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UNIVERSITY OF MYSORE



Estd. 1916

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No.AC.2(S)/507/12-13

Dated: 01-06-2013.

**NOTIFICATION**

**Sub:** Revision of Syllabus in Sericulture under Semester Scheme.

**Ref:** 1. Proceedings of Faculty of Science & Technology Meeting held on 21-02-2013.  
2. Proceedings of the Meeting of Academic Council held on 27-03-2013.

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The Board of Studies in **Sericulture (UG)** at its meeting held on 26-11-2012 has resolved to revise the syllabus -**Semester scheme** in vogue for (B.Sc.) under graduate from the academic year 2013-14.

The Faculty of Science and Technology and the Academic Council at their meetings held on 21-02-2013 and 27-03-2013 respectively approved the above proposals and the same is hereby notified.

The copy of Revised Syllabus in Sericulture is annexed herewith.

*S. Srinivas*  
REGISTRAR. 3/6/13

To

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Chairperson, BOS/DOS in Sericulture, MGM.
3. The Dean, Faculty of Science & Technology, DOS in Zoology, MGM.
4. The Principals of the Affiliated Colleges running B.Sc. course.
5. The Director, College Development Council, UOM, Mysore
6. The Deputy/Assistant Registrar (Evaluation), University of Mysore, Mysore.
7. Sri Narasimha Murthy, Statistician, E.B. UOM, Mysore.
8. The Supdt. AC.1 & AC.2, A.B., Academic Section, UOM., Mysore.
9. The P.A. to the Vice-Chancellor/Registrar/Registrar (Evaluation), UOM., Mysore.
10. The Case Worker, AC.7, Academic Section, University of Mysore, Mysore.
11. The Section Guard File(Supdt.AC.2), A.B., A.C., UOM.
12. The Schedule File.

AC2.Eng 25-4.R

**UNIVERSITY OF MYSORE**  
**SCHEME OF EXAMINATION UNDER SEMESTER PATTERN**  
**B.Sc., DEGREE COURSE –SERICULTURE AS ONE OF THE OPTIONAL**

**FROM THE YEAR 2013 – 2014 ONWARDS**

Title of the Paper	Teaching Hrs. per Week	Duration of Exam in Hrs.	Marks in Examination					
			Theory	IA	Prac	IA	Total	
<b>I Semester</b>								
Theory Paper –1 Sericultural Botany and Silkworm Biology	4	3	60	10	-	-	100	
Practical-1 Sericultural Botany and Silkworm Biology	3	3	-	-	20	10		
<b>II Semester</b>								
Theory Paper-2 Mulberry cultivation and Silkworm Rearing	4	3	60	10	-	-	100	
Practical-2 Mulberry cultivation and Silkworm Rearing	3	3	-	-	20	10		
<b>III Semester</b>								
Theory Paper-3 Diseases and pests of Mulberry and Silkworm	4	3	60	10	-	-	100	
Practical-3 Diseases and pests of Mulberry and Silkworm	3	3	-	-	20	10		
<b>IV Semester</b>								
Theory Paper-4 Physiology of Mulberry and Silkworm	4	3	60	10	-	-	100	
Practical-4 Physiology of Mulberry and Silkworm	3	3	-	-	20	10		
<b>V Semester</b>								
Theory Paper-5 Genetics and breeding of Mulberry and Silkworm	4	3	80	20	-	-	100	
Theory Paper-6 Silkworm seed production and Seri-Biotechnology	4	3	80	20	-	-	100	
Practical-5 Genetics and breeding of Mulberry and Silkworm	3	4	-	-	40	10	50	
Practical-6 Silkworm seed production and Seri-Biotechnology	3	4	-	-	40	10	50	
<b>VI Semester</b>								
Theory Paper-7 Silk Technology.	4	3	80	20	-	-	100	
Theory Paper-8 Non-Mulberry Sericulture, Sericulture Extension and Economics.	4	3	80	20	-	-	100	
Practical-7: Silk Technology.	3	4	-	-	40	10	50	
Practical-8: Non-mulberry Sericulture, Sericulture Extension and Economics.	3	4	-	-	40	10	50	
<b>Grand Total of Marks</b>			<b>560</b>	<b>120</b>	<b>240</b>	<b>80</b>	<b>1000</b>	

**PROF. H.B.MANJUNATHA**  
**Chairman (BOS)**

**I SEMESTER**

**PAPER-1. SERICULTURAL BOTANY AND SILKWORM BIOLOGY**

**4 Hrs / Week X 14 = 56 hrs.**

**PART-A: SERICULTURAL BOTANY**

**Unit-1** 9 Hrs.

1. Introduction to Sericulture.
2. Origin and history of Sericulture- Silk road. Spread of Sericulture to Europe, South Korea, Japan, India and other countries.
3. Sericulture map of World, India and Karnataka.

**Unit-2** 9 Hrs.

4. Components of Sericulture-food plant cultivation, egg production, Silkworm rearing, reeling of cocoons and silk weaving.
5. Taxonomy of mulberry.
6. Morphology of mulberry.
7. Different varieties of mulberry with special reference to Karnataka.

**Unit-3** 10 Hrs.

8. Floral biology of mulberry:
  - i) Microsporogenesis and development of male gametophyte.
  - ii) Megasporogenesis and development of female gametophyte.
  - iii) Pollination and fertilization.
  - iv) Development of endosperm, embryo and seed.
  - v) Polyembryony and parthenocarpy in mulberry.

**PART –B : SILKWORM BIOLOGY**

**Unit-4** 9 Hrs.

9. Characteristic features of the class insecta and order Lepidoptera.
10. Detailed study of the families- Saturnidae and Bombycidae.
11. Classification of sericigenous insects.
12. Classification of silkworms based on moultnism, voltinism and geographical distribution.

**Unit-5** 9 Hrs.

13. Popular silkworm breeds and hybrids of Karnataka and their economic traits.
14. Life cycle of silkworm *Bombyx mori* L.
15. Morphology of egg, larva, pupa and adult.
16. Integument: its structure and derivatives.

**Unit-6** 10 Hrs.

17. Anatomy of digestive and excretory systems of silkworm larva.
18. Anatomy of circulatory, respiratory, nervous systems of silkworm larva.
19. Structure of Silk glands in silkworm larva.

20. Reproductive systems of silkworm silk moth.

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## PRACTICAL-1-SERICULTURAL BOTANY AND SILKWORM BIOLOGY

14 practicals -3 hrs each

### PART- A : SERICULTURAL BOTANY.

7 Pract.

1. Sericulture maps: (a) World map and silk road.  
(b) Sericulture maps of India and Karnataka.
2. Taxonomic description of mulberry.
3. Study of five popular mulberry cultivars of Karnataka.  
(Mysore local, K<sub>2</sub>, S<sub>36</sub>, S<sub>13</sub> and V<sub>1</sub>)
4. Mounting of Pollen grains, Ovary and Embryo.

### PART –B: SILKWORM BIOLOGY

7 Pract.

5. Life cycle of Silkworm *Bombyx mori*. L.
6. Morphology of egg, larva, pupa and adult of *Bombyx mori*. L.
7. Sex separation in larva, pupa and adult of the silkworm *Bombyx mori* L.
8. Mounting of integument derivatives and antennae of male and female silk moths.
9. Anatomy of Silkworm:
  - (a) Dissection of digestive and excretory system of larva.
  - (b) Dissection of respiratory, nervous systems and Silk glands of silkworm larva.
  - (c) Dissection of reproductive system of male and female moths.

### SCHEME OF PRACTICAL EXAMINATION

#### I SEMESTER - Practical I

Duration 3 Hrs

Max. Marks - 20

Question No. 1

07marks

Taxonomic description of food plant of mulberry silkworms.

Note: Distribution of marks : a) Identification of family / classification - 1.5  
b) Diagnostic features - 4.0  
c) Sericultural importance - 1.5

OR

Mounting of pollen grains / ovary/ embryo.

Note: Distribution of marks: a) Preparation -02  
b) Identification - 03  
c) Procedure - 02

Question No2

07 marks

Dissection of any one of the following (dissection only)

Male/ female reproductive system of silk moth / silk glands / Nervous / respiratory system.

OR

Dissection of digestive and excretory system at larval stage.

Note: Distribution of marks : a) Dissection/ sex separation - 4.0

- b) Labeled diagram - 3.0  
 3. Identification: -- Any FOUR- two from each part. 1.5 x 4 = 06 marks  
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## II SEMESTER

### **PAPER-2:- MULBERRY CULTIVATION AND SILKWORM REARING** *4 hrs / Week X 14 = 56hrs.*

#### **PART –A: MULBERRY CULTIVATION**

- |   |        |
|---|--------|
| <b>Unit- 1</b>  | 9 Hrs. |
| 1. Definition of soil and soil profile.<br>2. Different types of soils - basics of soil classification.<br>3. Importance of soil air, soil water and soil micro organisms.<br>4. Importance of soils with reference to mulberry cultivation.<br>5. Soil analysis-Soil sampling, soil pH.<br>6. Propagation of mulberry- i) Raising of seedling and sapling.<br>ii) Layering-Sample, Compound, trench and gooting (Air Layer).<br>iii) Grafting-Root, Stem and bud.<br>iv) Raising of commercial nursery.  |        |
| <b>Unit –2</b>  | 10 Hrs |
| 5. Establishment of mulberry garden under rain-fed and irrigated conditions:<br>(a) Planting season.<br>(b) Selection and preparation of land.<br>(c) Formation of pits and rows, rooting media; implements required. Pit and row Systems; recommended system; advantages and disadvantages.<br>(d) Selection and preparation of planting material.<br>(e) Manuring: Manures and fertilizers-Types, dosage, application and schedule.<br>(f) Irrigation: Source, methods, periodicity and quantity of irrigation, over-irrigation and its effects.<br>(g) Chawki garden-importance and maintenance. |        |
| <b>Unit-3</b>   | 9 Hrs  |
| 7. Weeds of mulberry garden: Classification and characteristics and Integrated weed management.<br>8. Leaf harvesting: Harvesting methods (leaf, branch and shoot harvests); Effects of harvest on Mulberry plant. Transportation and preservation of harvested leaf and shoot.<br>9. Pruning: Importance and methods<br>10. Estimation of leaf yield: Importance of leaf quality.  |        |

#### **PART-B: SILKWORM REARING**

- |  |         |
|--|---------|
| <b>Unit-4</b>  | 9 Hrs   |
| 11. Rearing house: Location, orientation, plan and utilities; model rearing house; low-cost rearing house.<br>12. Rearing appliances-shelf and shoot rearing;(rearing appliances per unit rearing of 100dfls).<br>13. Disinfection of rearing house and rearing appliances; disinfectants (formalin, bleaching powder, slaked lime, bed disinfectants, rearing and personal hygiene.   |         |
| <b>Unit-5</b>  | 10 Hrs. |
| 14. Incubation- definition, requirement of environmental conditions, incubation devices; black boxing and its importance.<br>15. Leaf selection for young and late age silkworms.<br>16. Chawki rearing: Preparation; brushing and brushing methods; types of chawki rearing – traditional method, paraffin paper with foam rubber and wrap-up method; optimum environmental conditions; methods and frequency of feeding; methods of bed cleaning; spacing; moulting and care during moult. |         |
| <b>Unit -6</b>   | 9 Hrs   |
| 17. Late age silkworm rearing: Methods; optimum environmental conditions; feeding quantity and frequency; methods of bed cleaning; spacing; moulting and care during moult.<br>18. Identification of spinning larva; spinning; mounting and mounting density; types of mountages, their advantages and disadvantages; environmental requirements during spinning.  |         |

19. Harvesting: Time of harvesting; sorting, preservation, packaging and transport of cocoons
20. leaf-cocoon ratio; maintenance of rearing records.

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## **PRACTICAL –2 MULBERRY CULTIVATION AND SILKWORM REARING**

**14 Practicals -3 hrs each**

### **PART – A: MULBERRY CULTIVATION**

**7 Pract.**

1. Study of soil profile and identification of different types of soils and soil sampling.
2. Determination of soil pH and water holding capacity of different types of soils.
3. Identification of Farm implements.
4. Preparation of land, pits and rows, preparation of rooting media (fieldwork).
5. Raising of sapling and seedling (field work).
6. Intercultivation, mulching, irrigation, pruning and estimation of leaf yield.  
(demonstration and exercise).
7. Grafting and Layering in mulberry.
8. Identification of common weeds of mulberry garden.
9. Visit to soil testing laboratory, poor and well maintained mulberry garden.

### **PART – B : SILKWORM REARING**

**7 Pract.**

10. Rearing houses- model rearing house and low-cost rearing house.(Model preparation)
11. Identification of rearing appliances.
12. Disinfection- Types of disinfectants- concentration and dosage requirement;  
preparation of spray formulation of disinfectants.
13. Incubation of silkworm eggs- Methods; black boxing; manipulation of temperature and humidity; harvesting and preservation techniques; leaf selection for different instars.
14. Brushing: Methods; chawki rearing; use of paraffin paper and blue polythene sheet.  
Bed cleaning: use of bed cleaning net and disposal of bed refuses and silkworm litter.
15. Moulting: Identification of moulting larva, care during moulting; mounting and mounting density; harvesting of cocoons; assessment of cocoons; types of mountages;  
maintenance of records for silkworm rearing.
16. Visit to Silk farms, CRC, commercial silkworm rearing houses.

## **SCHEME OF PRACTICAL EXAMINATION**

### **II SEMESTER - Practical II**

**Duration 3 Hrs**

**Max. Marks - 20**

Question No. 1

-- 07 marks

Determination of soil pH/ grafting/ layering/ water holding capacity.

Note: Distribution of marks

- a) Procedure - 2.0
- b) Diagramme - 1.0
- c) Experiment - 4.0

Question No. 2

-- 07 marks

Calculations and procedure about disinfection/ brushing/ bed cleaning/ hatching percentage

Note: Distribution of marks

- a) Procedure - 3.0

- b) Experiment - 4.0  
3. Identification: --Any FOUR- two from each part.  
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1.5 x 4 = 06 marks

### III SEMESTER

#### **PAPER- III: DISEASES AND PESTS OF MULBERRY AND SILKWORM**

4 Hrs / Week X 14 = 56 Hrs.

#### **PART-A: DISEASES AND PESTS OF MULBERRY**

##### **Unit-1**

**9 Hrs**

1. Introduction to plant diseases and importance of plant protection.
2. Classification of mulberry diseases.
3. Influence of biotic and abiotic factors on the incidence of plant diseases- mulberry diseases.
4. Root-knot disease of mulberry- occurrence, symptoms, preventive and control measures.

##### **Unit-2**

**10 Hrs.**

5. Fungal diseases of mulberry: Occurrence, symptoms, etiology and preventive and control measures of the following diseases :
  - (a) Powdery mildew.
  - (b) Leaf spot.
  - (c) Leaf rust.
  - (d) Leaf blight.
  - (e) Root rot.
9. Viral, bacterial and dwarf diseases of mulberry- their occurrence- symptoms, preventive and control measures.

##### **Unit-3**

**9 Hrs.**

10. Mulberry pests: Major pests: Scale insects, Bihar hairy caterpillar, mealy bugs, jassids and thrips – their preventive and control measures.
11. Minor pests: girdlers, termites and mites-their preventive and control measures.
12. Biological control of mulberry pests.
13. Pesticides: Forms, formulations, application and pesticide calculation

#### **PART B: DISEASES AND PESTS OF SILKWORM**

##### **Unit-4**

**9 Hrs**

14. Introduction; classification of silkworm diseases.
15. Protozoan disease – symptomatology, structure of pebrine spore, life cycle of *Nosema bombycis*, source of inoculum, mode of infection and transmission, cross infectivity, prevention and control.
16. Bacterial diseases - causative agents, symptoms, factors influencing flacherie, source of inoculum, mode of infection and transmission prevention and control.

##### **Unit-5**

**10 Hrs**

17. Viral diseases (grasserie, infectious flacherie, cytoplasmic polyhedrosis, denonucleosis and gattine)- causative agents- symptoms - sources of inoculum- mode of infection and transmission- cross infectivity- prevention and control.
18. Fungal diseases: white and green muscardine and aspergilliosis- causative agents- symptoms - structure and life cycle of fungal pathogen- mode of infection and transmission- cross infectivity- prevention and control.

##### **Unit-6**

**9 Hrs,**

19. Life cycle of Indian uzifly and Japanese uzifly; seasonal occurrence; oviposition and host-age preference; nature and extent of damage; prevention and control; integrated management of Indian uzifly.
20. Cocoon pests of silkworm: Dermestid beetle- life cycle; nature and extent of damage;

prevention and control measures.

21. Predators of silkworm: Cockroaches, ants, lizards and rodents; prevention and control measures.

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### III SEMESTER

#### **PRACTICAL –3: DISEASES AND PESTS OF MULBERRY AND SILKWORM**

**14 Practicals -3 hrs each**

##### **PART – A DISEASES AND PESTS OF MULBERRY**

**7 PRACT.**

1. Collection and preservation diseased specimen of mulberry.
2. Study of root-knot nematode in mulberry
3. Study of powdery mildew, leaf spot and leaf rust through sectioning, staining and temporary mounting; study of stem canker.
4. Collection, mounting/preservation of insect pests of mulberry (field work)
5. Identification of mulberry pests. Study of nature of damage of the following pests:  
Leaf roller, Bihar hairy caterpillar, scale insects, mealy bug, thrips, beetles, jassids and grasshoppers.
6. Identification of fungicides; Forms, formulations and calculation.
7. Identification of Pesticides; Forms, formulations and calculation.

##### **PART – B DISEASES AND PESTS OF SILKWORM**

**7 PRACT.**

8. Identification of different diseased silkworms based on external symptoms. (grasserie, flacherie, muscardine and pebrine).
9. Identification of pathogens associated with silkworm diseases: Staining and preparation of temporary slides of **a)** Mycelial mat of muscardine. **b)** Polyhedra of nuclear polyhedrosis virus (NPV) **c)** Bacteria **d)** Spores of pebrine.
10. Identification of disinfectants and bed disinfectants.
11. Methods of application of silkworm bed disinfectants for management of silkworm diseases.
12. Life cycle of Uzi fly; Identification of uzi-infested silkworms and cocoons.
13. Application of uzicide and its evaluation. Identification of parasitoids of uzi fly
14. Life cycle of dermestid beetles :Dermestid infested silkworm cocoons and estimation of incidence.

#### **SCHEME OF PRACTICAL EXAMINATION**

##### **III SEMESTER - Practical III**

**Duration: 3 Hrs**

**Max. Marks - 20**

Question No.1 -- 07 marks

Temporary mounting of any one of the following:-  
Leaf spot/ leaf rust/ powdery mildew/ root knot nematode of mulberry.

Note: Distribution of marks : a) Identification - 1.5  
b) Sectioning, staining and mounting -4.0  
c) Labelled diagram - 1.5

Question No. 2 -- 07 marks

Temporary mounting of any one of the following.  
Pebrine spore/ nuclear polyhedral bodies/ mycelia and conidial spores.

Note: Distribution of marks: a) Identification - 2.0  
b) Staining and mounting -3.0



- c) Procedure - 2.0  
3. Identification: --Any FOUR – two from each part. 1.5 x 4 = 06 marks  
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## **IV SEMESTER**

### **PAPER –4: PHYSIOLOGY OF MULBERRY AND SILKWORM**

4 hrs/Week X 14 = 56 hrs.

#### **PART –A: ANATOMY AND PHYSIOLOGY OF MULBERRY**

**Unit –1** 9 Hrs.

1. Anatomy of mulberry: internal structure of stem, root and leaf; secondary growth in root and stem
2. Absorption of water and solutes by roots; effect of external conditions.

**Unit -2** 9 Hrs.

3. Mineral nutrition (plant nutrients) - macro and micro nutrients; their physiological role.
4. Brief account of photosynthesis: Outline of the process; types of carbon fixation (C3 and C4); brief account of photorespiration and its significance.

**Unit-3** 10 Hrs.

5. Chemical composition of mulberry leaf.
6. Transpiration: Significance; stomata- mechanism of opening and closing; regulation of water loss by stomata; factors influencing the rate of transpiration.
7. Brief account of biological nitrogen fixation; types- importance in mulberry cultivation; Biofertilizers.
8. Plant growth regulators: Importance and application in mulberry.

#### **PART-B: DEVELOPMENTAL BIOLOGY AND PHYSIOLOGY OF SILKWORM**

**Unit-4** 9 Hrs

9. Morphology and structure of silkworm egg, fertilization, cleavage, blastoderm, germ bed formation, blastokinesis, eye spot and blue egg; diapause development .
10. Digestion: Organization- structure and function- relationship between parts of digestive system; digestive enzyme; process of digestion and absorption in midgut.

**Unit-5** 9 Hrs.

11. Respiration: tracheal systems- spiracles, mechanism of respiration, factors affecting respiration.
12. Excretion: Malpighian tubules-structure and function, cryptonephrial arrangement and its significance in water regulation; Water balance in silkworm.
13. Neuro -endocrine system: Nervous system; Structure and distribution of endocrine glands; role of nervous system in endocrine function; chemical nature and functions of insect hormones.

**Unit-6** 10 Hrs.

14. Sense organs: Photoreceptors, Chemo receptors and Mechanoreceptors.
15. Circulation: heart beat-role of alary muscles; accessory hearts; blood pressure in open circulatory system. Haemolymph.
16. Reproduction: Male and female reproductive systems in insects; role of accessory

glands; oviposition.  
17. Metamorphosis- Definition. Types of insect metamorphosis.

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#### **IV SEMESTER**

### **PRACTICAL –4: PHYSIOLOGY OF MULBERRY AND SILKWORM**

14 Practicals -3 hrs each

#### **PART – A: ANATOMY AND PHYSIOLOGY OF MULBERRY**

7 pract.

1. Anatomy of stem and root
2. Anatomy of petiole and leaf lamina
3. Kranz Anatomy
4. Estimation of leaf protein and leaf moisture
5. Estimation of leaf photosynthetic pigments of mulberry through paper chromatography.
7. Determination of water potential of potato tubers.

#### **PART - DEVELOPMENTAL BIOLOGY AND PHYSIOLOGY OF SILKWORM**

7 Pract.

8. Morphology of silkworm egg.
9. Mounting of 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> day old embryos.
10. Mounting of larval mouth parts and spiracle.
11. Dissect and display the excretory system in silkworm larva and demonstration of heart beat in silkworm larva.
12. Study of haemocytes in silkworm.
13. Estimation of amylase activity in haemolymph.
14. Estimation of SDH activity in the eggs.

#### **SCHEME OF PRACTICAL EXAMINATION**

##### **IV SEMESTER - Practical IV**

**Duration 3 Hrs**

**Max. Marks - 20**

Question No. 1 --

07 marks

Separation of photosynthetic pigments/ water holding capacity of potato tubers / anatomy of stem/ leaf/ petiole/ leaf lamina/ Kranz anatomy.

Note: Distribution of marks : a) Procedure - 2.0  
b) Diagramme - 1.0  
c) Experiment - 4.0

Question No. 2 --

07marks

Estimation of amylase/ succinate dehydrogenase activity levels/ mounting of Silkworm embryo (7<sup>th</sup>/ 8<sup>th</sup>/ 9<sup>th</sup> day)

Note: Distribution of marks : a) Procedure - 3.0  
b) Experiment - 4.0

3. Identification: --Any FOUR - two from each part.

1.5 x 4 = 06 marks

**V SEMESTER****PAPER-5:- GENETICS AND BREEDING OF MULBERRY AND SILKWORM**

4 hrs / Week X 14 =56 hrs.

**PART-A: - CYTOGENETICS AND BREEDING OF MULBERRY**

- |  |               |
|--|---------------|
| <b>Unit-1</b>  | <b>9 Hrs.</b> |
| 1. Ultra-structure of eukaryotic cell.   | ..            |
| 2. Cell division; Mitosis and Meiosis.   |               |
| 3. Chromosomal aberration- Deletion, duplication, inversion and translocation. |               |

- |  |              |
|--|--------------|
| <b>Unit-2</b>  | <b>9 Hrs</b> |
| 4. Brief account of polyploidy in plants- polyploidy in mulberry.            |              |
| 5. Mutation- Types; mutagens; physical and chemical mutagenesis.             |              |
| 6. Germplasm bank: Importance; collection, characterization and maintenance. |              |

- |  |               |
|--|---------------|
| <b>Unit-3</b>  | <b>10 Hrs</b> |
| 7. Mulberry breeding: Objectives and methods.                        |               |
| a). Plant introduction and acclimatization; Quarantine.              |               |
| b) Selection methods of breeding.                                    |               |
| c) Hybridization methods of breeding.                                |               |
| d) Polyploidy breeding in mulberry.                                  |               |
| e) Mutation breeding; breeding for disease and drought resistance.   |               |
| 8. Evaluation of selected genotypes and release of improved variety. |               |

**PART-B: GENETICS AND BREEDING OF SILKWORM**

- |   |              |
|---|--------------|
| <b>Unit-4</b>   | <b>9 Hrs</b> |
| 9. Chromosome numbers in mulberry and non-mulberry silkworms.                         |              |
| 10. Evolutionary significance of chromosomes in <i>Bombyx mori</i> . L.               |              |
| 11. Linkage groups in <i>Bombyx mori</i> . L.,  |              |
| 12. Gametogenesis- Oogenesis and Spermatogenesis                                      |              |
| 13. Genetic basis of vultinism and moultnism in the silkworm, <i>Bombyx mori</i> . L. |              |

- |  |              |
|--|--------------|
| <b>Unit-5</b>  | <b>9 Hrs</b> |
| 14. Hereditary traits of silkworm eggs and larva.  |              |
| 15. Genetics of cocoon colours- inheritance of cocoon colours.                                       |              |
| 16. Parthenogenesis in silkworm- types and induction of parthenogenesis.                             |              |
| 17. Sex determination mechanism in silkworm- importance of ZZ and ZW chromosomes- sex-limited races. |              |

- |   |               |
|---|---------------|
| <b>Unit-6</b>   | <b>10 Hrs</b> |
| 18. Silkworm germplasm bank.  |               |
| 19. Introduction to silkworm breeding- objectives.  |               |
| 20. Silkworm breeding-techniques- different types of breeding.  |               |
| a) Inbreeding and out breeding concepts.  |               |
| b) Mutation breeding.   |               |
| c) Selection: Methods- individual and mass selection- fixation of characters- qualitative and quantitative traits- evolution of new breeds- race authorisation. |               |

21. Heterosis and hybrid vigour-exploitation of heterosis in silkworm- concept of single, double and polyhybrids.

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## V SEMESTER

### **PRACTICAL-5: GENETICS AND BREEDING OF MULBERRY AND SILKWORM**

**14 Practicals -3 hrs each**

#### **PART – A : GENETICS AND BREEDING OF MULBERRY**

**7 pract.**

1. Mulberry germplasm and mulberry multilocational trials (field visit).
2. Evaluation of mulberry cultivars for growth and yield parameters.
3. Tissue culture technique (demonstration / visit to any research laboratory).
4. Induction of tetraploidy in mulberry using Colchicine (Demonstration).
5. Study of mitosis in onion root tip / mulberry root / shoot tip.
6. Staining and temporary slide preparation of pollen and study on pollen size and fertility in mulberry and other plants.
7. Staining and temporary slide preparation of stomata and study on stomatal size and stomatal frequency in mulberry and other plants.
8. Study on hybridization technique in mulberry.

#### **PART – B : GENETICS AND BREEDING OF SILKWORM**

**7 Pract**

9. Study of meiosis in silkworm and grasshopper testis.
10. Study of Multivoltine breeds characters - Pure Mysore, Hosa Mysore, C.Nichi, Nistari etc.,
11. Study of Bivoltine breeds characters – NB4D2, NB18, NB7, KA, CSR2, CSR4 etc.,
12. Identification of silkworm larval mutants – Zebra, Ursa, Knobbed etc.,
13. Identification of sex limited races of silkworm - *Bombyx mori. L.*
14. Comparative assessment of the pure races and hybrids cocoons.  
(Compulsory Rearing of one pure and one hybrid laying by each students).

### **SCHEME OF PRACTICAL EXAMINATION**

#### **V SEMESTER - Practical V**

**Duration 4 Hrs**

**Max. Marks - 40**

1. Squash preparation of mitotic / meiotic chromosomes. -- 10 marks
2. Determine the comparative assessment of the given hybrid and pure race cocoons (minimum 5 cocoons each) by taking average cocoon weight, shell weight and shell percentage. 6 marks
3. Determine the stomatal size / frequency / pollen size / frequency. 6 marks
4. Conduct an experiment to demonstrate mulberry hybridization / Evaluation of mulberry Cultivars. 6 marks
5. Identification: Any four – two from each chapter. 4 x 3 = 12 marks

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## V SEMESTER

### **PAPER-6:- SILKWORM SEED PRODUCTION AND SERI-BIOTECHNOLOGY**

4 hrs/Week X 14 = 56 hrs.

#### **PART-A: SILKWORM SEED PRODUCTION**

##### **Unit-1**

**10 Hrs**

1. A general account of silkworm seed, grainages, production and demand trends.
2. Silkworm seed organization, significance of seed organization;  
Basic seed multiplication centres-P4, P3, P2 and P1; Seed areas- identification, concept of selected seed rearers/villages- Seed Legislation Act- maintenance of seed crops.  
Seed cocoon markets- pupal examination, certification of seed cocoon lots- price fixation for seed cocoons.

##### **Unit-2**

**9 Hrs**

3. Disinfection and hygiene in seed production units.
4. Seed production centres (grainages)- types of grainages- organisation and functions of grainages- plan for model grainage- grainage equipments and their use - Seed production plan.
5. Procurement and transportation of seed cocoons- processing and preservation of seed cocoons- sex separation in seed cocoons.

##### **Unit-3**

**10 Hrs**

6. Moth emergence and synchronisation; sex separation in moth; effect of improper synchronisation on egg hatching and quality-safe duration.
7. Coupling and decoupling; oviposition; method of egg production; refrigeration of male moths; mother moth examinations- individual and mass methods- dry moth examination; environmental conditions for grainage activity.
8. Egg disinfection- handling of multivoltine eggs- preservation of eggs to postpone hatching- ideal embryonic stages for cold storage- maximum duration of cold storage.

##### **Unit-4**

**9 Hrs**

9. Handling of bivoltine eggs for early hatching- physical and chemical methods- hot and cold acid treatment.
10. Postponement of hatching; hibernation schedule for 3, 4, 6 and 10 month's duration.
11. Preparation of loose egg- advantages- handling of loose eggs; Incubation of eggs.

#### **PART –B: SERI-BIOTECHNOLOGY**

##### **Unit-5**

**9 Hrs**

12. Introduction to Seri-biotechnology.
13. Brief account of tissue culture and morphogenesis; its applications in mulberry Improvement.
14. Biomedical importance of mulberry.

##### **Unit-6**

**9 Hrs**

15. Silkworm as a model organism in Genetic engineering and in Biotechnology.
16. Bio-synthesis of silk in silkworm.

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## V SEMESTER

### **PRACTICAL-6:- SILKWORM SEED PRODUCTION AND SERIBIOTECHNOLOGY**

**14 Practicals -3 hrs each**

#### **PART – A SILKWORM SEED PRODUCTION**

**9 Pract.**

1. Model grainage plan
2. Identification of grainage equipments.
3. Seed cocoon processing / handling – deflossing, sorting and preservation.
4. Pupal gut examination, sex separation of pupa and moth.
5. Moth emergence – selection of moths-pairing and depairing, oviposition-preservation of male moths.
6. Preparation of disease free layings – sheet and loose egg.
7. Mother moth examination for pebrine- Individual and mass moth examination.
8. Surface disinfection of silkworm eggs and identification of different types of eggs.
9. Acid treatment of Bivoltine eggs-Hot and Cold acid treatment and incubation of eggs.
10. Visit to cold storage to know preservation and handling of hibernated eggs for 3, 4, 6 and 10 month hibernation schedules.
11. Identification of different types of eggs: diapause and non-diapause- Fertilized, unfertilized, dead and hatched eggs and calculate their percentage.

#### **PART – B SERI-BIOTECHNOLOGY**

**5 Pract.**

12. Tissue culture technique (Demonstration and visit to any research institute).
13. Extraction of DNA from mulberry and silkworm tissue.
14. Estimation of Amylase activity from silkworm haemolymph.
15. Estimation of DNA in mulberry and silkworm tissue.

### **SCHEME OF PRACTICAL EXAMINATION**

#### **V SEMESTER - Practical VI**

**Duration 4 Hrs**

**Max. Marks – 40**

- |   |          |
|---|----------|
| 1. Extraction of DNA from mulberry / silkworm tissue / Estimation of Amylase activity from silkworm haemolymph / Estimation of DNA in mulberry and silkworm tissue. | 10 marks |
| 2. Any one: Pupae / mother moth examination.  | 6 marks  |
| 3. Any one: Sex separation of pupae / moth stage.   | 6 marks  |

4. Any one: Cold / Hot acid treatment of bivoltine eggs / hatching percentage. 6 marks  
5. Identification: Any four – two from each chapter. 4 x 3 = 12 marks

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**VI SEMESTER**  
**PAPER-7:- SILK TECHNOLOGY**

**4 hrs / Week X 14 = 56 hrs.**

**Unit-1**

**9 Hrs.**

1. Introduction to different textile fibres - natural and synthetic fibres- characteristics- types of silk produced in India; Importance of mulberry silk.
2. Physical and commercial characteristics of cocoons: cocoon colour, shape, size, hardness, grain/wrinkle, weight of cocoon, weight of cocoon shell, shell ratio,
3. Cocoon marketing- Procedure for procurement of raw material- purchase of cocoon in open auction; grading of cocoons- visual inspection and selection.
4. Cocoon sorting: Objectives and procedure; defective cocoons- double, flimsy, melted, urinated, stained, uzi-infested, moth emerged, deformed and flossy.

**Unit-2**

**9 Hrs.**

5. Cocoon stifling: Definition, objectives, different methods-conventional –Sun drying, steam stifling and modern techniques-Hot air drying; advantages and disadvantages.
6. Conditioning and preservation- Methods of storing and preservation of stifled cocoons.
7. Cocoon cooking/boiling: Definition and objectives, different methods of cocoon boiling-Mono pan, three pan and pressurized cocoon boiling methods.
8. Cocoon brushing: Definition and objectives; methods- stick, hand and mechanical brushing.

**Unit-3**

**9 Hrs.**

9. Reeling water; quality required for silk reeling, total and permanent hardness, optimal pH; corrective measures.
10. Reeling: Objective and cocoon reeling from various devices-country charaka, cottage basin, multi end reeling machine, auto and semi-automatc, improved CSTRl reeling devices; advantages and disadvantages.
- 11 Re-reeling and packing: Objectives, process; lacing, skeining, booking and baling.

**Unit-4**

**10 Hrs.**

12. Raw silk properties- physical, chemical and biological. Uses of raw silk- Textile and other commercial uses.
13. Raw silk testing and grading; a) Visual inspection. b) Mechanical tests- winding test, size deviation test, seriplane test, serigraph test and cohesion test.  
c) Supplementary tests- conditioning weight, scouring loss, exfoliation tests.
14. Silk throwing: Introduction, objectives of silk throwing, preparation for twisting, soaking, winding, doubling, twisting (high & low), heat/steam setting, rewinding.

**Unit-5**

**10 Hrs.**

15. Silk weaving: Warp preparation- warp, beaming, drawing and denting.  
Weft preparation- different pirn winding methods.  
Powerloom and handloom weaving. Flow chart of weaving; weaving defects.
16. Chemical processing of silk yarns and fabric:  
Introduction and objectives of degumming- Methods.  
Silk bleaching- Importance and processing.  
Silk dyeing-Acidic and basic dyeing processing.  
Introduction of different classes of dyes and chemicals used for silk dyeing.
17. Spun silk industry- various steps involved, spun silk yarn and noil yarn, flow chart.

**Unit-6**

**9 Hrs.**

18. Printing of silk fabrics: Objectives, methods- hand and screen printing.
19. Silk finishing: Objectives, methods- Mechanical and chemical finishing.

20. Introduction to by-products of sericulture industry-Bye- product utilization in Mulberry; types of silk waste and pupal waste-oil extraction and cake preparation.

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## VI SEMESTER

### **PRACTICAL-7:- SILK TECHNOLOGY**

**14 Practicals -3 hrs each**

1. Sorting of cocoons-good and defective cocoons-calculation of percentage of each type.
2. Cocoon stifling-different methods and determination of degree of drying.
3. Reeling water; Determination of total and permanent hardness, alkalinity and PH.
4. Cocoon cooking and brushing-study of different methods.
5. Determination of commercial characters of cocoon-average cocoon weight, shell weight, shell percentage and shell ratio.
6. Silk reeling on eprouvette- Determination of commercial characters of raw silk-average filament length, raw silk recovery percentage, renditta and denier.
7. Identification of Natural Textile Fibres-Silk, Cotton, Wool by physical method-flame and microscopic test, chemical and confirmatory tests.
8. Identification of Synthetic Fibres- Viscose, Nylon, Polyester by physical method-flame and microscopic test, chemical and confirmatory tests.
9. Study of charka, cottage basin, multi-end, automatic and semi-automatic and other reeling machines –practical demonstration (visit to private reeling unit and filature).
10. Degumming of raw silk -estimation of sericin and fibroin percentage by soap and soda wash method.
11. Study of silk fabric manufacturing unit-Hand and Power loom.
12. Identification of weaving defects (visit to private / Govt.Silk factory).
13. Bleaching of silk thread / fabric.
14. Silk dyeing by using acid dye stuff with different shades (Single color dyes).
15. Silk dyeing by using compound acid dye stuff with different shades.
16. Preparation of histograms and pie diagrams on:
  - (a) Silk and other textile fibres in India.
  - (b) World silk production.
  - (c) Pie chart on mulberry and non-mulberry silk production in India.

### **SCHEME OF PRACTICAL EXAMINATION**

#### **VI SEMESTER - Practical VII**

**Duration 4 Hrs**

**Max. Marks – 40**

1. Determination of filament length/ reelability / raw silk % recovery / renditta / denier  
(any three with minimum of 5 cocoons each) – 10 marks
2. Estimation of total alkalinity / hardness / pH of reeling water / Determination of  
fibrion and sericin percentage from the raw silk / cocoon shell. 6 marks
3. Identification, sorting and percentage calculation of different types of cocoons. 6 marks
4. Identification of textile fibers by physical, chemical and confirmatory tests (Any 2 fibers). 6 marks
5. Identification: Any four specimens. 4 x 3 = 12 marks



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**VI SEMESTER**

**PAPER-8: NON MULBERRY SERICULTURE, SERICULTURE EXTENSION AND ECONOMICS.**

**4 hrs/Week X 14 = 56hrs.**

**PART-A: NON-MULBERRY SERICULTURE.**

**Unit-1**

**9 Hrs.**

- 1.Types of non-mulberry silkworms and their distribution in India and other countries.
- 2.Taxonomical features of non-mulberry silkworms food plants- Magnoliaceae, Caesalpiniaceae, Euphorbiaceae, Combretaceae, Apocyanaceae, Caricaceae, Rhamnaceae, Lauraceae, giving more emphasis on the plants of Sericultural importance.
- 3.Life cycle of Tasar, Eri and muga silkworms.

**Unit-2**

**10 Hrs.**

4. Brief account of important diseases and pests of primary non-mulberry food plants and their management
- 5.Rearing of non-mulberry silkworms. Ecological conditions that influence rearing of non-mulberry silkworms- improved rearing methods for young and late age tasar, eri and muga silkworms. Mounting methods- different kinds of mountages- rearing of seed and commercial crops- Indoor rearing of tropical tasar and muga silkworms. Disinfection methods.

**Unit-3**

**9 Hrs.**

6. Seed cocoons- Procurement- cocoons of different ecotypes and their advantages and disadvantages- cocoon preservation-synchronisation of moth emergence- production of disease free eggs. Seed organisation of tasar and muga silkworms.
7. Diseases of non-mulberry silkworms- protozoan, bacterial, viral and fungal diseases. Symptoms- causative agents-preventive and control measures.

**PART-B: SERICULTURE EXTENSION AND ECONOMICS.**

**Unit-4**

**9 Hrs.**

8. Sericulture organization in India and Karnataka; role of state department of Sericulture, Central Silk Board, Universities and NGOs in Sericulture development.
9. Sericultural practices in India, China and Japan.
10. Employment generation in sericulture-Role of women in sericulture.
11. Silk exchange - KSMB and KSIC.
12. Extension education- meaning, objectives and importance.

**Unit-5**

**10 Hrs.**

13. Extension education- Principles and concepts. Transfer of technology.
14. Communication- definition and planning- types of communications.
15. Training- concepts and definition- different methods of training.
16. TSC's, Co-Operative Chawki Rearing Centers: Role and Importance.
- 17.Farm management; lab management and utilization, maintenance of records.

**Unit-6**

**9 Hrs.**

18. Mulberry cultivation (per hectare) –Cost and returns under irrigation and rainfed in comparison with other cash crops.
19. Economics of egg production(for producing 10 lakh Dfls): Expenditure and income.
20. Economics of silkworm rearing(for 100 Dfls):Investment and returns. .
21. Economics of silk reeling (per kg of rawsilk): Cost and returns for different types of

reeling establishments.

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## **VI SEMESTER**

### **PRACTICAL-8: NON MULBERRY SERICULTURE, SERICULTURE EXTENSION AND ECONOMICS.**

**14 Practicals -3 hrs each**

#### **Part – A : NON MULBERRY SERICULTURE**

1. Study of non-mulberry silkworm's food plants-salient features of the families- Magnoliaceae, Caesalpiniaceae, Euphorbiaceae, Combretaceae, Apocyanaceae, Caricaceae, Rhamnaceae, Lauraceae giving more emphasis on the plants of Sericultural importance.
2. Study of diseases and pests of non-mulberry food plants.
3. Morphology of egg, larva, pupa, cocoon and moths of Tasar, Eri and Muga silkworms.
4. Life Cycle of Tasar, Eri and Muga silkworms.
5. Identification of appliances used in rearing and seed preparation of non-mulberry silkworms
6. Determination of Fibroin and Sericin percentage of Eri Cocoons.

#### **Part - B SERICULTURE EXTENSION AND ECONOMICS**

7. Preparation of Audio- Visual aids- Charts, handouts, pamphlets- film shows – arranging and conducting of panel discussion with the rearers
8. Visit to rearers house, CRC, TSC, KSMB, KSIC, Cocoon market, Silk exchange and Research Institutes and panel discussion with farmers.
9. Preparation of economic model- Mulberry cultivation, Silkworm rearing, Silkworm egg production and Silk reeling.
10. Study of Byproduct utilization of Sericulture Industry.
11. Identification of byproducts of Sericulture industry.

### **SCHEME OF PRACTICAL EXAMINATION**

#### **VI SEMESTER - Practical VIII**

**Duration 4 Hrs**

**Max. Marks – 40**

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|--|------------------|
| 1. Taxonomic description of any two food plants of non-mulberry silkworms.   | 5 x 2 = 10 marks |
| 2. Staining and temporary slide preparation of the Muscardine / grasserie / flacherie / pebrine disease of non – mulberry silkworms. | 6 marks          |
| 3. Any one: Preparation of Charts / Handouts / Pamphlets.  | 6 marks          |
| 4. Preparation of an economic model of mulberry cultivation /silkworm rearing / silkworm egg production / silk reeling.              | 6 marks          |
| 5. Identification: Any four – two from each part.  | 4 x 3 = 12 marks |



**SCHEME OF THEORY EXAMINATION**

Sl.No.	Semester	Paper	Marks for theory	Marks for Internal Assessment	Total
1	I	1	60	10	70
2	II	2	60	10	70
3	III	3	60	10	70
4	IV	4	60	10	70
5	V	5	80	20	100
6	V	6	80	20	100
7	VI	7	80	20	100
8	VI	8	80	20	100
<b>Total</b>			<b>560</b>	<b>+</b>	<b>120</b>
					<b>680</b>

**QUESTION PAPER PATTERN**

**I-IV SEMESTER**

Sl. No	Types of question	Marks /Question	No of Question to be asked	No of Question to be answered	Total
1	Objective	1	06	05	05
2	Short answer	3	06	05	15
3	Medium Type	5	06	04	20
4	Long answer/ Essay	10	04	2	20
<b>Total =</b>					<b>60</b>

**V AND VI SMESTER**

Marks / Question	No of Question to be asked	No of Question to be answered	Total
2	08	6	12
3	08	6	18
5	06	4	20
10	04	03	30
<b>Total =</b>			<b>80</b>

Distribution of Internal Assessment.

1. One class test for 10 Marks will be conducted at the end of I-IV semester
2. One class test for 15 Marks will be conducted at the end of V and VI Semester and candidate will submit one assignment for 05 marks.

**Note: Examination question paper pattern will be followed for every class test.**

## INSTRUCTION TO PRACTICALS

1. Importance should be given to students participation In the observation of morphological characters. Students should complete the record work before the next practical classes and it has to be signed by the teacher and later submission should be entered in their record.
2. Student who are absent for a particular practical classes, wherever possible be allowed to complete the record only when they make observation in the next practicals.
3. Students should submit the certified practical record at the time of practical examination Otherwise they will not be allowed to take the practical examination without the certified record and field report.

## SCHEME OF PRACTICAL EXAMINATION

### a) Marks allotted Semester wise.

Sl.No.	Semester	Marks for practical	Marks for Internal assessment
1	I	20	10
2	II	20	10
3	III	20	10
4	IV	20	10
5	V	80 (40+40)	20 (10+10)
6	VI	80 (40+40)	20 (10+10)
Total Marks for Practicals =240		+	80 =320

### b)Distribution of Marks for practicals.

**Note: Questions will be covered from all sections**

Semester	Marks	Type	Marks
I-IV	a) 20 marks for practicals	a)One major question	07
	b) 10 marks for internal assessment	b)One minor question	07
		c)Identification and commenting (1.5X4)	06
V-VI	a) 40 marks for each practical -5,6,7,8.	a)One major question	10
	b)10 marks for each practical 5,6,7,8	b)One minor question	06
	internal assessment	c)One minor question	06
		d)One minor question	06
		e)Identification and commenting(3X4)	12

## Internal assessment for practical

Semester	Distribution	Marks	Duration
I-IV	a) Based on the performance of students at every practicals / field work	05	3 Hrs
	b) Submission of practical records and herbarium preparation during examinations	05	
V-VI	a) Based on the performance of every student in rearing work / mulberry cultivation and reports	05	3 Hrs
	b)Submission of practical records and herbarium during examinations	05	

<b>Summary of distribution of Marks</b>				
<b>Semester</b>	<b>Examination proper (marks)</b>	<b>Internal assessment (marks)</b>	<b>Examination proper (marks)</b>	<b>Internal assessment (marks)</b>
For each semester from I-IV	60	10 (one class test)	20	10 (5 for regular assessment ,5 for submission of records)
<b>V</b>	80	20 (one class Test for 15 marks and one assignment for 5 marks).	80 (40+40)	20 (5 for rearing and mulberry cultivation and report 5 for submission of records)  (10+10)
	80	20 (one class Test for 15 marks and one assignment for 5 marks).		
<b>VI</b>	80	20 (one class Test for 15 marks and one assignment for 5 marks).	80 (40+40)	20 (5 for rearing and mulberry cultivation and report 5 for submission of record.) (10+10)
	80	20 (one class Test for 15 marks and one assignment for 5 marks).		
<b>Total of I-VI</b>	<b>560</b>	<b>120</b>	<b>240</b>	<b>80</b>

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