SRI KRISHNADEVARAYA UNIVERSITY: ANANTAPUR
DEPARTMENT OF SERICULTURE

CURRICULUM FOR B.Sc Z.S.C (Zoology, Sericulture & Chemistry) COURSE (SEMESTER PATTERN)

(Effective from the Academic Year 2015-2016)

B.Sc ZSC I Semester **60 Hours**

Paper – 1 - BIOLOGY OF MULBERRY & PRODUCTION TECHNOLOGY

Unit 1: **TAXONOMY & ANATOMY OF MULBERRY** 14 hrs

1. Botanical Description and taxonomical characters of Mulberry Varieties and Species.
2. Anatomy of Root (Primary & Secondary), Stem (Primary & Secondary), Petiole and leaf.
3. Influence of Environment on Mulberry growth and development.
4. Soil- Physical and Chemical Properties of soils, soil texture, soil structure and their classification in relation to mulberry growth red loamy soils, clay soils, sandy soils and black soils.

Unit 2: **MULBERRY PROPAGATION** 10 hrs

1. Asexual Propagation or Vegetative Propagation
   - Propagation by cuttings.
   - Grafting- Stem, Bud and root grafting.
   - Layering- Simple, Air, Trench.

2. Sexual Propagation
   - Propagation through seeds and seedlings preparation
3. Nursery Technology

Unit 3: **MULBERRY AGRONOMY -I**: 10 hrs

1. Factors of soil for mulberry growth
2. Mulberry cultivation. Selection of the Land- Preparation of the Land
3. Planting material
4. Methods of Planting-a) Pit system, b) Row system
5. Irrigation methods- Flatbed method, basin method, furrow method, sprinkler or over head method, drip irrigation.
6. Manuring

Unit 4: **MULBERRY AGRONOMY- II** 12 hrs

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. Preservation of Mulberry.

Unit 5: **PHYSIOLOGY OF MULBERRY**: 14 hrs

1. Brief Account of Photosynthesis; Carbon Fixation and their relation to leaf quality and productivity
2. Chemical Composition of Mulberry leaf. In relation to environmental conditions, soil conditions, cultural practices
3. Plant Nutrition- A. Macronutrients; Micronutrients their role in growth and respective deficiency syndromes.
4. Growth regulating substances and their application in improvement of mulberry.

PRACTICALS 45 Hours

1. TAXONOMY: Moraceae.

2. ANATOMY:
   1. T.S. Primary and Secondary Roots and Stems of Mulberry.
   2. Leaf and Petiole.

3. MULBERRY PROPAGATION:
   1. Stem cutting
   2. Nursery Preparation.
   3. Bud Grafting– Root Grafting - Layering

4. Collection of Mulberry seeds for Germplasm development

5. Land Preparation and mulberry plantation

6. Inter cultivation of mulberry

7. Morphology and systematic position of Common weeds of Mulberry.

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B.Sc ZSC II Semester 60 Hours

Paper -2 CYTOGENETICS, BREEDING, BIOTECHNOLOGY, PATHOLOGY OF MULBERRY AND RESOURCE MANAGEMENT FOR MULBERRY CROP IMPROVEMENT

Unit 1: **EMBRYOLOGY:** 10 hrs

1.

Unit 2: **CYTOLOGY, GENETICS, BREEDING OF MULBERRY:** 13 hrs

1. Cytological aspects of Mulberry;
2. Brief account of Mendelian genetics, selection, scope and methods.
3. Collection and maintenance of Germplasm Bank.
4. Breeding of Mulberry;
5. Plant introduction and acclimatization.
6. Hybridization- Scope, application and limitations
7. Polyploidy- Euploidy, Aneuploidy, Introduction of Polyploidy and their significance.
8. Mutations-Natural, Induced-Techniques, applications, Limitations.

Unit 3: **BIOTECHNOLOGY IN MULBERRY:** 13 hrs

1. Introduction and Scope of biotechnology in mulberry improvement
2. Biofertilizers –Bio-fertilizers and their application in mulberry cultivation, methods of application, scope and limitation.
3. VermiTechnology.
4. Mulching: Mulches and their significance in soil conservation.
5. Tissue Culture – Tissue culture techniques in mulberry anther/ pollen culture, callus culture, somoclonal variants, somatic, hybrid in *vitro* screening, cryopreservation.

Unit 4: **DISEASES & PESTS OF MULBERRY, INTEGRATED PEST MANAGEMENT (IPM):** 14 hrs

1. **Introduction to Plant diseases**
    1. Foliar Diseases- A. Powdery mildew; B. Rust; C. Leaf Spot; D.Tukra.
    2. Stem Diseases- A. Trunk rot; B. Dogare blight; C. Dwarf; D.Stem Canker
    3. Root Diseases- A. White root-rot; B. Violet root-rot C. Root-Knot.
    4. Prevention and Control of Mulberry Diseases
2. **Pest Attack on Mulberry:**
    1. Identification of different types of leaf eating caterpillars, Jassids, Mealy Bugs, Thrips, Scale Insects, Beetles, Nature of damage, Preventive and control measures.
    2. Common Pesticides, Chemical nature, Mode of action.
    3. Integrated Pest Management methods.

Unit 5: **RESOURCE MANAGEMENT & ECONOMICS OF MULBERRY 10** hrs

1. Water management and Watershed management concept – significance of water recharging technologies.
2. Intercropping and uses for soil management.
3. Economics of mulberry cultivation
4. Bye – products of mulberry and their industrial use

PRACTICALS 45 Hours

1. Identification of different mulberry genotypes
2. Bio – Fertilizers – Identification, Preparation of panchagavya & Jeevamrutha.
3. Vermin Technology
4. By – Products of Mulberry and their utilization – Fruit jam preparation
5. Identification of mulberry diseases and pests Identification,
6. Submission of Herbarium Sheets

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B.Sc ZSC III Semester 60 Hours

Paper -3 SILKWORM BIOLOGY & PHYSIOLOGY

Unit 1: BIOLOGY OF SILKWORM: 10 hrs

1. Systematic position of Mulberry and Non mulberry silkworms in the animal kingdom (Taxonomic Classification).
2. Kinds of Silkworms & geographical distribution (Mulberry and Non Mulberry Silkworms)
3. Life cycle (Holometabola) of silkworm – egg stage, larva stage, pupa stage and adult stage

Unit 2: MORPHOLOGY & PHYSIOLOGY OF SILKWORM: 14 hrs

1. Morphology of Silkworm Egg, Larva, Pupa & Moth.
2. Anatomy of Silkworm larva
   A. Digestive System, Excretory System of Larva
   B. Respiratory, Circulatory and Central Nervous System of Larvae and Silk glands
   C. Male and Female reproductive system in silkworm larva and moth.

Unit 3: THE SILKWORM AND THE ENVIRONMENT: 10 hrs

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 4: INCUBATION AND PRESERVATION OF SILKWORM EGGS: 10 hrs

1. Preparatory Work for Incubation of Silkworm Egg
2. Development of Silkworm Embryo
3. Environmental conditions for Incubation
4. Technical Management in Incubation
5. Preservation of eggs for initiation of rearing.

Unit 5: SILKWORM REARING & METHODS OF REARING: 16 hrs

1. Rearing of Chawki Silkworms:
   A. Paraffin Paper method,
   B. Box rearing
   C. Cooperative Rearing
2. Scientific Rearing Technology (Package of Practices):Brushing, feeding, bed cleaning, spacing,
3. Moulting and care during moulting
4. Adult Silkworm Rearing Methods:
   A. Shelf Rearing,
   B. Floor Rearing
   C. Shoot Rearing.
5. Mounting-Methods-Various Mountages
6. Spinning and Harvesting

PRACTICALS

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.

2. Silkworm Rearing:

1. Model rearing house.
2. Chopping Boards, Chopping Knives, Leaf Chambers, Ant wells.
3. Basin Stand, Cleaning Nets.
4. Feeding Stand, Chopsticks and feathers.
5. Hygrometer, Thermometer.
6. Rearing Stands, Chandrikae, Wooden tray.

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B.Sc ZSC IV Semester 60 Hours

Paper – 4 - ENDOCRINOLOGY, SILKWORM EGG PRODUCTION, SEED ORGANIZATION & PATHOLOGY

Unit 1: ENDOCRINOLOGY: 10 hrs

1. Introduction, Structure and functions of Endocrine Glands (Brain, Corpora allatum, Prothoracic gland, Corpora cardiaca & Sub oesophageal ganglion).

2. Brief account of juvenile hormones, Ecdysone and Diapause Hormones.

Unit 2: PROCESS OFSILKWORM EGG PRODUCTION: 14 hrs

Grainage introduction:

1. Grainage system in A.P., Model Grainage,
2. Grainage Equipment.
3. Grainage activities(Hybrid Disease free egg laying):
   a. Disinfection of grainage
   b. P1 Seed cocoon procurement and transportation of seed cocoons,
   c. Cocoon Sorting and Cocoon arrangements,
   d. Sex Separation, Moth Emergence & Synchronization of moth emergence,
   e. Pairing & De - pairing,
   f. Oviposition, Refrigeration of Male moths
   g. Pupal gut examination.
   h. Moth Examination: (Individual, Sampling and Mass Moth examination
   i. Artificial hatching, Hot and Cold Acid Treatment, Postponement of hatching by Chilling,
   j. Hibernation and Incubation of Eggs.

Unit 3: SEED ORGANIZATION: 10 hrs

1. Objectives of seed organization
2. Types of cocoon production areas
   a. Industrial cocoon production areas,
   b. seed cocoon production areas,
3. P4 Stations (Evolution of new silkworm breeds)
4. P3 Stations (Basic Seed Farms)
5. P2 Stations (Seed Multiplication Farms) and
6. P1 centers (Parent Seed Cocoon Production Centers)

Unit 4: SILKWORM PATHOLOGY: 14 hrs

1. Introduction of Parasitism, Commensalism, Symbiosis and Parasite relationship.

2. Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control.

3. Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases.

Unit 5: SILKWORM PESTS AND PREDATORS: 12 hrs

1. Introduction, types of pests – Indian and Japan Uzi fly Life Cycle - Nature of Damage, Preventive and control measures.

2. Brief Account of Predators of Silkworms, Cockroaches, Ants, Beetles, Lizards, and Rodents - Nature of damage and control measures.

PRACTICALS 45 Hours

Seed Technology & Pathology

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.

5. Identification of diseased silkworm larvae:
    1. Muscardine
    2. Grasserie
    3. Flacherie

6. Collection and identification of Pests of Mulberry silkworms: Uzi fly, its life cycle.

7. Morphology of predators of silkworm (Beetles, ants and Rats).

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B.Sc. ZSC. V Semester 60 Hours

Paper – 5 SILKWORM DEVELOMENTAL BIOLOGY, CYTOLOGY AND GENETIC ENGINEERING

Unit 1: DEVELOPMENTAL BIOLOGY: 14 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.

Unit 2: CYTOLOGY: 12 hrs

1. Mitosis,
2. Meiosis,
3. Chromosome number in Mulberry and Non-Mulberry Silkworms.

Unit 3: GAMETOGENESIS: 10 hrs

1. Detailed account of Gametogenesis:
    a. Spermatogenesis
    b. Oogenesis

Unit 4: SEX DETERMINATION: 12 hrs

1. Sex determination in silkworms,
2. Role of Z and W Chromosomes

Unit 5: INTRODUCTION TO GENETIC ENGINEERING: 12 hrs

1. Molecular vectors – Cloning, shuttle, expression, binary vectors, plasmids, and virus.

2. Enzymes – Restriction endonucleases, types and utility in gene cloning and mapping.

Practicals **45 Hours**

SILKWORM DEVELOMENTAL BIOLOGY,

CYTOLOGY AND GENETIC ENGINEERING

1. Staining and mounting the different embryonic stages (Blue Egg Stage, Pin Head stage).
2. Mitotic and Meiotic, preparation, procedure and identification (Prophase, Metaphase, Anaphase, Telophase).
3. Identification of different cocoons of silkworm races- NB4D2, NB18, NB7, KA, PM, C.B., Nistari, Tasar, Muga, Eri.
4. Cocoon Assessment- Single Cocoon Weight, Single Shell Weight, Shell Ratio.
5. Class Record.

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B.Sc. ZSC V Semester 60 Hours

Paper – 6 SILK FIBRE TECHNOLOGY

Unit I: TEXTILE FIBRES 10 hrs

1. Brief introduction to natural and man-made fibres – Cotton – Wool – Silk and Nylons – Polyester – Acrylic.
2. Physical and chemical properties of silk.
3. dentification of fibres – Burning, microscopic and solubility tests

Unit 2: GRADING AND MARKETING 12 hrs

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
3. Cocoon sorting Objectives and Methods. Defective cocoons – Types -defective cocoon percentage
4. 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.
5. purchase of cocoons in the open auction, preservation of cocoons, transportation, determination Marketing-and price fixation

Unit3: **POST COCOON PROCESSES** 14 hrs

1. Cocoon Stifling-Sun drying-Barrel-Hot air Oven methods
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 12 hrs

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 and Twisting.

4. Silk Degumming, Processing and bleaching methods.
5. Silk Weaving in Handlooms and Power looms.

Unit 5: REELING INDUSTRY, REELING WASTE AND RESOURCE MANAGEMENT 12 hrs

1. Evolution of silk reeling industry in India and other silk producing countries.
2. Spun Silk Industry, Process of technology, utilization of bye products and uses.
3. Employment potential and income generation in Sericulture
4. Impact of advanced technology in the development of Sericulture Industry.

PRACTICALS 45 hours

1. Identification and sorting of different types.
2. Estimation of Shell ratio of M.V, B.V & C.B. Cocoons.
3. Reeling of cocoons, estimation of filament length, Non breakable filament length, calculation of Denier , Denier variation and Renditta of M.V, B.V & C.B Cocoon breeds(Comparative analysis)
4. Estimation of alkalinity in reeling water.
5. Textile fibers – Collection and Identification of Natural Fibres
6. Physical & Chemical Tests A) Microscope Test B) Burning Test.
7. Identification of silk wastes.

Class Record.

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B.Sc. ZSC VI Semester **60 Hours**

Paper – 7 SILKWORM GENETICS AND BREEDING

Unit:I **12 hrs**

1. An overview of mendelian principles of inheritance
2. Introduction: Gene and Environment Phenocopy : Interaction of genotype with environment and Special reference to silkworms.
3. Linkage and Crossing Over, Linkage Maps, factors influencing crossing over, Linkage groups.
4. Parthenogenesis with reference to silkworm-types and methods, induction of parthenogenesis. Merits and limitations.
5. Polyploidy-induclion and nature of polyploids-practical importance of polyploids in breeding.

Unit: 2 **12 hrs**

1. Allelism, Multiple alleles.
2. Pleiotropism- mechanism of pleiotropic action of 'E' group alleles.
3. Pseudo alleles ,Mosaic dominants.
4. Hereditary traits in silkworms- mutants of egg, larva, pupa and adult: hereditary lethal.

Unit:3 **12 hrs**

1. Genetic control of Voltinism and Moultinism, relation between genes and hormones,
2. Maternal inheritance and its biochemical aspects.
3. Genetics of cocoon colours.
4. Mutation - radiation and chemical mutagenesis measurement of mutation frequency – radiation sensitivity - mutation response - dose rate dependence - types of chemical mutagens, importance of mutagens in induction of mutations.

Unit:4 **14 hrs**

1. Aim of Breeding, inbreeding, out breeding, consequence of homozygocity,
2. Inbreeding depression, Pure line selection, Mass Selection,
3. Hybridization
4. Evolution of new breeds, Sex Limited races

Unit:5 **10 hrs**

1. Hetcrosis-theories-manifestation of hybrid vigour for economic characters-estimation of heterosis
2. Exploitation of heterosis in silkworm Bombyx mori-Hybrid vigour and Environment-Hybrid vigour in different crossing systems- utilization of hybrid vigour in the evolution of new races.
3. General and specific combining ability
4. Single and polyhybrids.

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VI Semester. Paper – VIII .Cluster.A.2 **60 Hours**

ECONOMICS OF SERICULTURE INDUSTRY.

Unit l:

Sericulture scenario in India-

- History and region wise pattern of growth Sericulture in Andhra Pradesh, Recent trends, development programmes, problems and prospects.
- **Infrastructure development** -Grainages, TSC, Cocoon markets. Silk exchange, institutional finance, R&D base, filature, weaving factories and spun silk mills.
- 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

- Costs & returns under rain fed and irrigated conditions, leaf -cocoon ratio.
- Cost benefit ratio of improved sericulture practices vis - a- vis traditional practices
- Income and employment generation in sericulture vis- a- vis other compotative crops
- Economics of seed production

Unit 3: Cost and returns

- Cocoon-Dfls ratio
- Economics of silk reeling
- Comparative economics between charaka, cottage basin and multi-end basin.
- 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

- Comparative economics between hand loom and power loom
- Value addition due printing, dyeing and finishing
- Economics of tasar Eri and Muga cultivation

Unit 5:

- Mechanization in Sericulture- Definition and scope

- Machines used in Moriculture –
- machines used in Rearing of Silkworms –
- Management and maintenance of Machinery used in sericulture.

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B.Sc. ZSC VI Semester 60 Hours

Paper – VIII.Cluster.A.1 VANYA SERICULTURE

Unit 1 -14 hrs

1. Status of vanya a silk in India-characteristic features, advantages, income and production and demand.

2.Host plants of vanya silkworms- Distribution and Economic importance.

3.Classification of non-mulberry silkworms: Geographical distribution, moultinism. voltinism, cocoon colour and shape.

Unit 2: 13 hrs

1.Establishment of Host plants of vanya silkworm and package of practices for their cultivation.

2.Pests and diseases of Primary host plants of Vanya silkworms

3.Management/Disinfection and hygiene practices in grainages and silkworm rearing house.

Unit 3: 13 hrs

1.Egg production technology of vanya silkworms

2.Rearing technology of young and late-age vanya silkworm

3.Pest and Diseases of vanya silkworm and their management.

Unit 4: 12 HRS

1.Cocoon Reeling and spinning of vanya silkworms

2.Economics of vanya sericulture and their utilization

3.By products of vanya sericulture and their Utilization.

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III B.Sc. ZSC VI Semester **60 Hours**

Paper – VIII.Cluster.A.3. ORGANIC FARMING TECNOLOGY& MECHANIZATION

Unit 1:

Organic Farming- Need - 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 – Application of biofertiizers-N2 fixing-phosphate solubilizing-Phosphate mobilizing-Bio fertilizers for Micronutrients-Plant growth promoting Rhizo bacteria-Liquid Bio fertilizers-Charecteristics-Methodology-value of Technology-Constraints in Bio fertilizer technology-Economics

Unit2:

Green Manuring- Definition and Scope of green manuring-Green manure crops-Cropping systems-Plant species suitable for green manures-Manures Vs Fertilizers –Types of Green manures – production of green manures – Application of green manures

Unit 3:-

Vermicompost Technology:- Definition and Scope of Vermicompost technology – Types of Earth worms used in vermicomposting – Methods of preparation of Vermicompost –a) At Farmers level and 2) commercial production of vermicompost – Care during production of vermicompost – application of vermicompost for different crops – Vemiwash – definition , Preparation and application

Unit 4:

Biopesticides – Definition and Scope of Biopesticides – Types of Biopesticides – Botanical origin Biopesticides -Microbial origin- Nanotech origin- Methods of Preparation of Bio pesticides – Application of Bio pesticides.

Unit 5:

Mechanization in Sericulture- Definition and scope – Machines used in Moriculture – machines used in Rearing of Silkworms – Management and maintenance of Machinery used in sericulture.