



**YUVARAJA'S College**  
**University of Mysore**  
**(National Education Policy - 2020)**



**V and VI Semesters Syllabus for Undergraduate Program**

**B.Sc.**

**in**

**SERICULTURE**

**DEPARTMENT OF SERICULTURE**  
**YUVARAJA'S COLLEGE**  
**UNIVERSITY OF MYSORE**  
**MYSURU – 570 005**  
**(2023-24)**

**CURRICULUM FOR B.Sc., V AND VI SEMESTERS - SERICULTURE**

Sem.	Course Code	Course Title	Credits Assigned	Instructional Hours per week		Duration of Exam (Hrs.)	Exam/ Evaluation Pattern (Marks)		
				Theory	Practical		IA	Exam	Total
V	DSC-SER A9 –Theory	Mulberry Cytogenetics, Breeding and Physiology	4	4	-	2	40	60	100
	DSC-SER A10 –Practical	Mulberry Cytogenetics, Breeding and Physiology	2	-	4	3	25	25	50
	DSC-SER A11- Theory	Silkworm Genetics, Breeding and Physiology	4	4	-	2	40	60	100
	DSC-SER A12- Practical	Silkworm Genetics, Breeding and Physiology	2	-	4	3	25	25	50
	SEC-4 Theory	Biochemical Techniques	2	2	-	2	20	30	50
	SEC-4 Practical	Biochemical Techniques	1	-	2	3	20	30	50
VI	DSC-SER A13-Theory	Silkworm Seed Technology and Vanya Sericulture	4	4	-	2	40	60	100
	DSC-SER A14-Practical	Silkworm Seed Technology and Vanya Sericulture	2	-	4	3	25	25	50
	DSC-SER A15- Theory	Silk Technology, Extension and Economics	4	4	-	2	40	60	100
	DSC-SER A16- Practical	Silk Technology, Extension and Economics	2	-	4	3	25	25	50
		Internship		2	-	-	-	-	50

-sd-

**Dr.H.B.MAHESHA**  
**CHAIRMAN**  
**Board of Studies in Sericulture**  
**Yuvaraja's College**

## V- SEMESTER

**DSC : SER-A9-THEORY**

**Credits - 4**

**MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY**

4 hrs/week : 60 hrs.

<b>Unit- 1</b>		
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 flow cytometry.	3 Hrs.
4.	Chromosome identification - Pre-treatment- fixation- staining – observation under Microscopy	2 Hr.
5.	Segregation of genes-Linkage-Linkage maps-Homozygosis-Quantitative inheritance-Features of polygenic inheritance-Population structure-Combining ability-General combining ability-Specific combining ability-Heritability-Genetic advance-Genetic divergence.	4 Hrs.
<b>Unit -2</b>		
6.	Genetic resources of mulberry; Germplasm - collection, characterization, conservation and utilization; cryopreservation, genetic erosion.	2hrs.
7.	Mulberry breeding: Objectives, parameters associated with yield and quality of leaf. Methods and problems in breeding. Variability in economic traits of mulberry.	3Hrs.
8.	Plant introduction - purpose, agencies, procedures' quarantine. Achievements, merits and demerits. Acclimatization.	3Hrs.
9.	Selection techniques: mass, pure line and clonal selection.	3Hrs.
10.	Hybridization: Objectives, types and procedure in self and cross pollinated plants.	2Hrs
11.	Mutation breeding in Mulberry: Types, mutagens - physical and chemical mutagenesis. Merits and demerits.	2Hrs.
<b>Unit - 3</b>		
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.	Multilocal trials, mulberry authorization programme, testing of seed quality.	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.
<b>Unit - 4</b>		
18.	Photosynthesis: Outline of the process, photosynthetic pigments and their characteristics, factors affecting photosynthesis, carbon fixation (C3 and C4 plants). Photorespiration and its significance.	4Hrs.
19.	Growth regulators: Importance, physiological role and application in mulberry.	3Hrs.
20.	Biological nitrogen fixation; types and importance in mulberry cultivation.	2Hrs
21.	Physiology of flowering: Photoperiodism and vernalization. Phytochrome – concept. Senescence, dormancy and seed germination.	3Hrs
22.	Stress physiology: Biotic and abiotic stresses in crops, effects on mulberry: Mineral toxicity, Salinity and plant tolerance.	3Hrs.

**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 Pra.
2.	Mulberry germplasm and Mulberry multi-locational trials	1 Pra.
3.	Evaluation of breeding parameters in different mulberry varieties. Leaf-Petiole ratio, Leaf moisture percentage and moisture retention capacity, Leaf area and Inter-nodal distance.	2 Pra.
4.	Induction of tetraploidy in mulberry by using colchicine (Demonstration)	1 Pra.
5.	Observation of Mulberry breeding equipments.	1 Pra.
6.	Hybridization technique (Field work).	1 Pra.
7.	Determination of stomatal index.	1 Pra.
8.	Kranz Anatomy in relation to photosynthesis and Hill reaction.	1 Pra.
9.	Estimation of leaf protein and glucose content.	2 Pra.
10.	Separation of leaf photosynthetic pigments of mulberry through paper chromatography.	1 Pra.
11.	Extraction of photosynthetic pigments by solvent wash method.	1 Pra.
12.	Determination of water potential by potato tuber method.	1 Pra.

**Note:** Visit/Tour to research institutes and mulberry germplasm, report shall be consider for IA

**SCHEME OF PRACTICAL EXAMINATION**

Duration : 3 hours

Max. Marks:25

1.	Mitosis slide preparation/Evaluation of breeding parameters of the given mulberry variety (any one)	9
	Distribution of Marks	
	a) Preparation of the slide/ Identification of the variety - 3 b) Procedure/ Diagnostic features - 3 c) Identification of stages with explanation /Calculation - 3	
2.	Estimation of protein/carbohydrate/separation of photosynthetic pigments/Determination of water potential of the plant tissue/Hill reaction/Kranz anatomy.	8
	Distribution of Marks	
	a) Procedure - 3 b) Tabular column, calculation and report - 2 c) To conduct Experiment - 3	
3.	Identify and comment on the spots A, B, C and D with valid reasons (Any four from the practical syllabus, 2 marks each	8

DSC: SER-A11-Theory

Credits - 4

**SILKWORM GENETICS, BREEDING AND PHYSIOLOGY**

3 hrs/week : 60 hrs.

<b>Unit-1</b>		
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 multivoltinism 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.
<b>Unit -2</b>		
8.	Silkworm germplasm-introduction, international gene bank programme, utilization of silkworm genetic resources, silkworm germplasm conservation by conventional methods.maintenance of silkworm stocks.	2 Hrs.
9.	Silkworm breeding: scope and objectives; methods – inbreeding, line breeding, outbreeding 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 dialyl 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)	2 Hrs
14.	Genotype - environmental interactions. Heritability studies in <i>Bombyx mori</i> - broad and narrow range of heritability for various economic traits in silkworm.	2Hrs.
<b>Unit 3</b>		
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.	Circulation: Heart beat, role of alary muscles, accessory hearts, blood pressure in open circulatory system. Haemolymph and haemocytes.	3 Hrs.
18.	Respiration: Tracheal system, spiracles, mechanism of respiration, factors affecting respiration.	2 Hrs.
19.	Excretion: structure and function of excretory system and cryptonephridial arrangement and its significance in water regulation.	2 Hrs.
<b>Unit – 4</b>		
20.	Neuro-endocrine system: Structure and function of endocrine glands and their secretions.	3 Hrs.
21.	Muscle Physiology: Histology of insect muscles, flight muscles in insects, ultra structure of skeletal muscle, mechanism of muscle contraction.	3 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.	3 Hrs.
24.	Inset 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**

**Credits-2**

**SILKWORM GENETICS, BREEDING AND PHYSIOLOGY**

15 Practicals of 4 hrs each

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

**SCHEME OF PRACTICAL EXAMINATION**

Duration: 3 hours

Max. Marks 25

1	Meiosis slide preparation/Estimation of heterosis/Comparative assessment of pure breeds and hybrids	9
	Distribution of Marks	
	d) Preparation of the slide/ Estimation of heterosis - 3	
	e) Procedure/ Features - 3 f) Identification of stages with explanation /Calculation - 3	
2	Estimation of protein/glucose/Preparation of haemocytes / Estimation of amylase activity/Estimation of SDH activity	8
	Distribution of Marks	
	d) Procedure - 3	
	e) Tabular column, calculation and report - 2 f) To conduct Experiment - 3	
3	Identify and comment on the spots A, B, C and D with valid reasons (Any four from the practical syllabus, 2 marks each	8



**SEC-4 Theory****Credits-2**

2 hrs/week; 30 hrs

**BIOCHEMICAL TECHNIQUES**

<b>Unit -1</b>		
1.	SI units, molarity, moles, pH and buffer solutions	3 Hrs.
2.	Cell fractionation techniques: Cell lysis, homogenization, extraction, salting in, salting out, dialysis and ultra filtration.	5 Hrs.
3.	Spectrophotometry	1 Hrs.
4.	Chromatographic techniques: Principles and applications of paper, TLC, adsorption, ion exchange, gel filtration, affinity, GLC, Chromatofocusing, HPLC and FPLC.	6 Hrs.
<b>Unit-2</b>		
5.	Centrifugation: Svedberg's constant, sedimentation velocity and Sedimentation equilibrium. Ultra centrifugation: Differential and density gradient centrifugation, centrifugal elutriation.	5 Hrs.
6.	Electrophoretic techniques: Polyacrylamide gel electrophoresis, SDS-PAGE, 2D-electrophoresis, diagonal, agarose gel electrophoresis, isoelectric focusing, pulsed field electrophoresis, high voltage electrophoresis, capillary electrophoresis.	5 Hrs.
7.	Visualizing proteins, glycoproteins, lipoproteins, and nucleic acids. Zymogram and reverse zymogram.	5 Hrs.

**SEC-4 PRACTICAL****Credits-1****BIOCHEMICAL TECHNIQUES**

15 Practicals of 2 hrs. each

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

**SCHEME OF PRACTICAL EXAMINATION**

Duration: 3 hours

Max. Marks 25

1	Estimation of protein/carbohydrate/Extraction of DNA/RNA	9
	Distribution of Marks	
	g) Procedure - 3 h) Tabular column, calculation and report - 2 i) To conduct Experiment - 3	
2	Estimation of DNA/RNA	8
	Distribution of Marks	
	j) Procedure - 3 k) Tabular column, calculation and report - 2 l) To conduct Experiment - 3	
3	Identify and comment on the spots A, B, C and D with valid reasons (Any four from the practical syllabus, 2 marks each)	8

## VI - SEMESTER

DSC: SER –A 13- Theory

Credits-4

### SILKWORM SEED TECHNOLOGY AND VANYA SERICULTURE

4hrs/week : 60 hrs.

<b>Unit-1</b>		
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 seed production, grainages, environmental requirements and demand.	3Hrs.
4.	Silkworm seed organization: Concept and significance of seed organization. Basic seed forms and multiplication centers - P <sub>4</sub> , P <sub>3</sub> , P <sub>2</sub> and P <sub>1</sub> stations. Norms and procedure followed in P <sub>3</sub> , P <sub>2</sub> and P <sub>1</sub> multiplication centers.	6Hrs.
<b>Unit-2</b>		
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.
<b>Unit-3</b>		
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.	Grainage and rearing equipments.	2 Hrs.
14.	Disinfection and hygiene practices in grainages and silkworm	2 Hrs.

	rearing houses/premises.	
<b>Unit-4</b>		
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 cocoon spinning.	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**

**Credits - 2**

**SILKWORM SEED TECHNOLOGY AND VANYA SERICULTURE**

15 Practicals - 4 hrs each

1.	Morphology of silkworm egg. Mounting of 7 <sup>th</sup> , 8 <sup>th</sup> and 9 <sup>th</sup> day old embryos.	1 Pra.
2.	Model grainage building plan and Grainage equipments.	1 Pra.
3.	Seed cocoon processing/handling - deflossing, sorting and preservation- pupal examination and Sex separation of pupa and silk moth. Synchronization of emergence.	1 Pra.
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 Pra.
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 Pra.
6.	Acid treatment of bivoltine eggs- hot acid and cold acid treatment. Incubation of acid treated eggs-Calculation of hatching percentage.	1 Pra.
7.	Visit to Seed production center, commercial Grainage and cold storage center to know activities related to preparation and preservation of silkworm eggs.	1 Pra.
8.	Morphology and taxonomic description of primary primary/secondary/tertiary food plants of vanya silkworms.	1 Pra.
9.	Major diseases and pests of food plants.	2 Pra.
10.	Life cycle and morphology of vanya silkworms.	2 Pra.
11.	Rearing of non mulberry silkworms.	1 Pra.
12.	Diseases and pests of vanya silkworms.	1 Pra.

**Note:** Visit/Tour to Grainage and submission of report shall be considered for IA.

**SCHEME OF PRACTICAL EXAMINATION**

**Duration: 3 hours**

**Max. Marks 25**

1	Mounting of 7 <sup>th</sup> / 8 <sup>th</sup> / 9 <sup>th</sup> day embryo/Pebrine test (pupa/moth)/Acid treatment	9
	Distribution of Marks	
	a) Procedure	

	b) Tabular column, calculation and report - 2 c) To conduct Experiment - 3	
2	Assign the given food plants of non mulberry silkworms to its respective family.	8
	Note: Distribution of marks	
	a) Identification and classification -02 b) Taxonomical description -03 c) Diagrams with sericulture importance -03	
3	Identify and comment on the spots A, B, C and D with valid reasons (Any four from the practical syllabus, 2 marks each	8

**SILK TECHNOLOGY, EXTENSION AND ECONOMICS**

4 hrs/week; 60 hrs.

<b>Unit-1</b>		
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.	3 Hrs.
4.	Reeling water: quality required for silk reeling, total and permanent hardness, optimal pH; corrective measures	3 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	3Hrs.
<b>Unit-2</b>		
6.	Re-reeling and packing: Objectives, process; lacing, skeining, booking and baling. Raw silk properties- physical, chemical and biological.	2 Hrs.
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.	3Hrs.
9.	Silk weaving: Warp and weft preparation, beaming, drawing and denting -different pirns and winding methods. Power loom and handloom components-weaving defects.	3 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.
<b>Unit-3</b>		
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.
<b>Unit-4</b>		
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 rain-fed 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 Pra.
2.	Determination of total and permanent hardness of reeling water: alkalinity and pH.	1 Pra.
3	Demonstration of cocoon cooking methods - Mono pan and three Pan type.	1 Pra.
4.	Determination of average filament length, reelability, raw silk recovery, renditta and denier of Pure breed, cross breed, single and double hybrid.	1 Pra.
5.	Degumming of raw silk by soap & soda wash method.	1 Pra.
6.	Bleaching of raw silk fibers.	1 Pra.
7.	Silk dyeing to obtain different shades using acidic and basic dyes.	1 Pra.
8.	Identification of different types of silk waste; floss, cooker, reeler, basin refuse and re-reeling waste, dupion silk.	1 Pra.
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 Pra.
10.	Preparation of audio visual aids-charts.	1 Pra.
11.	Preparation of handouts, pamphlets and preparations for film shows.	1 Pra.
12.	Estimation of economics for mulberry cultivation under rain-fed and irrigated conditions.	1 Pra.
13.	Estimation of economics for silkworm seed production under private and government grainages.	1 Pra.
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 Pra.
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 Pra.

**NOTE:** Visit/Tour to reeling units/filatures/TSC/institutes-Report submission for IA.

**SCHEME OF PRACTICAL EXAMINATION****Duration: 3 hours****Max. Marks 25**

<b>1</b>	Estimation of filament length/ reelability/ raw silk % recovery/ renditta/denier (any two) from the given cocoons (OR) Identification, sorting and percentage determination of different types of cocoons (OR) Estimation of fibroin and sericin %	<b>9</b>
----------	--	----------

	from the cocoon shell / raw silk.	
	Note: Distribution of marks	
	a) Procedure - 03 b) To conduct Experiment - 03 c) Calculations - 03	
<b>2</b>	Preparation of bar charts/ graphs/ pie charts/ posters/ flashcards/ handouts/ pamphlets (OR) Identification of textile fibres.	<b>8</b>
	Note: Distribution of marks	
	a) Procedure/ identification -03 b) Experiment -03 c) Diagrams -02	
<b>3</b>	Identify and comment on the spots A, B, C and D with valid reasons (Any four from the practical syllabus, 2 marks each	<b>8</b>

### **Internship for Graduate Programme in Sericulture**

Semester	VI Semester III Year B.Sc.
Course Title	Discipline specific with Sericulture as a major (Field problem, silkworm rearing and mulberry related courses may be allocated to the students)
No. of contact hours per Mentor/Guide	90 Hrs. / Duration of 4-6 weeks
No. of Credits assigned per Candidate	2 credits (20 marks for oral presentation and viva, 30 Marks for internship report submission)
No. of Students	3-6 students per guide depending upon the available teaching faculty
Method of evaluation by Mentor/Guide	Presentation of work done / Internship report submission / field and extension activity etc.,

#### **REFERENCE BOOKS**

1. Sericulture Manual-1 (Mulberry cultivation) (1972); Food and Agriculture Organization of the United Nations, Rome.
2. Sericulture Manual-2 (Silkworm rearing) (1972); Food and Agriculture Organization of the United Nations, Rome.
3. Sericulture Manual-3 (Silk reeling) (1972); Food and Agriculture Organization of the United Nations, Rome.
4. Hand Book of Silkworm rearing (1972); Fuji Publishing Co., Ltd., Tokyo, Japan.
5. Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers 4-2-24, Hiroo, Sibuya-ku, Tokyo, Japan.
6. Charles J. Huber (1929); The Raw silk Industry of Japan. The Silk Association of America, Inc.
7. Chaudhury S.N. (1981); Muga Silk Industry, Directorate of Sericulture and Weaving, Government of Assam, Gowhati, Assam.
8. Govindan R., Devaiah M.V., Rangaswamy H.R., (1978); Reshme Vyavasaya (Kannada), University of Agriculture Sciences, Bangalore – 560065.
9. Hisao Aruga & Tanaka Y. (1971); Cytoplasmic Polyhedrosis virus of the Silkworm, University of Tokyo Press.
10. Jolly M.S., Sen S.k., Maqbool Ahsan M. (1974); Tasar culture, Published by Ambika Publishers, Lakhani Terrace, 30-E, Cawasjt, Patel Street, Bombay-400001.
11. Kovalev P.A., (1970); Silkworm breeding Stocks, Central Silk Board, Bangalore.
12. Sarkar D.C. (1980); Sericulture in India, Central Silk Board, Government of India, Bangalore.
13. Sainosuka Omura (1973); Silkworm rearing Techniques in Tropics, Overseas Technical Co-operation Agency, Tokyo, Japan.
14. Sturnikov V.A., (1976); Control of Silkworm Development and Sex, MIR Publisher, Moscow.
15. Tanaka Y. (1964); Sericology, Central Silk Board Publication, Bangalore.
16. Tazima Y. (1964); Genetics of Silkworm, Academic Press, London.
17. Tazima Y. (1978); The Silkworm: An Important laboratory tool, Kodansha Ltd., Tokyo.

18. Tripurari Sharan (1984); Sericulture & Silk Industry, Published by Y.K.Sharma, Consortium on Rural Technology, A-89, Madhuvan, Delhi-110092.
19. Yokoyama (1954); Synthesised Science of Sericulture, Published with permission by Sugimani-Ko, Tokyo.
20. Yonemura (M) & Rama Rao N., (1925); Hand Book of Sericultural Rearing of Silkworms, Mysore Government Branch Press.
21. Allard (R.W.) (1976); Principles of Plant Breeding, New York, John Wiley.
22. Chapman, R.F. The insect – structure and function, Cambridge University Press.
23. Darlington (C.D) & Lewis (K.R) Eds. (1969); Chromosomes Today, Edinburgh, Oliver & Boyd.
24. Darlington (C.D) & La Cour (L.F) (1976); Handling of Chromosomes, Edn. 6; Rev. by L.F. La cour, London, Allen & Unwin.
25. De Robertis, & De Robertis(1988); Cell & Molecular Biology, Lea and Febiger Int.Edition, Hongkong.
26. Gardner E.J. (1981); Principles of Genetics Edn.5, John Wiley & Sons, New York, Chichester Toronto, Singapore.
27. Gilmour (Darver) (1961); Biochemistry of insects, Academic Press, New York.
28. Imms (A.D) (1961); General Text book of Entomology, Edn.9. Rev. by O.W. Richards & R.G. Davies, Bombay.
29. Lehninger, (Albert L) (1978); Biochemistry, Molecular basis of Cell. Structure & function, 2<sup>nd</sup> Edn. Ludhiana, Kalyani.
30. Lerner (F. Michael) & Donald (H.P) (1969); Modern developments in Animal breeding, Academic Press, London.
31. Levine (Lavis) (1969); Biology of the gene, Saint Louis, Mosby.
32. Smith & Kaary (P.F) (1975); Genetic Structure and Function Macmillan, London.
33. Smith (Robert Leo) (1974); Ecology & Field Biology Edn. 2, Harper & Row, New York.
34. Strickberger (Monroe W) (1976); Genetics, Macmillan, New York.
35. Stryer (L Ubert) (1975); Biochemistry, Freeman, San Francisco.
36. Swanson (Corl P) (1968); Cytology and Cytogenetics, Macmillan Co., Bombay.
37. White (M.J.D.) (1973); Animal Cytology & Evolution, Edn.3, C.U.P., London.
38. Wigglesworth (V.B.) (1956); Insect Physiology (Edn.5; Rev.) Methuen, London.
39. William J. Shull (1964); Mutations: Ann. Arbor, The University of Michigan Press.
40. Winchester A.M (1974); Genetics, New Delhi, Oxford & IBH.
41. Akira Nakamura (2000); Fiber science and technology. Oxford & IBH publications, New Delhi.
42. Eikichi Hiratsuka (2000); Silkworm breeding. Oxford and IBH publications, New Delhi.
43. Nobumasa Hojo (2000); Structure of the Silk yarn. Oxford and IBH publications, New Delhi.
44. Sivarama Sastry. K, Padmanaban G and Subramanyam, C (1994); Textbook of molecular biology, Mac Millon India limited, New Delhi.
45. Hames B.D, Hooper N.M and Haughtan I.D , (1997); Instant notes in Biochemistry, VivaBooks Private limited, Chennai.
46. Joshi.P (2000); Genetic engineering and its application agrobios Pvt. Ltd.,
47. Bruce alberts, Dennis Bray, Jullian Lewis, Martin Raff, Keith Robertis and James Watson (1983); Molecular Biology of the cell, Garland Publishing, Inc, New York & London.

48. Bhojwani, S.S. and S.P. Bhatnagar (1999); The embryology of Angiosperms. Vikas publishing House pvt. Ltd., New Delhi.
49. Singh B.D (2000); Plant breeding- Principles and methods, Kalyani Publ., New Delhi.
50. Yellamanda Reddy T and G.H Shankara Reddi, (1995); Principles of Agronomy, Agronomy Publishers New Delhi.
51. Sankaran S and V.T. Subbaiah Mudaliar (1997); Principles of Agronomy, Publ. BAPPCO, Bangalore.
52. Shankar M.A (1997); Hand book of mulberry nutrition, UAS- Multiplex, Bangalore.
53. Thangavelu K *et. al.*; Hand book of Muga culture, CSB, Bangalore.
54. Pandey S.N and B.K Sinha (1995); Plant physiology, Vikas Publishing House, PVT. Ltd, New Delhi.
55. Chaudhuri H.K (1971); Elementary Principles of Plant Breeding Oxford and IBH Publ.W, New Delhi.
56. Devaiah M.C *et al.* (2001); Advances in Mulberry Sericulture. Dept. of Sericulture, UAS, Bangalore.
57. Yasuji Hamamura. (2001); Silkworm Rearing on artificial diet. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi & Calcutta.
58. Eikichi Hiratsuka. (1999); Silkworm Breeding (Translated from Japanese) Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi & Calcutta.
59. S. Morohosi. (2000); Development Physiology of Silkworms (Translated Japanese) Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi , Calcutta.
60. Silk Dyeing and Finishing Handbook.(2000); (Translated from Chinese) Compiled by Shanghai Silk Industry Corporation, China. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi & Calcutta.
61. Sericulture Manual 4 (Non mulberry sericulture) (1972); Food and Agriculture Organization of the United Nations, Rome.
62. De, D., Rao, MS and Jirli, B. (2008); Entrepreneurship- A conceptual framework. Entrepreneurship: Theory and practice in agriculture. pp. 1-74.
63. Singh, AK and Singh, L. (2008); Dynamics of Entrepreneurship development in agriculture: Basics to advances. Entrepreneurship: Theory and practice in agriculture. pp. 120-131.
64. Rashmi Singh, J. P. Sharma, DUM Rao, M. S. Nain and R. Roy Burmon (2012); Entrepreneurship development in agriculture. Publ. Biotech.
65. Dandin, S.B. and Giridhar, K. (2010); Hand book of sericulture technologies. Central Silk Board, Bangalore.
66. Mohammed Shamsuddin (2009); Silkworm physiology- A concise textbook. Daya publishing house, Delhi.
67. Basavaraja, H.K., Ashwath, S.K., Suresh Kumar, N. Mal Reddy, N. and Kalpana, G.V. (2005); Silkworm breeding and genetics. Central Silk Board, Bangalore.
68. Govindaiah., Gupta, V.P., Sharma, D.D., Rajadurai, S. and Nishtha Naik, V. (2005); Mulberry crop protection. Central Silk Board, Bangalore.
69. Silkworm crop protection (2005); Central Silk Board, Bangalore.
70. Dandin, S.B. and Gupta, V.B. (2002); Advances in Indian sericulture research. CSR & TI, Mysore.
71. Prafulla Kumar Mohanty. (2003); Tropical wild silk cocoons of India. Daya publishinghouse, Delhi.

72. South zone mulberry sericulture-Technology Descriptor. (2015). CSR&TI, Mysore.
73. Tribhuwan Singh. And Pramod Kumar Singh. (2013); Mulberry crop protection (concept and approaches). Discovery publishing house Pvt. Ltd., New Delhi.
74. Pandey, B.P. (2004); A textbook of botany – Angiosperms. S. Chand & Company Ltd., New Delhi.
75. D.T. Plummer (1988): An introduction to practical biochemistry, Tata McGRAW-Hill Edition.
76. S. Sadashivam and A. Manickam (2004): Biochemical Methods, New Age International Publishers.
77. S.K. Sawhney and Randhir Singh (2005): Introductory Practical Biochemistry, Narosa publishers.

---

-sd-

**Dr.H.B.MAHESHA**  
**CHAIRMAN**  
**Board of Studies in Sericulture**  
**Yuvaraja's College**