

**TUMKUR UNIVERSITY
DEPARTMENT OF SERICULTURE
SRI SIDDARTHA FIRST GRADE COLLEGE
SARASWATHIPURAM,
TUMKUR-572105**

**APPROVED SYLLABUS FOR
UNDERGRADUATE COURSE
B.Sc. (5TH AND 6TH SEMESTERS)
IN
SERICULTURE**

DATE OF BOS MEETING HELD: 15-09-2023

V - SEMESTER
DSC : SER-A9-THEORY (Credits - 4)
MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY
4 hrs/week : 60 hrs.

Unit-1		
1.	Ultra-structure of eukaryotic cell and dynamics of chromosomes.	2 Hrs.
2.	Cytogenetics: Chromosomes in mulberry- Number (basic, somatic and gamatic) and Karyomorph, mitosis, Chromosome banding during meiosis.	4 Hrs.
3.	Chromosomal associations during meiosis in autopolyploidy and allopolyploidy. chiasma frequency-meiotic irregularities-cytophotometry and flowcytometry.	3 Hrs.
4.	Chromosome identification - Pre-treatment- fixation- staining – observation under Microscopy	2 Hr.
5.	Segregation of genes-Linkage-Homozygosis-Quantitative inheritance-Features of polygenic inheritance-Population structure-Combining ability-General combining ability-Specific combining ability-Heritability-Genetic advance-Genetic divergence.	4 Hrs.
Unit -2		
6.	Mulberry breeding: Objectives, parameters associated with yield and quality of leaf. Hybridization, Methods, problems in breeding. Variability in economic traits of mulberry.	3 Hrs.
7.	Genetic resources of mulberry; Germplasm - collection, characterization, conservation and utilization; cryopreservation, genetic erosion.	2hrs.
8.	Plant introduction - purpose, agencies, procedures' quarantine. Achievements, merits and demerits. Acclimatization.	1Hr.
9.	Selection techniques: mass, pure line and clonal selection.	3 Hrs.
10.	Hybridisation: Objectives, types and procedure.	3 Hrs
11.	Mutation breeding in Mulberry: Types, mutagens - physical and chemical mutagenesis. merits and demerits.	3 Hrs.
Unit -3		
12.	Polyploidy breeding in mulberry: Induction, types, and their importance. Evolution of triploids in mulberry and their importance.	3 Hrs.
13.	Breeding for disease and drought resistance.	2 hrs.
14.	Evaluation of selected genotypes and release of improved varieties.	2 Hrs.
15.	Plant and water: Water potential, absorption of water and solutes - active and passive absorption, absorption of minerals, translocation of salutes. Source and sink relationship,	2 Hrs.
16.	Mineral nutrition - macro and micro nutrients and their physiological role. Foliar Nutrition in mulberry and its significance.	3 Hrs.
17.	Transpiration: Significance, mechanism of stomata opening and closing, regulation of water loss by stomata and factors affecting the rate of transpiration.	3 Hrs.
Unit-4		
18.	Photosynthesis: Outline of the process, photosynthetic pigments and their characteristics, factors affecting photosynthesis, carbon fixation (C3 and C4plants). Photorespiration and its significance.	4 Hrs.
19.	Plant growth regulators: Importance, physiological role and application in mulberry. Biological nitrogen fixation; types and importance in mulberry cultivation.	5 Hrs.
20.	Physiology of flowering: Photoperiodism and vernalization. Phytochrome – concept. Senescence, dormancy and seed germination.	3 Hrs
21.	Stress physiology: Biotic and abiotic stresses in crops, effects on mulberry: Mechanism of resistance to drought, salinity, mineral toxicity. Disease resistance in crop plants with special reference to mulberry.	3 Hrs.

DSC : SER-A10- Practical (Credits – 2)
MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY

15 Practicals of 4 hrs each

1.	Study of mitosis in onion and mulberry.	2 Pract.
2.	Mulberry germplasm and Mulberry multi-locational trials	1 Pract.
3.	Evaluation of breeding parameters in different mulberry varieties.	1 Pract.
4.	Induction of tetraploidy in mulberry by using colchicine (Demonstration)	1 Pract.
5.	Observation of Mulberry breeding equipments.	1 Pract.
6.	Hybridization technique in mulberry field.	1 Pract.
7.	Determination of stomatal index	1 Pract.
8.	Kranz Anatomy in relation to photosynthesis	1 Pract.
9.	Estimation of leaf protein and carbohydrate content	2 Pract.
10.	Separation of leaf photosynthetic pigments of mulberry through paper chromatography.	1 Pract.
11.	Extraction of photosynthetic pigments by solvent wash method.	1 Pract.
12.	Estimation of moisture percentage and retention capacity of mulberry leaf.	1 Pract.
13.	Determination of water potential by potato tuber method.	1 Pract.
<p style="text-align: center;">Note: Visit to research institutes and mulberry germplasm, report shall be consider for IA</p>		

DSC: SER-A11-Theory
SILKWORM GENETICS, BREEDING AND PHYSIOLOGY

(Credits – 4)

3 hrs/week : 60 hrs.

Unit-1		
1.	Structure and chromosome numbers in mulberry and non-mulberry silkworms. Evolutionary significance of chromosomes in <i>Bombyx mori</i> .	2 Hrs.
2.	Sex determination mechanism in silkworm. Importance of ZZ and ZW chromosomes.	2 Hrs.
3.	Gametogenesis- dynamics of Oogenesis and Spermatogenesis	2 Hrs.
4.	Genetic basis of voltinism and moulting in silkworm, <i>Bombyx mori</i> .	2 Hrs.
5.	Hereditary traits of silkworm egg, larva, pupa and adult of <i>Bombyx mori</i> .	3 Hrs.
6.	Genetics of cocoon colours - inheritance of cocoon colours of <i>Bombyx mori</i> .	2 Hrs.
7.	Parthenogenesis in silkworm- types and induction of parthenogenesis.	2 Hrs.
Unit -2		
8.	Silkworm germplasm bank. Screening, selection criteria and indexing of parameters	2 Hrs.
9.	Silkworm breeding: scope and objectives; methods – inbreeding, line breeding, out breeding and mutation breeding.	3 Hrs.
10.	Selection: individual and mass selection, fixation of characters, evolution of new breeds and race authorization.	3 Hrs.
11.	Heterosis/hybrid vigour, theories of heterosis, combining ability - general and specific, line to tester and dialysis analysis, exploitation of heterosis in improvement of silkworm breeds. Concept and importance of single, double and polyhybrids.	3 Hrs.
12.	Breeding of Sex-limited breeds and sex-limited breeds in India. Quantitative genetics- Quantitative trait loci (QTL)	4 Hrs.
Unit -3		
14.	Genotype - environmental interactions. Heritability studies in <i>Bombyx mori</i> - broad and narrow range of heritability for various economic traits in silkworm.	3Hrs.
15.	Silkworm breeding organization in India and China. Race authorization system of India - a comparative analysis; release of races for commercial exploitation; authorized races / hybrids of India.	5Hrs.
16.	Digestion: Structure and function of digestive system. Phagostimulants and feeding deterrents. Process of digestion, midgut pH - potassium secretion, digestive enzyme. Nutritive requirements of the silkworm. Artificial diets and their composition.	3 Hrs.
17.	Respiration: Tracheal system, spiracles, mechanism of respiration, factors affecting respiration.	2 Hrs.
18.	Excretion: structure and function of excretory system and cryptonephridial arrangement and its significance in water regulation.	2 Hrs.
Unit -4		
19.	Neuro-endocrine system: Structure and function of endocrine glands and their secretions	3 Hrs.
20.	Circulation: Heartbeat, role of alary muscles, accessory hearts, blood pressure in open circulatory system. Haemolymph and haemocytes.	2 Hrs.
21.	Muscle Physiology: Histology of insect muscles, flight muscles in insects, ultra structure of skeletal muscle, mechanism of muscle contraction.	2 Hrs.
22.	Exoskeleton -Integument Structure and function, formation of new cuticle and chitin, physical and chemical properties of moulting, physiology of moulting and role of ecdysone hormone.	3 Hrs.
23.	Metamorphosis- types of insect metamorphosis, theories of metamorphosis.	2 Hrs.
24.	Insect clock-types, characteristics, rhythmic changes in behavior with reference to photoperiodism, seasonal adaptations and ontogenic changes in biology of terrestrial insects.	3 Hrs.

DSC : SER-A12-Practical
SILKWORM GENETICS, BREEDING AND PHYSIOLOGY

(Credits-2)

1

5 Practicals of 4 hrs each

1.	Study of chromosomes in testis and ovaries of silkworm, <i>Bombyx mori</i> .	2 Pract.
2.	Identification of different multivoltine and bivoltine silkworm breed cocoons - NB4D2, KA, CSR2 and CSR4, FC1 and FC2, PM-Ciniche, Nistari.	1 Pract.
3.	Identification of mutants of silkworm larva- zebra, ursa, knobbed and sex-limited Races.	1 Pract.
4.	Comparative assessment of the silkworm hybrids and pure race cocoons.	1 Pract.
5.	Estimation of heterosis and over dominance in silkworm.	1 Pract.
6.	Estimation of inbreeding depression in mulberry silkworm	1 Pract.
7.	Estimation of protein content in silkworm egg and haemolymph.	2 Pract.
8.	Estimation of haemolymph glucose level in silkworm <i>Bombyx mori</i> L	1 Pract.
9.	Morphology of types of haemocytes in mulberry silkworm.	1 Pract.
10.	Estimation of haemolymph amylase activity level of bivoltine and multivoltine breeds	2 Pract.
11.	Estimation of SDH activity in the eggs/fatty body tissue of the Silkworm <i>Bombyx mori</i> L	1 Pract.
12.	Estimation of Liquid content of Fat body tissue in silkworm <i>Bombyx mori</i> L	1 Pract.

SEC-4 PRACTICAL**Credits-4****BIOCHEMICAL TECHNIQUES****Practical****15 Practicals of 4 hrs. each**

1.	Introduction of Scientific instruments/Laboratory equipments.	1 Pract.
2.	Laboratory safety measures, laboratory waste disposal, procedure and laboratory maintenance and hygiene.	1 Pract.
3.	Calculation of Normality, molarity and Moles.	1 Pract.
4.	Determination of pH, Acidity and Basicity of sample.	1 Pract.
5.	Preparation of buffer solutions.	1 Pract.
6.	Demonstration of Centrifugation and different methods.	1 Pract.
7.	Separation of amino acid by paper chromatography technique.	1 Pract.
8.	Isolation and identification of compounds using chromatography.	1 Pract.
9.	Quantitative estimation of protein and sugars.	2 Pract.
10.	Quantitative estimation of DNA.	1 Pract.
11.	Quantitative estimation of RNA.	1 Pract.
12.	Electrophoresis-SDS PAGE/ Agarose gel	2 Pract.

VI – SEMESTER
DSC: SER –A 13- Theory

(Credits-4)

SILKWORM SEED TECHNOLOGY TECHNOLOGY AND VANYA SERICULTURE

4hrs/week : 60 hrs.

Unit-1		
1.	Developmental biology: Morphology and structure of silkworm egg, fertilization, cleavage, blastoderm and germ band formation, blastokinesis, eye spot and blue egg.	4Hrs.
2.	Incubation of eggs - methods, environmental conditions required for incubation. Embryonic stage for refrigeration.	2Hrs.
3.	Disinfection and hygiene in seed production units. General account of silkworm egg production, grainages, environmental requirements and demand.	3Hrs.
4.	Silkworm seed organization: Concept and significance of seed organization. Basic seed forms and multiplication centers - P4, P3, P2 and P1 stations. Norms and procedure followed in P3, P2 and P1 multiplication centers.	6Hrs.
Unit-2		
5.	Silkworm Seed Legislation Act. CSB Silkworm seed regulations 2010. Concept of seed areas, selected/adopted seed rearers/villages. Maintenance of seed crops.	4Hrs.
6.	Grainages - types of grainages, location and capacity, model grainage, grainage equipments and their uses. Procurement and transportation of seed cocoons. Cocoon sorting, selection and preservation of seed cocoons. Sex separation – significance and methods.	4Hrs.
7.	Moth emergence and synchronisation; sex separation in moth; effect of improper synchronisation on egg hatching and quality-safe duration. Coupling and decoupling, oviposition, refrigeration of male moths, preparation of loose and sheet eggs. Mother moth examinations - individual and mass methods, dry moth examination.	4 Hrs.
8.	Handling of multivoltine eggs - preservation of eggs to postpone hatching, ideal embryonic stages for cold storage and maximum duration of cold storage. Handling of bivoltine eggs - physical and chemical methods - hot and cold acid treatment.	3 Hrs.
Unit-3		
9.	Insect and non-insect fauna producing silk and their distribution in India.	2 Hrs.
10.	Status of vanya silks in India. Host plants of vanya silkworms – distribution and economic importance.	3 Hrs.
11.	Establishment of primary host plants of vanya silkworms and package of practices for their cultivation.	3 Hrs.
12.	Pests and diseases of primary host plants of vanya silkworms and their management.	3 Hrs.
13.	Planning for vanya silkworm egg production and rearing; grainage and rearing equipments.	2 Hrs.
14.	Disinfection and hygiene practices in grainages and silkworm rearing houses/premises.	2 Hrs.
Unit-4		
14.	Breeding, eco-races / races, morphology and life cycle of vanya silkworms. Egg production technology of vanya silkworms.	3 Hrs.
15.	Rearing technology of young and late-age vanya silkworms.	3 Hrs.
16.	Pests and diseases of vanya silkworms and their management	2 Hrs.
17.	Tasar and muga cocoon reeling: Selection, cooking and reeling; eri cocoonspinning.	2 Hrs.
18.	Economics of tasar, eri and muga culture. Byproducts of vanya sericulture and their utilization.	3 Hrs.
19.	Constraints (inherent and man-made) in vanya silk production; strategies for improvement of vanya sericulture (host plants and vanya silkworms) in India.	2 Hrs.

DSC : SER-A14-PRACTICAL
SILKWORM SEED TECHNOLOGY AND VANY SERICULTURE

(Credits - 2)

15 Practicals - 4 hrs each

1.	Morphology of silkworm egg. Mounting of 7 th , 8 th and 9 th day old embryos.	1 Prac.
2.	Model grainage building plan and Grainage equipments.	1 Prac.
3.	Seed cocoon processing/handling - deflossing, sorting and preservation- pupal examination and Sex separation of pupa and silk moth. Synchronization of emergence.	1 Prac.
4.	Moth emergence- selection of moths- pairing and de-pairing- oviposition- preservation of male moths- preparation of disease free layings- sheet egg and loose egg preparation- Preparation of starch coated paper, washing of loose eggs, Drying-Treatment of eggs with acid-Weighing and packing.	1 Prac.
5.	Pupa and Mother moth examination for Pebrine spores- Individual and Mass moth examination- surface disinfection of silkworm eggs. Preservation and handling of hibernated eggs for 3, 4, 6 and 10 month hibernation schedules.	2 Prac.
6.	Acid treatment of bivoltine eggs- hot acid and cold acid treatment. Incubation of acid treated eggs-Calculation of hatching percentage.	1 Prac.
7.	Visit to Seed production center, commercial Grainage and cold storage center to know activities related to preparation and preservation of silkworm eggs.	1 Prac.
8.	Morphology and taxonomic description of primary food plants of vanya silkworms.	1 Pract.
9.	Major diseases and pests of primary food plants.	2 Pract.
10.	Life cycle and morphology of vanya silkworms.	2 Pract.
11.	Rearing of non mulberry silkworms.	1 Pract.
12.	Diseases and pests of vanya silkworms.	1 Pract.
Note: Visit to Grainage and submission of report shall be considered for IA.		

DSC : SER-A15-THEORY
SILK TECHNOLOGY, EXTENSION AND ECONOMICS

(CREDITS – 4)

4 hrs/week; 60 hrs.

Unit-1		
1.	Introduction to different textile fibres. Physical and commercial characteristics of cocoons: cocoon colour, shape size, hardness, grain/wrinkle, weight of cocoon, weight of cocoon shell, shell ratio.	2 Hrs.
2.	Cocoon harvesting and grading - visual inspection and selection. Cocoon stifling: objectives, different methods-conventional and modern techniques- steam stifling. Hot air drying- Batch type and conveyer type; advantages and disadvantages.	4 Hrs.
3.	Cocoon cooking/boiling, Brushing: Definition and objectives, different methods of cocoon boiling-Mono pan, three pan and pressurized cocoon boiling methods.	2 Hrs.
4.	Reeling water: quality required for silk reeling, total and permanent hardness, optimal pH; corrective measures	2 Hrs.
5.	Reeling: Objective and cocoon reeling from various devices-country charaka, cottage basin, multi end reeling machine, auto and semi-automatic, improved CSTR reeling devices; advantages and disadvantages	3 Hrs.
6.	Re-reeling and packing: Objectives, process; lacing, skeining, booking and baling. Raw silk properties- physical, chemical and biological.	2 Hrs.
Unit-2		
7.	Raw silk testing and grading; Visual inspection. Mechanical tests- winding test, size deviation test, seriplane test, serigraph test and cohesion test. Supplementary tests- conditioning weight, scouring loss, exfoliation tests.	4 Hrs.
8.	Silk throwing: Introduction, objectives of silk throwing, preparation for twisting, soaking, winding, doubling, twisting (high & low), heat/steam setting, rewinding.	4 Hrs.
9.	Silk weaving: Warp and weft preparation, beaming, drawing and denting -different pirns and winding methods. Power loom and handloom components-weaving defects.	4 Hrs.
10.	Introduction and objectives of degumming-Methods. Silk bleaching- Importance and processing. Silk dyeing-Acidic and basic dyeing processing. Chemicals used for silk dyeing.	3 Hrs.
Unit-3		
11.	Extension education: Characteristics, Principles and functions. Teaching and learning Process.	3 Hrs.
12.	Extension programme management: Concept and principles and steps in programme planning. Role of extension personnel and farmers in programme planning.	3 Hrs.
13.	Extension communication: Functions, models, elements and concepts. Extension teaching aids: According to use and form, factors for selection of extension teaching methods.	3 Hrs.
14.	Training: Principles, methods and training programmes in sericulture. Adoption and diffusion of innovations. TOT: Systems; role of extension in TOT.	3 Hrs.
15.	Sericulture extension system: Extension systems of CSB, state governments, voluntary organizations and Universities. Extension services in sericulture.	3 Hrs.
Unit-4		
16.	Importance of sericulture in rural, national economics – nature and scope of economic theory. Special features of sericulture vis-à-vis other agricultural enterprises – income and employment generation.	3 Hrs.
17.	Economics of mulberry production under rainfed and irrigated conditions with reference to popular cultivars.	3 Hrs.
18.	Economics of silkworm seed production in government and private grainages with reference to cross breed, single hybrid and double hybrid.	3 Hrs.
19.	Economics of cocoon production with reference to cross breed, single hybrid and double hybrid for seed and commercial purpose.	3 Hrs.
20.	Economics of raw silk production in charaka, cottage basin and multi-end reeling units.	3 Hrs.

DSC : SER-A16-PRACTICAL**(Credits -2)****SILK TECHNOLOGY, EXTENSION AND ECONOMICS****15 Practicals of 4 hrs. each**

1.	Identification of silk, cotton, wool and synthetic fibre (viscose/nylon/polyester) by physical methods - flame and microscopic test, chemical tests.	1 Prac.
2.	Determination of total and permanent hardness of reeling water: alkalinity and pH.	1 Prac.
3	Demonstration of cocoon cooking methods - Mono pan and three Pan type.	1 Prac.
4.	Determination of average filament length, reelability, raw silk recovery, renditta and denier of Pure breed, cross breed, single and double hybrid.	1 Prac
5.	Degumming of raw silk by soap & soda wash method.	1 Prac.
6.	Bleaching of raw silk fibers.	1 Prac.
7.	Silk dyeing to obtain different shades using acidic and basic dyes.	1 Prac.
8.	Identification of different types of silk waste; floss, cooker, reeler, basin refuse and re-reeling waste, dupion silk.	1 Prac.
9.	Study of charaka, cottage basin, multi-end silk reeling machine, automatic and semi-automatic reeling machine (Visit to private reeling unit and filature).	1 Prac.
10.	Preparation of audio visual aids-charts.	1 Pract.
11.	Preparation of handouts, pamphlets and preparations for film shows.	1 Pract.
12.	Estimation of economics for mulberry cultivation under rainfed and irrigated conditions.	1 Pract.
13.	Estimation of economics for silkworm seed production under private and government grainages.	1 Pract.
14.	Estimation of economics for silkworm rearing in shelf and shoot method of rearing with respect to cross breed, single hybrid and double hybrid silkworm breeds.	1 Pract.
15.	Estimation of economics for silk reeling under charaka, cottage basin, multi-end and filature units with respect to silk obtained from cross breed, single hybrid and double hybrid cocoons.	1 Pract.
NOTE: Visit to reeling units/filatures/TSC/institutes-Report submission for IA.		