and its usage in mulberry cultivation- advantages.
2. **TISSUE CULTURE** – Tissue culture techniques in mulberry anther/ pollen culture - callus culture – somoclonal variants – somatic - hybrid in *vitro* screening - cryopreservation.

## SEMESTER-VIII

## COURSE 22: SERI BIOTECHNOLOGY

Practical Credits: 1 2 hrs/week

1. Isolation and purification of DNA from Mulberry
2. Isolation and purification of RNA from Mulberry
3. Estimation of DNA in the given sample.
4. Estimation of RNA in the given sample
5. Restriction digestion of silkgland DNA and Visualization of DNA fragments using agarose gel electrophorosis.
6. Tissue culture: (a) Preparation of medium (b) Production of multiple shoots of mulberry
7. Proliferation of callus from auxillary nodes or bud or Morus,

**Lab references**


1. Plant Cell Culture:APracticalApproachbyR.A.Dixon&Gonzales, IRLPress.
2. PlantMolecularbiologybyD.Grierson&S.N.CoveyBlackie,London
3. RecombinantDNA(2ndEd.)WatsonJ.DGilmanm,workowskiJ.andZollerM.Scientific AmericanBooks,1992.

## SEMESTER-VIII

## COURSE 23: BIOINFORMATICS AND BIOSTATISTICS

Theory Credits: 3 3 hrs/week

Learning outcomes

- After studying this, students understand the importance and role of bioinformatics and biostatistics in the field of biology**.**
- Students also know about Data base information regarding mulberry and silkworm.

### UNIT-I

1. Bioinformatics**:** Definition, origin, history and applications.
2. Computational biology: Generation of high-speed computers. FORTRAN and IBM. Sequence alignment methods- dynamic programming, and word methods).
3. Biosensors –Definition and types. Concept of Biosensors and its applications in health food defense and environmental monitoring.

### UNIT - II

1. Genome projects: Genome size and gene number in silkworm, *Drosophila*, Mosquito and human. Whole-genome shotgun sequencing and composition of silkworm, *B. mori.*
2. Silkworm proteome analysis: Protein identification and analysis by various methods. Proteome of silkworm egg, silk glands, midgut, fat bodies, haemolymph, ovaries, and Malpighian tubules.
3. Comparative proteomic analysis of posterior silk glands of wild and domesticated silkworms.

### UNIT-III

1. Heat shock proteins and their application in silkworm strain improvement program.
2. Mulberry transcriptome. Comparative transcriptomic analysis between silk gland tissue of *B. mori* and *B. mandarina* using next generation sequencing methods.
3. Transcriptome analysis between silkworm and cytoplasmic polyhedrosis virus.

### UNIT-IV

1. Silkworm genome databases- KAIKObase & SilkDB. Silkworm protein databases- KAIKO2DDB (Silkworm two-dimensional polyacrylamide gel electrophoresis federated database).
2. Silkworm Pathogen Database: SilkPathDB (Comprehensive Resource for Silkworm Pathogens).
3. Silkworm phylogeny and evolution history. Mulberry Genome Database: MorusDB (Resource for Mulberry Genomics and Genome Biology).

### UNIT-V

### Biostatistics

**1.** Introduction-collection -classification of data – Tabulation of data

**2.** Frequency distribution.

3. Measures of central tendency.
4. Linear correlation and regression analysis.
5. Diagrammatic representation and Graphical representation of data
6. Sampling theory – Tests of significance – Student's 't' test,-'Chi -square' test
7. Analysis of variance –Levels of significance.

## SEMESTER-VIII

## COURSE 23: BIOINFORMATICS AND BIOSTATISTICS

Practical Credits: 1 2 hrs/week

1. Centrifugation, Spectroscopy and chromatography demonstration.
2. Silkworm proteome analysis: Protein identification and analysis by various methods. Proteome of silkworm egg, silk glands, midgut, fat bodies, haemolymph, ovaries, and Malpighian tubules.
3. Computational biology: Generation of high speed computers. FORTRAN and IBM. Sequence alignment methods- dynamic programming, and word methods.
4. Silkworm genome databases- KAIKO base & Silk DB. Silkworm protein databases.
5. Silkworm Pathogen Database: SilkPath DB(Comprehensive Resource for Silkworm Pathogens)
6. Mulberry Genome Database: Morus DB (Resource for Mulberry Genomics and Genome Biology).

**References:**


1. Introduction to Biophysical Methods for Protein and Nucleic Acid Research. A. Glasel and M.P. Deutscher. 1995. Academic Press.
2. Introduction to Bioinformatics. Lesk, A.M. 2005.2nd Edn. Oxford University Press, New
3. York.
4. Understanding Bioinformatics. Zvelebil, M and J. O. Bauss. 2008. Garland Science, New
5. York.
6. 13. Bioinformatics. M.M. Ranga. 2004. New Delhi.
7. 14. Bioinformatics – A practical guide to the analysis of genes and proteins. Baxeranis, A.D and
8. B.F.F. Ouellette. 2006. 3rd Edn. John Wiley and Sons, Singapore.
9. 15. Instrumental Methods of Analysis .D.Muralidhara Rao et.al., 2013.CBS Publishers and
10. Distributors PVT ltd. New Delhi
11. 16. Biosensors and Bioelectronics: D. D. Reddy et.al.,IKPuhlishersNewdelhi.

## SEMESTER-VIII

## COURSE 23: PLANT TISSUE CULTURE, GENETIC ENGINEERING AND RESEARCH METHODOLOGY

Theory Credits: 3 3 hrs/week

**COURSE OBJECTIVES**
**Enable the students**

- To train the students in the aspects of innovative applications and techniques in plant tissue culture which are essential for conservation programs.
- To Study about various vectors used in rDNA technology and to understand the molecular techniques essential for genetic diversity analysis and gene transfer programs.
- To make the students understand about basic concepts of Research and its methods.

### UNIT-I

**Introduction to Plant Tissue culture:**

1. History, Scope and concepts of basic techniques in plant tissue culture, Terms and definitions.
2. Laboratory requirements and organization, Sterilization – methods, Laboratory contaminants – its control measures.

### UNIT-II

**Culture Media preparation:**

1. Role of Macro and Micro nutrients, Carbon source, vitamins, organic supplements, gelling agents, phytohormones, composition of commonly used culture media.
2. pH, temperature, maintenance of cultures, environmental conditions, Explants characteristics.

### UNIT-III

**Micropropagation:**

1. Organogenesis-formation of shoots and roots, acclimatization.
2. Micropropagation through various explants (Leaf, Stem, Axillary bud), technical problems in Micropropagation.

### UNIT- IV

**Cloning Vectors:**

1. Prokaryotic vectors- (pBR322, Ti plasmid); Lambda phage, M13 phagemid, Cosmid.
2. Eukaryotic Vectors- (YAC). DNA isolation, Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS).

### UNIT- V

**Basic concepts of research:**

1. Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical).
2. Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

**SEMESTER-VIII**

## COURSE 23: PLANT TISSUE CULTURE, GENETIC ENGINEERING AND RESEARCH METHODOLOGY

Practical Credits: 1 2 hrs/week

1. Sterilization Techniques - Autoclave and Hot Air Oven,
2. Preparation of nutrient media.
3. Establishment of callus culture.
4. Organogenesis in callus cultures
5. Micro propagation through various explants
6. Production of Aseptic seedlings
7. Preparation of Synthetic seeds using Sodium alginate.

### TEXT BOOKS


1. Bhojwani, S.S and Razdan, M.K. 1996. Plant Tissue culture Theory and Practical (a revised edition). Elsevier Science Publishers, New York,USA.
2. Smith, R. H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, NewYork.
3. Smith, R. H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, NewYork.


### REFERENCE BOOKS


1. Collins,H.A and Edward, S. 1998 Plant Cell Culture. Bio-Scientific Publishers Oxford, UK.
2. Jain, S.M., Sopory, S.K. and Veilleux, R.E. 1996. *In vitro* Haploid Production in Higher plants. Vols 1-5, Fundamental Aspects and Methods, Kluwer Academic Publishers, Dordrecht, TheNetherland.
3. Kartha,K.K 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boak Raton, Florida,USA. Bhojwani, S.S 1990. Plant Tissue-Culture Applications and Limitations.Elsevier Science Publishers, New York,USA.
4. Bhojwani, S.S 1990. Plant Tissue-Culture Applications andLimitations.Elsevier Science Publishers, New York,USA
5. Razdan, M.K. 2004. Introduction to Plant tissue culture.2nd Edn. Oxford andIBHPublishing Co. Pvt. Ltd, New Delhi.
6. Vasil, I.K and Thorpe, T.A 1994. Plant Cell and Tissue-culture Kluwer Academic Publishers, The Netherland.
7. Anthony, M. Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry. Allyn Bacon.
8. Burno, R.B.. 2000. Introduction to Research Methods. New Delhi: Sage Publications.
9. Coley, S.M. and Scheinberg, C.A. 1990. Proposal Writing. New Delhi: Sage Publications.
10. Aay, R.A. 1992. How to Write and Publish a Scientific Paper. Cambridge University Press.
11. Fink, A. 2009. Conducting Research Literature Reviews: From the Internet to Paper. New Delhi: Sage Publications.
12. Leedy, P.D. and Ormrod, J.E. 2004 Practical Research: Planning and Design. New York: Prentice Hall.

**SEMESTER-VIII**

**COURSE 24: SERI- CRAFTS**

Theory Credits: 3 3 hrs/week

**Learning outcomes**

- Skills of the students will be explored through the making of handicrafts with by-products of sericulture industry to empower the women.
- The students would get inspired to become entrepreneurs

**UNIT-1**

3. Introduction to Seri –crafts and its importance.
4. Different types of cocoons.
5. Types of defective cocoons and their utilization (by-products of cocoons).
6. Overview on different cocoon and silk by-products

**UNIT-11**

1. Raw material - cut / pierced cocoons - Process of making of cocoon crafts: cocoon sorting, cleaning, method of dyeing with fabric, natural and food dyes.
2. Learning about different equipment/tools required for cocoon craft making

**UNIT-111**

1. Design, Development and Diversification of Cocoon crafts: hands on learning the skill and art of making single flowers, different types of garlands; cocoon, silk ball, cocoon cap, VIP big garlands.
2. Different forms of bouquets, arranging flowers using different types of vases.

**UNIT-IV**

1. Preparation of Cocoon craft photo frames, wall hangings, wall plates, car interior hangings, door, window hangings, making of key chains using cocoons, dolls etc.,
2. Interior decoration using cocoon crafts, learning skills of stage arrangement.
3. Integrating Agri, Horti wastes in cocoon crafts and value addition, learning the entrepreneurial skills of Cocoon crafts.

**UNIT-V**

1. Utility of silk waste for preparation of silk jewelry - bangles, necklaces, Anklets, earrings, finger rings etc., - materials required.
2. Utility of silk border/waste cloth in making ladies purses, Hand bags, vanity bags, office files other usable materials.
3. Cost analysis and Financial Management and Marketing strategies

## SEMESTER-VIII

## COURSE 24: SERI- CRAFTS

Practical | Credits: 1 | 2 hrs/week

**Preparation of various cocoon-based handicrafts**

1) Flower bouquets
2) Cocoon garlands
3) Cocoon frames
4) Silk jewellery

**SEMESTER-VIII**

**COURSE 24: NON- MULBERRY SERICULTURE**

Theory Credits: 3 3 hrs/week

**Learning outcomes**

- The students will get knowledge and learn about different types of non-mulberry or wild silkworms and their food plant for silkworm rearing.
- Students will get knowledge on seed production technology and rearing technology of wild silkworms like Tasar, Muga and Eri.

**UNIT-I:**

**General account of Vanya sericulture:**

1. Status of Vanya Sericulture in India
2. Different types of vanya silks and their production status in India
3. Distribution of vanya sericulture

**UNIT-II:**

**Food plant cultivation of Tasar and Muga silkworms:**

1. Introduction to Tasar and Muga culture-Primary and secondary food plants of tasar and Muga silk worms- and their geographical distribution.
2. Cultivation practices of Tasar food plants (*Terminalia arjuna, T. tomentosa. Shorearobusta*)
3. Cultivation practices of Muga food plants ((*Persia (machilus)bombycina; Litseapolyantha)*
4. Pests and diseases of Tasar and Muga food plants and their managment

**UNIT-III:**

**Food plant cultivation of Eri silkworms:**

1. Introduction to Ericulture- Primary and secondary food plants of Eri silk worms- and their geographical distribution.
2. Cultivation practices of primary food plants- castor and kessaru.
3. Cultivation practices of secondary food plants (Cassasva, Payam, Tapioca, Kesseru),

**UNIT-IV:**

**Seed and Cocoon production technology of Tasar and Muga silkworms**

**1.** Cocoon production technology: Rearing of Tasar and Muga Silkworms

2 Diseases, pest and predators of tasar and muga silkworms

3. Seed production technology of tasar and muga silkworms

## UNIT-V:

**Seed and Cocoon production technology of Eri silkworms :**

1. Cocoon production technology: Rearing of Eri Silkworms
2. Diseases, pest and predators of Eri silkworms
3. Seed production technology of Eri silkworms

## SEMESTER-VIII

## COURSE 24: NON- MULBERRY SERICULTURE

Practical Credits: 1 2 hrs/week

1. Study of primary and secondary food plants food plants of Tasar
2. Observation of package of practices for *Terminalia* species
3. Identification of stages of Tasar silkworm and study of life cycle 1class
4. Study of Tasar grainage process
5. Study of Tasar rearing process
6. Study of primary and secondary food plants of Eri silkworm
7. Observation of package of practices for Eri food plants
8. Identification of stages of Eri silkworm and study of life cycle 1class
9. Study of Eri cocoon production process
10. Study of Eri seed production process

**References:**


1. Introduction to Non-Mulberry Silkworms (2021) D.Elumalai, P. Mohan Raj, R. Ramamoorthy, C. Mohan, B. Poovizhiraja ISBN 9781032053998, CRC Press
2. Wild silks of India (A User's Manule – 3 volumes), Central Silk Board, Bangalore.
3. Tropical wild silk cocoons of India (Mohanty and Prafulla Kumar, Daya Publishing House, New Delhi

## SEMESTER-VIII

## COURSE 24: SILK FABRIC DESIGNING, DYEING AND PRINTING

Theory Credits: 3 3 hrs/week

**Learning outcomes:**

- After studying this paper students able to know about different types of fibres, yarns and fabrics.
- Also learn about fabric wet processing of silk, computer designing, dying, printing patterns and weaving.

### UNIT -I

1. Introduction to Silk fibres, fibre Sources and Industry.
2. Classification of fibers, different types of fibers.
3. Identification of different types of yarns, fabric, characteristics features of the different silk fibres and fabrics..

### UNIT-II

1. Varieties of Silk yarns, System of yarn numbering, Silk fabric particulars like Reed and Heald count, Dobby and Jacquard.
2. Design calculations, creation of designs for Jacquards and placement of motif.
3. Creation of designs for screen printing and placement of colour and generating different screens in compilation with full design.
4. Editing, Reproduction of images from silk sarees

### UNIT-III

**1.** Quality Aspects in Computer aided Textile designing.

**2.** Identification of defective silk fabric, identification of defective design/weave, printing process on silk fabric as per weave, quality of silk fabric.

**3.** Updating of CATD software, Good knowledge of computer applications, design as per end use of the fabric

### UNIT-IV

**1.** **Wet processing**: Degumming – Bleaching – Dyeing – Eco-friendly dyes.

**2.** Printing – Hand block printing- screen printing.

**3.** Fabric finishing.

### UNIT-V

**1.** **Silk weaving:** Silk Throwing / Preparatory processes – Winding – Doubling – Twisting – Rewinding - Warping – Pirn winding.

**2.** Handloom weaving - Types of power looms - Fabric defects - Silk knitting.

## SEMESTER-VIII

## COURSE 24: SILK FABRIC DESIGNING, DYEING AND PRINTING

Practical Credits: 1 2 hrs/week

1. Determination of pHof reeling water
2. Identification of different fibres.
3. Raw silk examination-Physicaltest,visual test and condition weight test.
4. Computer designing of fabrics.
5. Silk weaving – Vist to Handloom weaving and power-loom weaving units.
6. Dyeing of rawsilk and printing its fabrics.

**Reference books:**


1. Silk Dyeing, Printing and Finishing" by G H Hurst
2. Techniques of Dyeing and Printing" by Hemalatha Jain
3. Elementary Idea of Textile Dyeing, Printing and Finishing" by Kanwar Varinder Pal Singh

**SEMESTER-VIII**

## COURSE 25: RAW SILK TESTING& GRADING

Theory Credits: 3 3 hrs/week

**Learning Objectives:**

After studying this chapter student will be able to understand

- Raw silk testing and methods
- Parameters of silk testing
- What are standard Appliances for testing are there
- How to classify the raw silk
- Know about the economics machines

### UNIT-I

**INTRODUCTIO N**

1. Importance of raw silk testing as per the standard methods before marketing. Its benefits to the reeler and also weaver.
2. Silk Conditioning and Testing House- finding actual mercantile weight of raw silk by subjecting the raw silk to a process known as conditioning or dessication.
3. The silk classification and advantages of testing and classification.
4. Finding out the correct mercantile weight of raw silk.

### UNIT- II

**TESTING PARAMETERS**

1. Parameters Concerned to Silk Quality: Raw Silk, Skein, Denier.
2. Standard Condition: Standard Bale, Standard Atmosphere**.**

### .UNIT-III

1. Testing Methods: Visual Tests- uniformity of colour, luster and feeling, condition of general finish; and iii) nature of the lot.
2. Mechanical Tests:Winding test, Size test, Evenness variation test, Cleanness test, Neatness test, Tenacity and elongation test, Cohesion test, Conditioning of Raw silk.

### UNIT-IV

**STANDARD TESTING APPLIANCES:**

1. Winding Frame, Sizing Reel, Balance, Denier Scale.
2. Seriplane, Cohesion Tester. Serigraph, Conditioning Oven.

### UNIT-V

**GRADING AND CLASSIFICATION OF RAW SILK**

1. Raw Silk classification- 1st Category, 2nd Category, 3rd Category - 4A, 3A,2A, A, B.
2. Method of classification-Grading according to major tests, evenness variation I, Evenness Variation II, Neatness, Low Neatness.
3. De-grading according to Auxiliary Tests- Maximum Deviation, Evenness, Variation III, Winding, Tenacity, Elongation or Cohesion indicates silk grade.
4. Average size Variation and Size Variation**.**

## SEMESTER-VIII

## COURSE 25: RAW SILK TESTING& GRADING

Practical Credits: 1 2 hrs/week

1. Finding out the filament Denier and average Denier.
2. Textile fibers – Collection and Identification of Natural Fibres
3. Physical & Chemical Tests A) Microscope Test B) Burning Test.
4. Visit to Raw silk testing, Grading and conditioning centre.

**References:** 1**.** Silk Reeling FAO Manual(WHO) and CSB updated manuals.