

**SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY), TIRUPATI**

Département of Biosciences and Sericulture



Accredited by NAAC with "A" Grade

**SYLLABUS FOR
M.Sc. SERICULTURE
CHOICE BASED CREDIT SYSTEM
2020-2022**

SYLLABUS FOR

CURRICULUM
M. Sc. Sericulture- (4 SEMESTERS)
2020 - 2022
Credit Based Choice System (CBCS) Pattern

SEMESTER	SUBJECT CODE	TITLE OF THE PAPER
I SEMESTER		
Theory	SERI 101	Mulberry Production Technology
	SERI 102	Silkworm Seed and Cocoon production Technology
	SERI 103	Silkworm Biology and Breeding
	SERI 104	Silk Technology
	Foundation Course- 01	Communicative English
Practicals	SERI 101P	Mulberry Production Technology
	SERI 102P	Silkworm Seed and Cocoon production Technology
	SERI 103P	Silkworm Biology and Breeding
	SERI 104P	Silk Technology
II SEMESTER		
Theory	SERI 201	Mulberry Physiology and Pathology
	SERI 202	Silkworm Physiology and Pathology
	SERI 203	Biochemistry
	SERI 204	Molecular Biology and Bioinformatics
	Foundation Course -02	Foundation Course in Computer Application
Practicals	SERI 201P	Mulberry Physiology and Pathology
	SERI 202P	Silkworm Physiology and Pathology
	SERI 203P	Biochemistry
	SERI 204P	Molecular Biology and Bioinformatics

III SEMESTER		
Theory	SERI 301IE-I	Internal Electives (IE-I) (MOOC's Courses available on Swayam Portal) a) b) c)
	SERI 302	Research Methodology
	SERI 303	Non-Mulberry Sericulture
	SERI 304	Sericulture Economics, Extension and Management
	SERI EE	External Elective Sericulture and Entrepreneurial Development
	Foundation Course –03	Gender studies for Self Defense
Practicals	SERI 303P	Non-Mulberry Sericulture
	SERI 304P	Sericulture Economics, Extension and Management
IV SEMESTER		
Theory	SERI 401 IE-II	Internal Electives (IE-II) a)Value addition in Sericulture b)Environmental Science c)Tools and Techniques
	SERI 402	Mulberry Breeding
Practicals	SERI 401P IE-II	Internal Electives (IE-II) a)Value addition in Sericulture b)Environmental Science c)Tools and Techniques
	SERI 402P	Mulberry Breeding
Research Project & Industrial Training	SERI 403 RP	Research Project and submission of dissertation, Project presentation and Viva –voce
	SERI 404 IT	Industrial Training and submission of report, Presentation and Viva –voce

Note:

- **SERI 301IE-I a), SERI 301IE-I b), SERI 301IE-I c),** are Internal Elective papers of MOOCs Courses for the Students of M.Sc. Sericulture.
- **SERI EE** is External Elective paper for the students of other PG Courses of the University.
- **SERI 401 IE-II a), 401 IE-II b),401IE-II c),** are Internal elective papers for the Students of M.Sc. Sericulture.
- **FC-** Foundation Course

M.Sc. SERICULTURE (4 SEMESTERS)
SCHEME OF EXAMINATION UNDER SEMESTER PATTERN (CBCS)

Subject Code	Paper Title	Exam. Maximum Marks				
		Internal	External	Total	Total Marks for each Semester	
I SEMESTER						
Theory						
SERI 101	Mulberry Production Technology	20	80	100	600	
SERI 102	Silkworm Seed and Cocoon production Technology	20	80	100		
SERI 103	Silkworm Biology and Breeding	20	80	100		
SERI 104	Silk Technology	20	80	100		
Practicals						
SERI P1 (SERI 101P & SERI 102P)	Mulberry Production Technology & Silkworm Seed and Cocoon production Technology		100	100		
SERI P2 (SERI 103P & SERI 104P)	Silkworm Biology and Breeding & Silk Technology		100	100		
II SEMESTER						
Theory						
SERI 201	Mulberry Physiology and Pathology	20	80	100	600	
SERI 202	Silkworm Physiology and Pathology	20	80	100		
SERI 203	Biochemistry	20	80	100		
SERI 204	Molecular Biology and Bioinformatics	20	80	100		
Practicals						
SERI P1 (SERI 201P & SERI 202P)	Mulberry Physiology and Pathology & Silkworm Physiology and Pathology		100	100		
SERI P2 (SERI 203P & SERI 204P)	Biochemistry & Molecular Biology and Bioinformatics		100	100		
III SEMESTER						

Theory						
SERI 301IE-I	Internal Electives (IE-I) (MOOC's Courses available on Swayam Portal) a) b) c)	30	70	100	600	
SERI 302	Research Methodology	20	80	100		
SERI 303	Non- mulberry sericulture	20	80	100		
SERI 304	Sericulture Economics, Extension and Management	20	80	100		
SERI EE	External Elective (EE) Sericulture and Entrepreneurial Development	20	80	100		
Practicals						
SERI P (SERI 303P & SERI 304P)	Non- mulberry sericulture & Sericulture Economics, Extension and Management	-	100	100		
IV SEMESTER						
Theory						
SERI 401 IE-II	Internal Electives (IE-II) a) Value addition in Sericulture b) Environmental Science c) Tools and Techniques	20	80	100	600	
SERI 402	Mulberry Breeding	20	80	100		
SERI P (SERI 401P IE-II & SERI402 P)	Internal Electives (IE-II) a) Value addition in Sericulture b) Environmental Science c) Tools and Techniques & Mulberry Breeding	-	100	100		
Research Project & Industrial Training						
SERI 403 RP	Research Project and submission of Dissertation		100	150		
	Project Presentation and Viva –voce		50			
SERI 404 IT	Industrial Training and submission of report		100	150		
	Presentation and Viva –voce		50			
Total Marks of all Semesters				2400	2400	

Note:

- **SERI 301IE-I a), SERI 301IE-I b), SERI 301IE-I c)** are Internal Elective papers of MOOC's Courses for the Students of M.Sc. Sericulture.
- **SERI EE** is External Elective paper for the students of other PG Courses of the University.
- **SERI 401 IE-II a), 401 IE-II b), 401IE-II c)** are Internal elective papers for the Students of M.Sc. Sericulture.

DETAILS OF CREDITS FOR THE COURSE

**M. Sc. Sericulture - (4 Semesters)
2020 - 2022**

Sem ester	Subject Code	PAPER TITLES	No. of Theory hrs.	No. of Practical hrs.	No. of credits (Theory)	No. of credits (Practicals)	Total Credits
I.	SERI 101	Mulberry Production Technology	4	4	4	2	24
	SERI 102	Silkworm Seed and Cocoon production Technology	4	4	4	2	
	SERI 103	Silkworm Biology and Breeding	4	4	4	2	
	SERI 104	Silk Technology	4	4	4	2	
II.	SERI 201	Mulberry Physiology and Pathology	4	4	4	2	24
	SERI 202	Silkworm Physiology and Pathology	4	4	4	2	
	SERI 203	Biochemistry	4	4	4	2	
	SERI 204	Molecular Biology and Bioinformatics	4	4	4	2	
III.	SERI 301 IE-I	Internal Electives (IE-I): (MOOC's Courses available on Swayam Portal) a) b) c)	4	-	4	-	24
	SERI 302	Research Methodology	4	-	4	-	
	SERI 303	Non Mulberry Sericulture	4	4	4	2	
	SERI 304	Sericulture Economics, Extension and Management	4	4	4	2	
	SERI EE	External elective Sericulture and Entrepreneurial Development	4	-	4	-	
IV.	SERI 401IE-II	Internal Electives (IE-II) a) Value addition in Sericulture b) Environmental Science c) Tools and Techniques	4	4	4	2	24
	SERI 402	Mulberry Breeding	4	4	4	2	
	SERI 403 RP	Research Project and Submission of dissertation	4				
		Project Presentation and Viva – voce	2				
	SERI 404 IT	Industrial Training and Submission of report	4				
Presentation and Viva –voce		2					
Total Credits							96

SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI
(WOMEN'S UNIVERSITY)

DEPARTMENT OF BIOSCIENCES AND SERICULTURE

PROGRAM EDUCATIONAL OBJECTIVES:

- Two year MSc. Sericulture programme is distinct in nature among all the vocational programmes with blend of vocational based skilled subjects of agri farming and industrial technology (silk technology).
- The students will acquire with skills of sericulture farming and also get technologies related with silk production to fabric construction.
- In addition to these skills students will also study the core subjects like plant physiology, plantbreeding, tissue culture, Biochemistry and study advancedsubjects like molecular biology and Bioinformatics which help them to apply the knowledge for research and development in the field of plant and insect biology and biotechnology

PROGRAM OUTCOMES (POs) - M.SC SERICULTURE

PO 1. Disciplinary knowledge of Sericulture: Graduates will acquire with skills of basic science knowledge and hands on skills on advanced technology in the field of molecular biology and bioinformatics. In addition to all these the students get entrepreneurial skills to become an entrepreneur in the field of sericulture with blend of vocational based skilled subjects of agri - farming and silk industrial technology.

PO 2. Scientific reasoning: Application of advanced molecular biology techniques in the field of mulberry and silkworm pathology, mulberry crop improvement, silk production creates scientific temper to carry out research in the field of biological pest and disease control, tissueculture, plant breeding to evolve improved varieties /races with higher yield/tolerance to different abiotic and biotic stress.

PO 3. Critical thinking:Teaches the students to become an entrepreneur with clear knowledge to establish Seri-farm/or become agripreneur/nursery/silk reeler with problem solving and critical thinking attitude.

PO 4.Communication skills: Spoken English and soft skill teaching as a part of curriculum builds confidence among the students to communicate and compete with others and learn subject's skills in better way.

PO 5. Analytical reasoning:Students observe and think critically through field exposure visits to different farming communities and learn to understand the field problems and drawing solutions for problems.

PO 6. Collaboration/Cooperation/Team work: Carrying out research project/Farmer field visits/industrial training is the part of curriculum makes the students work as a team, helping each other and co-operate each other. When students are sent to research institutes and industries for project work they collaborate with other students /trainees which make them to become good citizens with team spirit and also to become good leaders.

PO 7. Moral and Ethical awareness: The students will learn to cooperate, collaborate, share, respect each other while working as a team and also learn to show empathy towards others and understanding their problems. The students will be taught the moral and ethical awareness while carrying out Research projects and drawing a hypothesis

PO 8: Sense of enquiry:The students are made to visit to nearby sericulture fields and prepare a questionnaire with relevant questions related to sericulture farming and enquire the farmers their problems which help the students to understand and analyze field problems and also play role in finding solutions.

PO 9: Digitally literate Information/digital literacy:The students become capable of using different ICT tools for searching relevant literature, preparing presentations, joining in online courses(MOOC's), Preparation of project reports and data analysis with appropriate tools.

PO 10: Multicultural competence:During industrial training and research project at different research institutes and field exposure visits to different farming communities students get exposed to different cultures and also while working for research projects/industrial training they learn to compete with other students.

PO 11: Lifelong learning: The programme teaches the students to learn and acquire most recent technologies and technical skills which will be changing time to time. As sericulture is agro-based industry development of new technologies is very necessary to make the industry thrive in the modern world. Hence the students will be learning new skills according to the industrial needs.

PO 12: Self-directed learning: Students acquire skills to work independently as they carry out individual research projects, they learn to identify research problem and required resources and also guided to find solutions and complete the project with appropriate outcome.

PROGRAM SPECIFIC OUTCOMES

1. Students are trained in various sericulture techniques right from soil analysis and agronomy practices to silkworm rearing and silk reeling. They acquire skills to identify different pests and diseases of mulberry and silkworm and their management with appropriate techniques. They gain knowledge on biological control methods.
2. Students learn the core techniques in biochemistry, physiology and molecular biology and apply the knowledge in applied research areas related to plant and insect. Students become capable of identifying the research problems, executing mini-projects with appropriate data collection and problem solving and data analysis with modern ICT tools.
3. Trained in the preparation of value added products from different sectors of sericulture which is need of the day. Develops entrepreneurial skills and to become entrepreneur.
4. Students acquire skills with the use of bioinformatics tools and biological databases to interpret and to retrieve DNA and protein sequences. Capable of describing basic principles of biostatistics and applying them to diverse biological data.

COURSE I

SERI 101-MULBERRY PRODUCTION TECHNOLOGY

Objectives

- To explain the general aspects of mulberry plants
- To learn the scientific approach of mulberry garden establishment

COURSE OUTCOMES (COS)

After successful completion of course the student will be able to

CO1. gain knowledge to classify and label the morphological features of different varieties of mulberry. Able to describe mulberry planting systems and irrigation methods

CO2. able to apply the knowledge of ecological requirement for cultivation and propagation of mulberry.

CO3. able to analyze the effectiveness of organic and inorganic fertilizers. Able to demonstrate the methods of preparation of organic manures, Biofertilizers and their relevance to soil productivity.

CO4.able to distinguish the intercultural activities, pruning methods and harvesting methods of mulberry leaf.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H												H	H		
CO2		H	M		M			H						H		
CO3		H			H			M			H	M		H		
CO4								M					H			

SYLLABUS

UNIT- I: Biology of Mulberry

1. Taxonomy and morphology of mulberry. Mulberry classification, Varieties and their distribution
2. Anatomy of Mulberry
 - a) Primary and secondary stem
 - b) Primary and secondary root
 - c) Leaf

UNIT-II: Mulberry cultivation practices

1. Suitable soils- Location and climate for mulberry cultivation
2. Mulberry cultivation practices under irrigated and rainfed conditions and schedule of package of practices
3. Principles and practices of plant propagation with reference to mulberry
 - Sexual and Vegetative propagation
 - Cuttings: Preparation of Cuttings -Raising of nurseries
 - Grafting: Stem - Root - Bud grafting techniques
 - Layering: Ground-Air- Trench layering methods

UNIT-III: Planting Systems and Irrigation

1. Planting systems: Row system, Pit system and Paired row system
2. Irrigation and Water requirements of mulberry, water sources, water quality, Irrigation systems (surface, sprinkler and drip systems) and their practical utility in management. Irrigation schedules for mulberry.

UNIT- IV: Manures and fertilizers

1. Organic manures and their applications: Farm yard manure-Compost-Vermicompost-Oil cakes, Methods of compost and vermicompost preparations.
2. Green manuring: Green manure crops and their relevance in soil productivity.
3. Chemical fertilizers: Classification- Composition- Properties of major Nitrogenous, Phosphatic and potassic fertilizers, Secondary and micronutrient fertilizers, Complex fertilizers, dosage calculation- fertilizer schedules for irrigated and rain fed mulberry gardens, Foliar nutrition: Foliar nutrient formulations- Mode of applications- Merits and demerits.
4. Bio fertilizers: Types: Nitrogen- Phosphate -Cellulolytic- Biological nitrogen fixation- Importance- Applications and limitations

UNIT-V: Intercultivation, Pruning and Harvesting

1. Inter cultivation and weeding: Objectives, Common weeds of mulberry plantations. Problems posed by weeds. Preventive and control methods. Physical, Chemical, biological and integrated weed control techniques.
2. Pruning: Types, objectives, methods and practical relevance.

3. Harvesting: Leaf and shoot harvesting methods in relation to cultivation and rearing practices. Storage, transportation and preservation methods

PRACTICALS

1. Studies on morphology of *Morus* species/ varieties. (Variability related to stem, leaves and inflorescence, flower and floral parts)
2. Determination of soil pH (pH paper and pH meter methods)
3. Determination of water-holding capacity of different soil samples -
4. Farming practices (Field work/ demonstration)
 - a. Land preparation (digging, ploughing, hoeing, harrowing, levelling, bund making etc.)
 - b. Row system, Pit system and Paired row system of mulberry cultivation.
 - c. Stem- cutting preparation and raising mulberry saplings by adopting nursery bed and polythene bag methods.
 - d. Preparation of grafts
 - e. Preparation of layers
 - f. Irrigation methods
 - g. Application of manures and fertilizers
 - h. Identification of weeds and methods of weeding
 - i. Pruning and harvesting

REFERENCES BOOKS

- 1) Hand book of Sericultural Technologies Dandin, S.B., J. Jaiswal and K. Gridhar. 2000, Central Silk Board, Bangalore.
- 2) Hand book of Sericulture Technologies, Central Silk Board, Bangalore Dandin, S.B. and K. Giridhar. 2010. Central Silk Board, Bangalore.
- 3) **G. Savithri**, P.Sujathamma and P. Neeraja (2016) Sericulture Industry -An Overview, Agrobios Publishers, ISBN No. (13): 978-81-7754-589-0
- 4) Mulberry crop protection, D D Sharma Central Silk Board, Bangalore.
- 5) Manual on sericulture. V. 1: Mulberry cultivation [1976] Rangaswami, G.; Narasimhanna, M.N.; Kasiviswanathan, K.; Sastry, C.R.; et al. FAO, Rome (Italy). Agricultural Services Div.

WEB REFERENCES

<https://www.fao.org/ag/aga/agap/frg/mulberry/Papers/HTML/Datta.htm>

https://agritech.tnau.ac.in/sericulture/seri_mulberry%20cultivation.html

<https://www.agrifarming.in/mulberry-cultivation>

SERI 102- SILKWORM SEED AND COCOON PRODUCTION TECHNOLOGY

OBJECTIVES

1. To make the students to observe and understand the growth and development pattern of silkworm in different instars and to understand the moulting process.
2. To impart silkworm rearing techniques to obtain good quality of commercial cocoons the basic raw material of the silk industry.

COURSE OUTCOMES (COS)

After successful completion of course the student will be able to

CO1. Gain knowledge about organization setup of silkworm seed production and silkworm seed crop rearing. Able to examine marketing trends in seed cocoons and its price fixation.

CO2. Demonstrate disinfection procedures and mother moth examination.

CO3. Analyze the types of seed and commercial cocoon rearing and also categorize different rearing houses and appliances.

CO4. Demonstrate complete commercial silkworm rearing practices right from incubation to cocoon harvesting.

CO5. Acquaint the skills in the management of environmental conditions, feeding behaviour of silkworms, mounting and spinning of cocoons and their transportation and marketing.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H					M							H			
CO2	H															
CO3	H		M										M		H	
CO4	H											M	H		H	
CO5	H														H	

SYLLABUS

UNIT – I: Seed production Technology

1. Terminology in seed technology, Seed organization set up in India, Seed farms –P3, P2 and P1 – Cultivation practices of mulberry for seed crop rearing
2. Seed farms –P3, P2 and P1-Rearing technology of seed crop rearing
3. Seed act-seed areas and seed farmers. Seed cocoon markets-Marketing of seed cocoons and price fixing.

UNIT- II: Grainage Building and equipments

1. Grainage building and equipments- Disinfection - Steps involved in silkworm egg Production
2. Moth examination methods. Egg handling – MV and BV eggs
3. Loose eggs and handling – Preparation and packing. Incubation and black boxing, Cocoon Production Technology

UNIT-III: Silkworm rearing technology

1. Silkworm rearing technology – Importance – Types of rearing – Seed cocoonrearing and commercial rearing – Preparation for rearing silkworms – programming of mulberry garden.
2. Model rearing house – Different types of rearing houses – Modifications to control, Uzi fly infestation – Rearing appliances.

UNIT–IV: Rearing practices: I

1. Sanitation – Importance and methods of disinfection – disinfectants – Bed disinfectants.
2. Methods and importance of incubation-Black boxing-Brushing of silkworms – Young age silkworm rearing, methods– importance of Chawki rearing. Late age silkworm rearing, methods, their advantages and disadvantages.
3. Cleaning and spacing – Principles and methods of cleaning – bed cleaning schedule - Objectives of spacing – Optimum spacing for different ages – Care during moulting.

UNIT–V: Rearingpractices: II

1. Environmental factors for silkworm rearing – effect of temperature, humidity, air and light on growth and development of silkworm larvae – Optimum conditions – Devices to control temperature and humidity.
2. Selection of mulberry for different ages of silkworm larvae – Feeding behaviour – Preparation of feed – frequency and quantity of mulberry leaf.

3. Mounting and spinning – methods of mounting – types of mountages – Population Density – Care during mounting spinning process – harvesting of Cocoons – Time of Harvest – Cocoon sorting – Assessment – Transportation and Marketing.

PRACTICALS

1. Visit to the seed cocoon market- Study of market operation.
2. Visit to seed area – Study of seed crop rearing
3. Visit to Grainage- Study of Grainage building and grainage operations
4. Identification of sexes at pupal / moth level
5. Preparation of sheet eggs / loose eggs
6. Mother moth examination.
7. Processing and handling of eggs
8. Plan and types of rearing houses and rearing appliances
9. Disinfection – Fumigation- Different types of disinfectants –Bed Disinfectants – Brushing methods- Leaf preservation- Young and late age silkworm rearing- Moulting – care during moulting -cleaning,feeding- spacing and mounting.
10. Leaf harvesting methods- selection of optimum quality leaf for different larval stages.
11. Mounting- Spinning - picking methods
12. Production of commercial cocoons -Maintenance of records for silkworm rearing
13. Cocoon harvesting and assessment- categorization and separation of different types of cocoons- double, flimsy, flossy stained and pest infected cocoons.

REFERENCES BOOKS

- 1) Hand book of Sericultural Technologies Dandin, S.B., J. Jaiswal and K. Gridhar. 2000, Central Silk Board, Bangalore.
- 2) Hand book of Sericulture Technologies, Central Silk Board, Bangalore Dandin, S.B. and K. Giridhar. 2010. Central Silk Board, Bangalore.
- 3) **G. Savithri**, P.Sujathamma and P. Neeraja (2016) Sericulture Industry –An Overview, Agrobios Publishers, ISBN No. (13): 978-81-7754-589-0
- 4) Tribhuwan Singhet al (2015) Silkworm Rearing Technology: Principles and management

WEB REFERENCES

- <https://www.agrifarming.in/silkworm-rearing-methods-beginners>
[https://www.researchgate.net/publication/258381833 Management of Climatic Factors for Successful Silkworm Bombyx mori L Crop and Higher Silk Production A Review](https://www.researchgate.net/publication/258381833_Management_of_Climatic_Factors_for_Successful_Silkworm_Bombyx_mori_L_Crop_and_Higher_Silk_Production_A_Review)
<http://ndpublisher.in/admin/issues/IJAEBv11n5i.pdf>
<https://egyankosh.ac.in/bitstream/123456789/9078/1/Unit-2.pdf>

SERI 103-SILKWORM BIOLOGY AND BREEDING

OBJECTIVES

- To learn the morphology, life cycle and embryology of silkworm, *Bombyx mori* L.
- To understand the various biological systems, silk gland and endocrine glands of silkworm *Bombyx mori* L. and to develop the ability of the students and enhance the competency of the students to execute experiments in silkworm breeding.

COURSE OUTCOMES

After successful completion of course the student will be able to

CO1. Distinguish the taxonomic position, biology and morphology of silkworms.

CO2. Describe the internal morphology of silkworm with respect to digestive, secretory and respiratory systems. Identify structure and functions of silkworm gland

CO3. Explain the biology of circulatory, nervous, muscular and reproductive systems. Able to understand the endocrine system in silkworms and its functions.

CO4. Summarize about the germplasm maintenance and strategies for silkworm breeding.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H										H	M				
CO2	H				H							M	M	H		
CO3	H	M	H		M							H	H	M		
CO4	H	H									H	M	H	H		

SYLLABUS

UNIT-I: Morphology and Life cycle of Silkworm

1. Systematic position of mulberry silkworm-Life cycle of silkworm, *Bombyxmori* L.
2. External morphology of silkworm-Egg, Larva, Pupa and Adult
3. Embryology-Structure of Egg-Fertilization-Cleavage-Blastoderm-Germ band formation-Blastokinesis-Involution of the embryo

UNIT -II: Systems of Biology-I

1. Digestive system-Nutritional requirements of silkworm
2. Excretory system-Morphology and ultrastructure of Malpighian tubules
3. Respiratory system-Spiracles-Trachea-Types of respiration-Respiratory pigments
4. Silk gland-Structure and functions

UNIT-III: Systems of Biology-II

1. Circulatory system-Types of circulatory system-Dorsal blood vessel-Aorta-Heart-Heart beat-Alary muscles-Haemolymph
2. Nervous system-Central nervous system-Visceral or sympathetic nervous system-peripheral nervous system
3. Muscular system-Structure of muscles-Types of muscles-Flight muscles
4. Reproductive system-Male and Female reproductive system of silk moth.

UNIT-IV: Endocrinology

1. Endocrine system-Neuro secretory cells-Corpora cardiaca-Corpora allata-prothoracic gland-suboesophageal ganglion
2. Pheromones-Types of pheromones-Advantages and disadvantages of pheromones.

UNIT-V: Silkworm Breeding

1. Silkworm breeding in India
2. Silkworm Races-Characteristics of different geographical races
3. Maintenance of silkworm germplasm and stocks
4. Strategies for silkworm breeding-Types of crosses-Sex discrimination-Maternal inheritance in *Bombyxmori*
5. Heterosis in silkworm

PRACTICALS

1. Study of larval morphology and Dissection and display of different parts in Silkworm

Bombyxmori

- i. Mouth parts
 - ii. Spiracle
 - iii. Silk glands
 - iv. IshiwattaandHerold's glands
 - vi. Digestive system
 - vii. Nervous system
 - viii. Male & Female Reproductive system
2. Study of Silkworm races
 3. Calculation of Inbreeding depression and Heterosis

REFERENCES BOOKS

- 1) Manual on sericulture. V. 2: silkworm Biology [1976] Rangaswami, G.; Narasimhanna, M.N.; Kasiviswanathan, K.; Sastry, C.R.; et al. FAO, Rome (Italy). Agricultural Services Div.

WEB REFERENCES

<http://www.jnkvv.org/PDF/06042020112348a.pdf>

OBJECTIVES

- The students study about textile fibers, properties of silk, cocoon properties, cocoon processing technology,
- The students learn about silk reeling, silk testing and spun silk processing

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Able to classify different types of textile fibers and able to distinguish textile fiber characteristics by different technical skills.

CO2. Evaluate the practicability of traditional cocoon testing methods of other countries under Indian conditions. Able to assess the cocoon characteristics for quality check.

CO3. Analyze merits and demerits of different cocoonstifling methods and cocoon storage and preservation practical techniques.

CO4. Describe different pre reeling techniques and able to demonstrate reeling methods on various reeling devices.

CO5. Appraise the silk quality through visual and mechanical testing techniques.

Mapping COs with Pos and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		M										H	M		
CO2	H													M		
CO3	H	M			L	M							H		M	
CO4	H	M			L	M							H	M	H	
CO5	H		M		M	H					M		H	M	H	

SYLLABUS

UNIT-I: Introduction to Textile fibres

1. Textile fibres: Brief introduction to natural and manmade fibres- cotton, flax, wool, silk acetate, triacetate, nylon, polyester, Acrylics.
2. Physical and chemical properties of silk. Identification of fibres- Burning and microscopic tests.

UNIT-II: Cocoon characters& assessment

1. Cocoon properties-assessment – cocoon testing-methods followed in Japan and their practicability under Indian conditions- cocoon sorting.
2. Defective cocoons –Types of defective cocoons, shell percentage shell ratio. Assessment of cocoon by filament length-filament denier- Estimated renditta. Raw silk percentage-kakeme cost.

UNIT-III: Cocoon processing technologies

1. Cocoon stifling /drying- objectives-Different methods- merits and demerits of each method.
2. Cocoon storage and preservation of cocoon in silk reeling units- factors to be considered for ideal storage- faulty storage- fungus and insect attack.

UNIT-IV: Silk reeling technology

1. Cocoon boiling/cooking-objectives- different methods-open pan, three pan, pressurized cocoon boiling system. Floating and sunken system, merits and demerits of each method.
2. Silk reeling- system of reeling- direct and indirect type-. Reeling method on country charakha, improved charakha, cottage basin, multiend and automatic reeling machines

UNIT-V: Silk testing and grading

1. Raw silk testing- visual methods
2. Mechanical tests, winding test, size test, tenacity, elongation test-evenness, cleanness, neatness test, cohesion, testing and grading

PRACTICALS

1. Textile testing-burning test-natural fibres-silk, cotton, wool, flax, Manmade fibres-nylon, polyester.
2. Commercial characters of cocoon
3. Cocoon sorting-estimation of defective cocoon and good cocoon percentage.
4. Determination of shell percentage of cocoon, Assessment of estimated renditta
5. based on defective cocoon percentage and shell percentage.

6. Calculation of filament length.
7. Cocoon cooking- open type, three pan type
8. Passage of thread on charkha, improved charkha, cottage basin, multiend reeling machine.
9. Raw silk examination-visual examinations
10. Calculation of denier variation across cocoon shell

REFERENCES BOOKS

Tammanna N. Sonwalkar (1993) **Handbook on Silk Technology, New Age International (p) limited publishers**

H. Panda (2010) The Complete Book on Textile Processing and Silk Reeling Technology, **ASIA PACIFIC BUSINESS PRESS Inc.**

WEB REFERENCES

<http://www.indiaagronet.com/indiaagronet/sericulture/contents/Raw%20Silk.htm>

SERI 201 MULBERRY PHYSIOLOGY AND PATHOLOGY

OBJECTIVES

- To teach the students the vital mechanism of photosynthesis and to make the students understand the important abiotic stresses like drought and salt stress and their impact on plant growth and plant response.
- To teach the students about biological nitrogen fixation and different plant growth regulators and their role to make the students understand different types of pests and disease of mulberry their life cycle and integrated pest and disease management.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Recall the mechanism of photosynthesis and are able to examine adverse effects of drought on mulberry plant growth and response

CO2. Describe symbiotic and asymbiotic N₂ fixation methods. Able to compare and contrast different plant growth regulators and their mode of action.

CO3. Able to examine different mulberry diseases and their management .

CO4. Distinguish different pests of mulberry and analyze crop loss and its management.

CO5. Able to execute different crop protection measures.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M		H	M							H		H	
CO2	H													H		
CO3	H	H	M		H	M							H	H	M	
CO4	H	H	M		H	M							H	H	M	
CO5	H	H			M	M	M	H					H		L	

SYLLABUS

UNIT-I: Photosynthesis & Transpiration

1. Photosynthesis-photosynthetic pigments involved in photosynthesis and their characteristics, photosynthetic phosphorylation, carbon fixation and reduction mechanism (C3, C4 and CAM)-photorespiration and productivity, factors affecting photosynthesis.
2. Drought and its effect on growth and development of mulberry. Biochemical and physiological adaptations, drought resistance. Transpiration-significance-Stomatal dynamics- Theories - and anti transpirants.

UNIT-II: Nitrogen fixation & PGR

1. Biological nitrogen fixation: symbiotic and non symbiotic biological nitrogen fixation mechanisms.
2. Growth regulators (Auxins, GA, Cytokinins, ABA, Ethylene and plant phenolics)- Chemistry, structure, distribution, transport, bioassay, physiological functions and mode of action.

UNIT –III: Diseases of Mulberry

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

UNIT- IV: Pests of Mulberry

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

UNIT-V: Crop Protection measures

1. Integrated pest management (IPM) - Crop protection measures:
 - i. Preventive measures
 - ii. Physical, chemical and biological methods of disease control.
 - iii. Pest control measures: Physical, chemical and biological methods of pest control.
 - iv. Important bio control agents of pests of mulberry and their significance.

PRACTICALS

1. Estimation of Total chlorophyll pigments by solvent stress method
2. Separation of chlorophyll pigments by paper chromatography method -
3. Determination of the absorption spectra of chlorophyll pigments by colorimetric method
4. Studies on the internal structure of C3 and C4 plants (Eg. Sugarcane and mulberry leaves)
5. Studies on the effect of drought (water stress experiment) and water logging on growth and development of mulberry
6. Determination of stomatal frequency in mulberry genotypes
7. Diseases of Mulberry: Fungal, bacterial and viral (students are expected to submit herbaria of different foliar diseases)-Histopathological studies-identification and characterization of different pathogens (Submission of three to five permanent slides)
8. Pests of mulberry: tukra-wingless grass hoppers-jassids-other important local pests and their seasonal occurrence-biological control agents of pests
9. Crop protection equipment: dusters, sprayers and fumigants
10. Identification of natural antagonists of pests of mulberry (Field study).4 visits

REFERENCES BOOKS

- 1) Mulberry crop protection, D D Sharma Central Silk Board, Bangalore.,
- 2) Experiments in Microbiology, plant pathology, Tissue culture and Mushroom cultivation K R Aneja, New age Publishers.
- 6) Textbook of Modern Plant Pathology K. S. Bilgrami and H.C. Dube
- 7) Fundamentals of Plant Physiology, by V. K. Jain
- 8) Plant Physiology, H. S. Srivastava
- 9) Plant Physiology, S, N. Pandey

WEB REFERENCES

[https://www.researchgate.net/publication/344807694 PHYSIOLOGY OF MULBERRY AND SILKWORM](https://www.researchgate.net/publication/344807694)

SERI 202 :SILKWORM PHYSIOLOGY AND PATHOLOGY

OBJECTIVES

- To understand about the physiology of digestive, excretion, circulation, reproduction, mechanism of muscle contraction, glandular system, mode of action of insect hormones.
- To impart skills to diagnose the silkworm diseases and pests on silkworm *Bombyx mori*.

COURSE OUTCOMES

After successful completion of course the student will be able to

CO1. Describe the physiological functioning of vital processes like digestion, excretion, nervous system and reproduction.

CO2. Analyze biological rhythms of insect behavior.

CO3. Investigate silk worm glandular systems and their functions with special reference to endocrine system and hormonal mechanism.

CO4. Discuss about the various bacterial, viral, fungal and protozoa diseases that affect silkworm

CO5. Evaluate pests and predators of silkworm and their control measures.

Mapping Cos with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M									M			H		
CO2	H	M									M			H		
CO3	H	M									M			H		
CO4	H	H			H			M	M		M		H	H		
CO5	H	H			H			M	M		M		H	H		

SYLLUBUS

UNIT -I: Silkworm Physiology

1. Physiology of digestion in silkworm – Physiology of Blood circulation in silkworm – Physiology of excretion in silkworm –
2. Morphology and physiology of nervous system in silkworm during metamorphosis –
3. Types of muscles-Fuels for flight-Metabolism in flight - Mechanism of muscle contraction –
4. Reproduction – Spermatogenesis – Oogenesis

UNIT-II: Insect behaviour

1. Insect behaviour: Insect clocks
2. Types of biological rhythms
3. Photoperiodism-Dormancy
4. Quiescence and Diapause-Types of diapauses

UNIT-III: Glandular system

1. Glandular system: Exuvial gland, salivary gland, tracheal gland, prothoracic gland,
2. Suboesophageal gland, peritracheal gland, oenocytes and pericardial cells Structure and function of silk gland.
3. Insect endocrinology-Endocrine glands and their secretions-Mode of action of insect hormones-functions of endocrine organs

UNIT -IV: Silkworm diseases & pathology

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

UNIT-V: Pests& predators of Silkworm

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

PRACTICALS

1. Activity levels of amylase in mid gut and haemolymph silkworm *Bombyxmori*.
2. Estimation of trehalose in haemolymph of silkworm larvae.
3. Estimation of glycogen in different tissues of silkworm larvae.
4. Estimation of glucose in different tissues of silkworm larvae.
5. Identification of Silkworm diseases and pests- symptoms at larval stage- pebrine, graserie, flacherie and muscardine.
6. Culturing and staining of bacteria and fungi.
7. Crop protection equipment: Dusters, sprayers etc. Disinfectants and Bed Disinfectants - other chemicals.

REFERENCES BOOKS

Govindan R, Tk Narayana Swamy, Mc Devaiah (1998) Principles of Silkworm Pathology, Seri Scientific Publishers

Silkworm crop protection Dr.B.Nataraju,Dr.Siva Prasad,Dr.D.Manjunath and Mr C.Aswani Kumar, Central SilkBoard,Bangalore

Principles of Sericulture by Hisao Aruga, CRC Press

WEB REFERENCES

[https://www.researchgate.net/publication/344807694 PHYSIOLOGY OF MULBERRY AND SILKWORM](https://www.researchgate.net/publication/344807694)

SERI -203BIOCHEMISTRY

OBJECTIVES

- To understand the importance and mechanisms of carbohydrates, proteins, nucleic acids, lipids and enzymes.
- To learn about vitamins and plant hormones and their physiological role.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Explain the carbohydrate metabolism.

CO2. Differentiate the metabolism of proteins and nucleic acids.

CO3. Describe the lipid and fatty acids metabolism.

CO4. Illustrate enzymes and enzyme metabolism.

CO5. Compare the role of vitamins and hormones in insect physiology.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H										H			H		
CO2		H									H			H		
CO3	H													H		
CO4	H				L						M			H		
CO5								M			M			H		

SYLLABUS

UNIT-I: Carbohydrates and Pathways

1. Importance of pH-Henderson-Hasselbalch equation-Buffers-Zwitterions
2. Carbohydrates-Structure, properties and classification

3. Pathways of metabolism of glucose-Glycogenesis-Glycogenolysis-Glycolysis-citric acid cycle-Gluconeogenesis-HMP pathway-Uronic acid pathway

UNIT-II:Proteins and Nucleic acids

1. Proteins-Classification and properties-silk proteins
2. Aminoacids-Classification and properties
3. Nucleic acids-Types and functions
4. Nitrogenous bases-Nucleosides-Nucleotides-Structure of DNA and RNA
5. DNA synthesis (Replication)
6. RNA synthesis (Transcription)
7. Protein synthesis (Translation)

Unit-III: Lipids and Fatty acids

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

Unit-IV:Enzyme and its Mechanism

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

Unit-V: Vitamins and Hormones

1. Vitamins-Fat soluble vitamins-metabolism-functions and deficiency symptoms Water soluble vitamins-metabolism-functions and deficiency symptoms
2. Plant hormones-Definition-Types of hormones
3. Auxins-Physiological role of auxins
4. Gibberellins - Physiological role of gibberellins
5. Cytokinins - Physiological role of cytokinins

PRACTICALS

1. Estimation of proteins in silk gland of silkworm larva.
2. Estimation of total free amino acids in silkworm tissues.

3. Estimation of ammonia in silkworm excreta.
4. Estimation of uric acid in silkworm excreta.
5. Estimation of urea in silkworm excreta.
6. Estimation of glutamine in silkworm excreta
7. Estimation of cholesterol in haemolymph of silkworm larva.
8. Estimation of lactic acid in haemolymph of silkworm larva.

REFERENCES BOOKS

1. Satyanarayana U and Chakrapani U Biochemistry, published by Books & Allied Ltd
2. Lehninger Principles of Biochemistry by David L. Nelson & Michael Cox
3. Biochemical methods S Sadasivam and A Manickam, New age international Publishers

WEB REFERENCES

<https://worldofmedicalsaviours.com/vasudevan-biochemistry-pdf/>

OBJECTIVES

- To discuss the structure of DNA, Mitochondrial genome, DNA replication, mechanisms of DNA damage and repair.
- To explain the process of transcription, translational and regulating the expression of prokaryote and eukaryotic genes.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Explain DNA and RNA organisation and replication

CO2. Discuss DNA replication in detail and explain about DNA damage and repair.

CO3. Distinguish the process of transcription and bio synthesis of RNA.

CO4. Illustrate the translation mechanism in prokaryotes and eukaryotes.

CO5. Analyze the structural and functional features of biological databases.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H									M			H		
CO2	H	H									M	L	L	H		
CO3	H	H									M			H		
CO4	H	H												H		
CO5	H	H							H		H			H		H

SYLLABUS

UNIT-I: Introduction to Nucleic acids

1. Introduction to nucleic acids- Biochemical evidence, structure and properties of DNA - Watson and Crick model of DNA, types of DNA, DNA organization in Chromosomes
2. Structure and properties of RNA, different types of RNA- t RNA, mRNA and rRNA DNA replication in prokaryotes and eukaryotes.

UNIT-II: DNA replication, damage & repair

1. DNA replication, semi-conservative replication – conservative replication discontinuous replication-Enzymology of DNA- replication, polymerases and other types of enzymes, multiple forks, fragments in replication, events in replication fork, Bi directional replication, termination of replication.
2. DNA damage and repair – types of DNA damage – deamination – oxidative damage alkylation and pyrimidine dimers – repair pathways mismatch – short patch repair nucleotide / base – excision repair - recombination repair.

UNIT-III: Biosynthesis of RNA & transcriptional system

1. Transcription–enzymes and molecular mechanisms involved in transcription, Regulatory sequences and transcriptional factors.
2. Biosynthesis of RNA, processing of rRNA, tRNA and mRNA in prokaryotes and eukaryotes, polycistronic and monocistronic mRNA, catalytic RNAs (ribozymes), inhibitors of transcription *In vitro* transcriptional systems and reverse transcription.

UNIT-IV: Post translational mechanisms

Translation-Ribosomes, genetic code, polypeptide chain initiation, elongation and termination in prokaryotes and eukaryotes, post-translational modifications. Protein localisation and translocation, inhibitors of protein synthesis

Unit-V: Bioinformatics

Introduction

Biological databases

1. Primary databases

A. Nucleotide databases: NCBI, EMBL, DDBJ.

B. Protein databases: SWISS PROT, PIR, MIPS, Tr-EMBL

2. Secondary databases: PROSITE, PRINTS, BLOCKS, PATTERNS

3. Protein structural Classification Databases: SCOP, CATH

4. Protein structure database: PDB

PRACTICALS

1. Extraction of Genomic DNA from tissues.
2. Isolation of Plasmid DNA
3. Quantification of DNA by Spectrophotometer
4. Extraction of RNA from dry yeast
5. Estimation of RNA by Orcinol method.
6. Quantification of DNA by Agarose Gel electrophoresis
7. SDS PAGE
8. Restriction digestion of Genomic DNA
9. Southern Blotting.
10. Retrieval of Nucleotide sequences from NCBI, DDBJ, EMBL
11. Protein sequence retrieval from Swiss port.
12. Protein sequence classification using SCOP and CATH.
13. Secondary databases information retrieving from PROSITE, PRINTS and BLOCKS.
14. Local alignment of sequence using BLAST.
15. Global alignment of sequence using FASTA

REFERENCES BOOKS

Principles of Molecular Biology, Rastogi

Jennifer A. Hackett, Julia Masters (2018), Molecular Biology: Concepts for Inquiry

Imran Patel and Nivedita Das (2015) A Textbook of Molecular Biology, Vision Publications

WEB REFERENCES

<https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/>

https://pages.jh.edu/rschlei1/Random_stuff/publications/molbiogene.pdf

INTERNAL ELECTIVES (IE-I)

SERI- 301 IE-I

(MOOC's Courses available on Swayam Portal)

- a)
- b)
- c)

MOOCs COURSES

OBJECTIVES

1. To aim at large-scale interactive participation and open access via the web, to provide interactive user forums that help build a networking community.
2. To provide free and open registration and distance education learning and to access online resources.

COURSE OUTCOMES

After successful completion of the course the student will be able to

1. Acquire knowledge to access the free online courses and integrate social networking.
2. Acquire knowledge to self-organize their participation according to learning goals, prior knowledge and skills, and common interests.

Mapping COs with Pos and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1									H		H			H		
CO2									H		H			H		
CO3																

SERI – 302 RESEARCH METHODOLOGY

OBJECTIVES

1. To enable the students to understand the significance of research methodology, develop ability to use appropriate data gathering methods and enhance the ability to interpret and present data in research report.
2. Gain knowledge on the role of statistics in research and apply statistical techniques in interpreting data meaningfully, and know the issues in research, intellectual property rights and patents.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Identify research methodologies and significance of scientific research procedures and qualities of researcher.

CO2. Execute research planning, hypothesis formation and sketch different types of hypothesis.

CO3. Compare the experimental designs and sampling methods.

CO4. Summarize research report in a better way and choose better options for publication and presentation

CO5. Compile research results and follow ethics in scientific writing to get intellectual property rights and able to produce patents.

Mapping COs with Pos and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		H				H			H	H		M		H		M
CO2		H				H			H	H		M		H		M
CO3		H				H			H	H		M		H		M
CO4		H				H			H	H		M		H		M
CO5		H				H			H	H		M		H		M

SYLLABUS

UNIT-I

Research: Meaning, Objectives, Motivation, Utility of Research, Research Significance – Types: Fundamental, Applied and methods, Qualities of researcher – Steps in Scientific research.

UNIT – II

Planning a Research: Selection of a problem – Formulation of research problem – Need for literature review – Sources of literature – Hypothesis formation – Types of hypothesis.

UNIT – III

Research Design: Basic principles – Features of a good design – Experimental designs.

Sampling methods: Characteristics of a good sample design – Probability and non-probability sampling methods.

UNIT – IV

Report Writing: Components – Types of reports, Layout of research report, Principles of writing, References, Appendices – Format of publication in research Journals – Paper Presentations: Planning, Preparation, Visual aids – Preparation of research proposal.

UNIT –V

Application of research results and ethics: Ethical issues –copy right, plagiarism, royalty-ethical committees, Intellectual property rights and Patents- Types of patents, Patent filling procedure.

REFERENCES BOOKS

C.R. Kothari, Gaurav Garg (2019) Research Methodology: Methods and Techniques

WEB REFERENCES

SERI- 303 NON- MULBERRY SERICULTURE

OBJECTIVES

- To Impart knowledge on different types of wild silks their distribution, food plant cultivation of wild silk worms like Tasar, Muga and Eri.
- To make the students understand various seed and cocoon production technology of Tasar, muga and Eri silkworms

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Describe different types of vanya (non-mulberry) silks and their status in India.

CO2. Illustrate food plant cultivation practices for Tasar and Muga silkworms and apply better management skills against pests and diseases of Tasar and Muga.

CO3. Demonstrate food plant cultivation practices for Eri silkworm.

CO4. Correlate Tasar and Muga silk worm rearing practices egg and cocoon production techniques.

CO5. Develop Eri silkworm seed and cocoon production technology.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H									L		M	M			
CO2	H	M	H		L	M		M					H	H		
CO3	H	M	H		L	M		M					H	H		
CO4	H	M	H		L	M	M	M				H	H	H		
CO5	H	M	H		L	M		M					H	H		

SYLLABUS

UNIT-I: General account of Vanya sericulture

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

3. Distribution of vanya sericulture

UNIT-II: Food plant cultivation of Tasar and Muga silkworms

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

UNIT-III: Food plant cultivation of Eri silkworms

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

UNIT-IV:Seed and Cocoon production technology of Tasar and Muga silkworms

1. Cocoon production technology: Rearing of Tasar and Muga Silkworms
- 2 Diseases, pest and predators of tasar and muga silkworms
3. Seed production technology of tasar and muga silkworms

UNIT-V: Seed and Cocoon production technology of Eri silkworms

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

Practicals

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

8. Identification of stages of Eri silkworm and study of life cycle 1class
9. Study of Eri cocoon production process 1class
10. Study of Eri seed production process 1class

REFERENCES BOOKS

Non-Mulberry Silks,by M. S. Jolly

Introduction to Non-Mulberry Silkworms,D. Elumalai , P. Mohan raj, et al
Wild Silks of India -An User Compendium,Central Silk Board(4 volumes)

WEB REFERENCES

<https://egyankosh.ac.in/bitstream/123456789/9172/1/Unit-4.pdf>

OBJECTIVES

- The paper is useful to make the students to learn the techniques and principles of transfer of knowledge and skills to the farmers to improve the adaptability of advanced techniques at the field level.
- It will make the students to understand Sericulture holistically.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Summarize the additional knowledge on the present status of sericulture worldwide and various schemes promoted by the Government.

CO2. Discuss the importance and pros and cons of transfer of technology (TOT) and various methods of Sericulture extension.

CO3. Describe the concept of farm management and functions through efficient coordination and communication skills

CO4. Assess the employment potentiality, prioritize recycling of sericulture waste to balance the environment and to support the marketing system of the industry.

CO5. Analyse the cost and benefit ratio in cocoon and silk production.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	M	L	M	M		H			H	M			H	
CO2			H	H	H			H	H		H	H		H		
CO3	M		M			H	M	H	M	M	H	H	H			
CO4	H	L	H		M	M		M			M			H		
CO5	H	H	M					M						M	M	

SYLLABUS

UNIT-I: History of Sericulture

1. History of Sericulture-Present status of Sericulture in the world. India's position: Distribution of Sericulture in India.
2. Organizational setup in Sericulture- Central silk Board and its role in promoting Sericulture-Variou schemes- Role of state government.

UNIT-II: Sericulture extension

1. Extension education-meaning-principles of education.
2. Classification of various extension teaching methods-scope and limitation of each methods- individual, group, mass contact methods.
3. Concept and functions of communication- definitions- meaning- importance in communication- evaluation.

UNIT-III: Farm management

1. Meaning, scope of management- importance of management- basic functions of management- Basic functions of management- planning- organising- staffing- Directing- motivating- controlling coordination-communication.
2. Concept of farm management- basic principles of farm management- Sericulture farm management- importance.

UNIT-IV: Sericulture industry –Importance

1. Employment potential in Sericulture.
2. Impact of advanced technology in the development of Sericulture industry.
3. Marketing of cocoons and silk –History – functions of regulated markets. Exports and imports of silk goods.
4. Exports and imports: preparing for exports- pre-inspection by Central silk Board- Customs clearance

UNIT-V: Economics of Silk industry

1. Economics of mulberry cultivation and Nursery raising
2. Economics of cocoon production
3. Economics of seed production
4. Economics of silk production.
 - i. Charkha
 - ii. Cottage basin and Multiend reeling basin

PRACTICALS

1. Visits to surrounding Sericulture villages
2. Visits to different Sericulture units
3. Rearing farms
4. Grainages
5. Reeling Units
6. P3, P2, P1 Seed farms
7. Regulated cocoon markets
8. Private entrepreneurs

REFERENCES BOOKS

Kumaresan P, Srinivasa G Sericulture Extension Management & Economics: publishers Central Silk Board

EXTERNAL ELECTIVE (EE)

SERI EE- SERICULTURE AND ENTREPRENEURIAL DEVELOPMENT

COURSE OBJECTIVES

- The main focus of the paper is to motivate the students for self-employment and to discuss various issues of entrepreneurial opportunities in sericulture industry.
- The paper mainly comprises of economics, cost benefit ratio and managerial aspects which are essential to become an entrepreneur.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Summarize the present status and the challenges of sericulture industry.

CO2. Describes the scientific package of practices of mulberry cultivation and propagation methods.

CO3. Analyze mulberry integrated pests and disease management.

CO4. Develop entrepreneurial skills in silkworm seed production.

CO5. Explain various silkworm rearing technologies to plan for enterprise in cocoon production.

Explain various silkworm rearing technologies and applicable disease management with an emphasis to develop entrepreneurship.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1			H		M			H			H				H	
CO2	M	M	H					M			H	M			H	
CO3		H			H			M			H				H	
CO4	H	H	H					H			H	M			H	
CO5	H	H	H					H			H	M			H	

SYLLABUS

UNIT-I: Introduction to Sericulture

1. General Introduction to Sericulture and its distribution in India. Insect and non-insect fauna producing silk; types of silk produced in India; status of mulberry and non-mulberry Sericulture in India. Sericulture organization in India.
2. Scope of Sericulture in India, employment potential and income generation.
3. Entrepreneurship Development Programme (EDP) for new enterprise creation; emergence and objectives of EDP.

UNIT-II: Mulberry cultivation

1. Morphology of mulberry --Varieties and their distribution.
2. Mulberry cultivation practices under irrigated and rainfed conditions and schedule of package of practices
3. Mulberry propagation: Sexual and Vegetative propagation
 Cuttings: Preparation of Cuttings -Raising of nurseries
 Grafting: Stem - Root - Bud grafting techniques
 Layering: Ground-Air- Trench layering methods

UNIT- III:

1. Planting systems: Row system- Pit system -Paired row system
2. Pruning: Objectives and methods

3. Harvesting- Transportation - Preservation of mulberry leaves.
4. Pests and diseases of mulberry and their management
5. Entrepreneurship development in mulberry cultivation

UNIT-VI: Seed Technology

1. Silkworm seed organization and its significance; importance of seed areas (bivoltine and multivoltine)
2. Grainage operations: Grainage building, Procurement and preservation of seed cocoons, sexing, moth emergence, mating, oviposition – sheet and loose eggpreparation, mother moth examination, surface sterilization of eggs, packing and sale of eggs. Entrepreneurship development in silkworm egg production.

UNIT-V: Cocoon production Technology

1. Rearing operations: Life cycle of the silkworm, *Bombyxmori*; transportation and incubation of eggs, disinfection, brushing, young and late-age rearing, environmental requirements, feeding, cleaning, spacing, care during moult, mounting and spinning, cocoon harvesting, transportation, marketing and cocoon markets.
2. Entrepreneurship development in silkworm rearing – chawki rearing Units. Pests and diseases of silkworm and their management

REFERENCES BOOKS

- 1) Hand book of Sericultural Technologies Dandin, S.B., J. Jaiswal and K. Gridhar. 2000, Central Silk Board, Bangalore.
- 2) Hand book of Sericulture Technologies, Central Silk Board, Bangalore Dandin, S.B. and K. Giridhar. 2010. Central Silk Board, Bangalore.
- 3) **G. Savithri**, P.Sujathamma and P. Neeraja (2016) Sericulture Industry –An Overview, Agrobios Publishers, ISBN No. (13): 978-81-7754-589-0
- 4) Mulberry crop protection, D D Sharma Central Silk Board, Bangalore.
- 5) Manual on sericulture. V. 1: Mulberry cultivation [1976] Rangaswami, G.; Narasimhanna, M.N.; Kasiviswanathan, K.; Sastry, C.R.; et al. FAO, Rome (Italy). Agricultural Services Div.
- 6) Hand book of Sericultural Technologies Dandin, S.B., J. Jaiswal and K. Gridhar. 2000, Central Silk Board, Bangalore.
- 7) Hand book of Sericulture Technologies, Central Silk Board, Bangalore Dandin, S.B. and K. Giridhar. 2010. Central Silk Board, Bangalore.
- 8) **G. Savithri**, P.Sujathamma and P. Neeraja (2016) Sericulture Industry –An Overview, Agrobios Publishers, ISBN No. (13): 978-81-7754-589-0

- 9) Tribhuwan Singh et al (2015) *Silkworm Rearing Technology: Principles and management*
- 10) Tammanna N. Sonwalkar (1993) *Handbook on Silk Technology*, New Age International (p) limited publishers
- 11) H. Panda (2010) *The Complete Book on Textile Processing and Silk Reeling Technology*, ASIA PACIFIC BUSINESS PRESS Inc.

SEMESTER –IV

INTERNAL ELECTIVES (IE-II) SERI 401 IE-II a) Value addition in Sericulture

OBJECTIVES

- To make the students understand about various value-added products prepared from different wastes generated during various stages of sericulture.
- To provide hands-on training in the preparation of value added products from sericulture wastes obtained during various stages of silk production

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. examine different sericulture byproducts of various sectors of sericulture industry.

CO2. Analyze the chemical composition of mulberry medicinal value and pharmaceutical utility of mulberry plant parts.

CO3. Develop and formulate different value added products of mulberry fruit and leaf.

CO5. Design biotechnological applications in recycling of byproducts from silk worm bed refuse.

CO6. Hypothesize the application of silk proteins for pharmaceutical and biomedical fields.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		H	M	M	H	M	M		L	M	M	L		H	
CO2	H		H	M	M	H	M	M			M	M			H	
CO3	H		H	M	M	H	M	M			M	M			H	
CO4	H		H	M	M	H	M	M			M	M			H	
CO5	H		H	M	M	H	M	M			M	M			H	

SYLLABUS

UNIT-I: General account of by-products /value added products in Sericulture

1. Importance and Scope of Sericulture value added/by product industry in India
2. Entrepreneurship development in by-products of Sericulture

UNIT-II: Pharmaceutical value of mulberry

1. Mulberry Leaf chemical composition
2. *Medicinal value/pharmaceutical utility of mulberry leaf, mulberry fruit, mulberry stem and root*

UNIT-III :Value added products of Mulberry

1. Different recipes from mulberry leaf and fruit
2. Value added products from mulberry leaf , stem, root and fruit

UNIT-IV :Value added products of Cocoon

1. Silkworm rearing bed refuge for vermi compost preparation and Mushroom cultivation -
Silkworm larvae for human consumption- nutrition value-
2. Silkworm as biotechnological and laboratory tool
3. Cocoon based handicrafts, defective and double cocoons for production of dupion silk

UNIT-V: Value added products of Silk

1. Value Adding Potentials and Prospects for Silk- types of silk wastes – spun silk- noil yarn and its utility.
2. Silk worm pupae as food material and - pupal oil extraction and its uses
3. Application of silk protein fibroin and Sericin as a biomaterial and other Seri-by-products-
pharmaceutical application- biomedical application- cosmetic application

PRACTICALS:

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

Recipes from mulberry leaf

TEXT BOOKS

REFERENCES BOOKS

WEB REFERENCES

SERI 401 IE-II b)ENVIRONMENTAL SCIENCE

OBJECTIVES

- To understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities, and ecosystems.
- To sensitize students towards environmental concerns, issues, and impacts of climate change and related management strategies.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Explain population ecology and the ecological niche.

CO2. Describe the community ecology species interaction and ecological succession.

CO3. Explain the natural resources and summarize the conservation biology.

CO4. Define the environmental pollution cause and effects of pollution.

CO5. Summarize the natural disasters and recommend the disaster management.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	M				M		H						M	M		
CO2	M				M		H						M	M		
CO3	M				M		H						M	M		
CO4	M				M		H						M	M		
CO5	M				M		H						M	M		

SYLLABUS

Unit-I: Environment & Population Ecology

1. The Environment: physical environment, biotic environment, biotic and abiotic interactions

2. Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
3. Population ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection). Concept of meta population-demes and dispersal, interdemec extinctions, age Structured populations

Unit-II:Community Ecology

1. Species interactions: Types of interactions, inter specific competition, herbivory, carnivore, pollination, symbiosis
2. Community ecology: nature of communities, community structure and attributions, levels of species diversity and its measurement, edges and ecotones.
3. Ecological succession: types, mechanisms, changes involved in succession, concept of climax.

Unit-III:Conservation biology

1. Natural Resources:Introduction-Atmosphere,Hydrosphere,Lithosphere,Biosphere - Different natural resources, Water recourses, Land resources, Forest resources, Mineral Resources Energy resources, Food resources
2. Conservation biology: principles of conservation, major approaches to management, and Indian case studies on conservation / management strategy (Project tiger, biosphere reserves).

Unit 1V:Environment pollution

1. Environmental pollution: Introduction-Types of pollutants, causes of pollution
2. Types of pollution: Air pollution, Water pollution, Land pollution, Noise pollution, Radioactive pollution and Plastic pollution

Unit- V: Disease & Disaster management

1. Natural disasters: Introduction and Management; Different natural disasters: Floods, Cyclones, Earth quake, Landslides and Drought
2. Disaster management

PRACTICALS

1. Study of SPMVV campus vegetation
2. Vegetation analysis
3. Determination of minimum no.of quadrates of analysis a plant community

4. Determination of minimum size of quadrates by species area- curve method
5. Determination of species wise- method in plant community.
6. Soil sample collection procedure
7. Estimation of Biomass.
8. Estimation of organic matter in different soil samples.
9. Estimation of water holding capacity of different soil samples.
10. Estimation of chlorides in soil samples.
11. Estimation of carbonates in soil samples.
12. Estimation of soil pH in different soil samples.
13. Estimation of organic matter in different water samples
14. Estimation of dissolved O₂ in different water samples.
15. Estimation of salinity in different water samples
16. Estimation of phosphates in different water samples.
17. Estimation of water pH in different water samples.
18. Visit local area to document Environmental assets
 - a. Study of River environment
 - b. study of a forest environment
- c. Environmental aspects of a grass land
 - d. Study of mountain and hill area
 - e. Study of a industrial polluted area
 - f. study of a water- logged / saline land
- g. Study of common plants, insects and birds

REFERENCES BOOKS

1. J S Singh, S P Singh, S R Gupta – Ecology Environmental Science and Conservation, S Chand Publ. 2014
2. Sharma, P.D. 2015. Ecology and Environment. 12th ed. Rastogi Publications, Meerut.
3. Cunningham, W.P. & M.A. Cunningham 2007. Principles of Environmental Science- Inquiry and Applications. Tata McGraw Hill Pub. New Delhi.

WEB REFERENCES

1. <https://openoregon.pressbooks.pub/envirobiology/front-matter/introduction>
2. <https://openoregon.pressbooks.pub/envirobiology/chapter/1-3-environment-sustainability/>

SERI 401IE-II c) TOOLS AND TECHNIQUES

OBJECTIVES

- To describe the basic aspects of some of the analytical instruments.
- To understand the working principal of techniques like Chromatography, Electrophoresis, Spectrophotometry, Centrifugation, Microscopy

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Acquire knowledge about various in-vitro and in-vivo biological assays, different tools & techniques used in biological systems and identify their use in research.

CO2. Demonstrate competency in using standard laboratory instruments and function successfully in the laboratory.

CO 3. Experiment with different kinds of centrifuge techniques

CO4. Correlate different histochemical and biotechnological procedures

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H				M	M		M		H	H		H		M
CO2	H	H				M	M		M		H	H		H		M
CO3	H	H				M	M		M		H	H		H		M
CO4	H	H				M	M		M		H	H		H		H

SYLLABUS

Unit -1: Assays and Analytical Instruments

1. Assay-definition and criteria of reliability-chemical assays, biological assays-in-vivo and in-vitro assays.

2. Analytical Instruments: Balances, pHMeter, colorimeter, densitometry scanner, radioactive counters-differential scanning colorimeters, ESR and NMR spectrometers, lyophilizer

Unit –II: Techniques in Biology-I

1. Chromatography: Introduction, paper and thin layer chromatography-gas and column chromatography-HPLC.
2. Electrophoretic methods: Introduction-gel electrophoresis-SDS-PAGE- Agarose gel electrophoresis-staining techniques and analysis.

Unit-III: Techniques in Biology-II

1. Spectrophotometry: Basic principles of absorption spectrophotometry-measuring the absorption of UV light.
2. Centrifugation: Basic principles-bench top centrifuges, high speed centrifuge, ultra centrifuge techniques and applications –differential centrifugation –density gradient Centrifugation.

Unit-IV:Techniques in Biology-III

1. Microscopy: Principles of light, transmission, electron, phase-contrast, fluorescence and scanning electron microscopes-microphotography-image analysers.
2. Microbiological techniques: Media preparation and sterilization-inoculation and growth monitoring –use of fermentors-biochemical mutants and their use-microbial assays.

Unit-V :Cell culture & Histological techniques

1. Histological techniques: Histology as a diagnostic tool-microtomy and staining procedures-histochemical techniques.
2. Cell culture techniques: Design and functioning of tissue culture laboratory – cell proliferation measurements-cell viability testing –culture media preparation and cell harvesting methods.

PRACTICALS

1. Chromatography –gel, column and paper chromatography for amino acid and fatty acids
2. Electrophoresis-SDS-PAGE for proteins and Diagonal electrophoresis.
3. Isoelectric focusing for aminoacids.
4. Preparation of culture media.
5. Inoculation and plating of culture.

SERI 402–MULBERRY BREEDING

OBJECTIVES

- To study the principles and approaches in mulberry breeding techniques
- To enlighten the application of tissue culture techniques and their practical applications

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Interpret developmental stages and life cycle of mulberry plant

CO2. Define basic principles and different methods followed in mulberry breeding.

CO3. Analyze significance of polyploidy in evolving popular mulberry varieties.

CO4. Demonstrate tissue culture techniques with good practical exposure to carry out plant tissue culture.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H				L								M	H		
CO2		H	M		M			M					M	H		
CO3		H	M		M			M	L				M	H		L
CO4	H							M			H		M	H		M

SYLLABUS

UNIT- I: Microsporogenesis

1. Types of reproduction- Structure of flower
2. **Microsporogenesis:** Male reproductive unit, Structure of anther, Pollen grain Pollen grain formation, Development of male gametophyte, Male gamete, Pollen tube

UNIT–II: Megaspороgenesis

1. Female reproductive unit, Ovule – Structure and development, Development of embryo sac, Structure of Embryo Sac, Female gamete
2. Pollination, Significance and types- Pollen - Pistil interaction, Fertilization, Double fertilization
3. Post fertilization- Embryo development, Endosperm development, Seed and Fruit Development

UNIT–III: Plant Introduction, Selection and Hybridization

1. **Plant introduction and acclimatization** –Scope, Objectives and limitations- Plant quarantine- Plant Introduction agencies, National and International.
2. **Selection:** Mass selection, pure line selection, clonal selection - methods and procedures. Application and significance
3. **Hybridization:** History, definition, objectives and application - Hybridization strategies in mulberry breeding (single cross, double cross, back cross, three way cross, reciprocal cross) Advantages and constraints- Heterosis and crop improvement.

Unit-IV: Polyploidy and Mutation breeding

1. Polyploidy: Definition, types- introduction of polyploidy-polyploidy in mulberry species/varieties- characters associated with polyploidy-significance of polyploidy in evolving popular mulberry varieties.
2. Mutation breeding: Definition, types- Artificial induction of mutations- Mutagens- mulberry mutants- role of physical and chemical mutants in inducing beneficial mutations.

Unit-V: Tissue culture

1. Introduction to Plant Tissue culture : History, Scope and concepts of basic techniques in plant tissue culture, Terms and definitions, Laboratory requirements and organization, Sterilization – methods, Laboratory contaminants – its control measures
2. Culture Media preparation: Role of Macro and Micro nutrients, Carbon source, vitamins, organic supplements, gelling agents, phytohormones, composition of commonly used culture media– pH, temperature, maintenance of cultures, Environmental conditions, Explants characteristics
3. Micropropagation: Organogenesis-formation of shoots and roots, Acclimatization, Micropropagation through various explants (Leaf, Stem, Axillary bud), technical problems in Micropropagation

PRACTICALS

1. Study of Microsporogenesis and Gametogenesis in sections of Anthers.
2. Study of Megasporogenesis

3. Studies on the plant introduction and selection methods (Demonstration with appropriate models).
4. Hybridization studies in mulberry (floral biology, pollen viability, pollen collection and preservation. Stigmatic receptivity, artificial pollination, bagging, handling the crossed fruits (Demonstration with appropriate models).
5. Studies on the induction of polyploidy in mulberry by using 0.4% colchicine solution.
6. Evaluation of mulberry genotypes (botanical and yield contributing parameters).
7. Tissue culture:
 - a. Preparation of medium
 - b. Production of multiple shoots of mulberry.
 - c. Proliferation of callus from auxiliary nodes or bud of *Morus* spp (Demonstration)

REFERENCES BOOKS

- 1) B.B. Bindroo S.P. Chakraborti, S. Roy Chowdhuri (2013) A Textbook on Mulberry Breeding and Genetics
- 2) Plant tissue culture- Techniques and Experiments by Roberta H. Smith Academic press INC
- 3) Introduction to plant tissue culture-M.K. Razdan, Science publishers INC.

WEB REFERENCES

**SERI 403 RP: RESEARCH PROJECT AND SUBMISSION OF DISSERTATION
PROJECT PRESENTATION AND VIVA –VOCE
OBJECTIVES**

1. Enabling students to develop scientific inquiry skills to design and carry out scientific investigations.
2. The objective is to train students in basics of research, literature recession. Analysis and expression of their understanding of the topic in their own words.
3. To enable students to learn about data collection, analysis of data and preparation of project report and submission of report.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Illustrate a report based on the experiences and project will be carried out with the ability to apply knowledge of Sericulture

CO2. Demonstrate competency in research through problem identification, formulation and solution.

CO3. Effectively implement skills in communication, in writing and using multimedia tools.

CO4. Acquire basic good practices to be followed in research and overall as a student with Interdisciplinary background.

CO5. Plan to work in any R&D setup.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1				M		H				H		H		M		
CO2						H				H		H		M		H
CO3			H						H					M		
CO4	M						H							M		
CO5						H						H				

**SERI 404 IT: INDUSTRIAL TRAINING AND SUBMISSION OF REPORT
PRESENTATION AND VIVA –VOCE**

OBJECTIVES

1. To expose the students to actual working environment and enhance their knowledge and professional skills from what they have learnt during their course. .
2. To instil the good qualities of integrity and self confidence and to cultivate student’s leadership ability and responsibility to perform the given task.

COURSE OUTCOMES

After successful completion of the course the student will be able to

Outcome

1. Students will extend the boundaries of knowledge through research and development.
2. Students will develop significant commitment towards their profession and develop greater clarity about academic and career goals.
3. Plan and design a startup
4. Develop business strategy with entrepreneurial skills
5. Evaluate sources of finance and develop skills to procure funds.

Mapping COs with Pos and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H		M	M		H		M		H	M	H		H		
CO2	H		M	M		H		M		H	M	H		H		
CO3	H		M	M		H		M		H	M	H		H		
CO4	H		M	M		H		M		H	M	H		H		
CO5	H		M	M		H		M		H	M	H		H		