

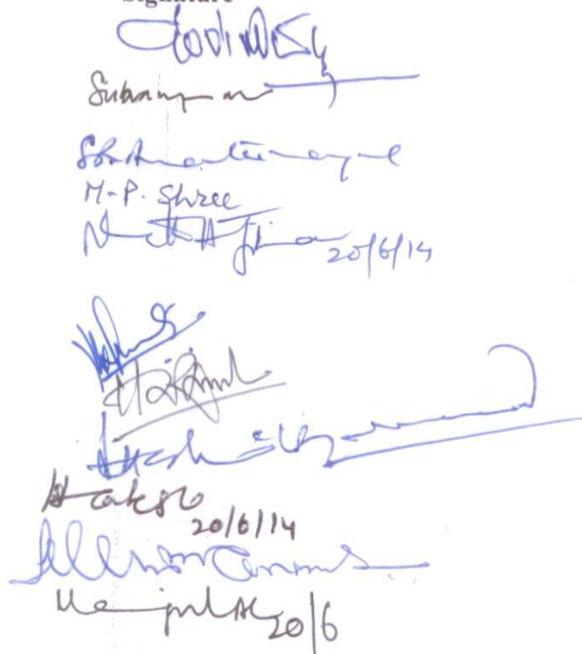
  
**BANGALORE UNIVERSITY**  
**DEPARTMENT OF SERICULTURE/LIFE SCIENCE**  
**SNEHA BHAVANA, J.B.CAMPUS, BUB**

Proceedings of the meeting of Board of Studies in Sericulture held on 20<sup>th</sup> June 2014, at 11.30 am in the Chambers of the Chairperson, Dept., of Studies in Sericulture/Life Science BUB.

**Member Present:**

1. Dr.Govindaiah
2. Dr.M.V.V.Subramanyam
3. Dr.S.R.Ananthanarayana
4. Dr.M.P.Shree.
5. Dr. Ismath Afshan
6. Dr. M. Shivashankar
7. Dr. K.R. Siddalinga Murthy
8. Dr. H.L. Ramesh
9. Dr. L.H. Shivashankarappa
10. Dr. Mahesh H-B
11. Dr. H.V. Anilkumar
12. Dr.A.C.Manjula


**Signature**

  
Govindaiah  
Subramanyam  
S.R. Ananthanarayana  
M.P. Shree  
Ismath Afshan 20/6/14  
M. Shivashankar  
K.R. Siddalinga Murthy  
H.L. Ramesh  
L.H. Shivashankarappa  
Mahesh H-B  
H.V. Anilkumar  
A.C. Manjula 20/6

At the outset the Chairperson welcomed the members of BOS in Sericulture (UG &PG) and discussed the following agenda.

1. **Approval of syllabus of Sericulture (UG & PG)** the syllabus prepared as per choice based credit system for UG & PG course in Sericulture was placed before the BOS. The syllabus prepared was discussed and suggestions were incorporated and approved by the BOS.
2. **Panel of Examiners for B.Sc., and M.Sc., Sericulture**  
The Panel of Examiners for UG and PG Course in Sericulture 2014 -15 was placed before the members and their suggestions were incorporated and approved.
3. **Panel of Examiners for BOAE (UG & PG)**  
The Panel of Examiners for BOAE (UG & PG) has been finalized and approved.

Finally the Chairperson thanked the members of the BOS for their participation in the meeting.

  
**(CHAIRPERSON)**  
**Dr. GOVINDAIAH**  
Professor & Chairman  
Dept. of Studies in Sericulture/ Life Science  
Bangalore University,  
Jnanabharathi Campus, Bangalore - 560 056.

**BANGALORE UNIVERSITY**  
**SYLLABUS OF M.Sc SERICULTURE (2 years)**  
**CHOICE BASED CREDIT SYSTEM**

Semester	Paper Code	Title of the Paper	Instruction hours	Duration of Exam (Hrs)	Marks Credits		Total	Credits
					IA	Exam		
<b>Papers (Hard Core)</b>								
<b>I<sup>st</sup> Semester</b>	SR - 101	Mulberry production Technology	4	3	30	70	100	4
	SR - 102	Silkworm Rearing Technology	4	3	30	70	100	4
	SR - 103	Biochemistry & Biological techniques	4	3	30	70	100	4
	SR - 104	Vanya Sericulture	4	3	30	70	100	4
<b>Paper (Soft Core)</b>								
	SR - 105	Sericulture Extension education & Management	3	3	30	70	100	2
<b>PRACTICALS</b>								
	SR - 106	Mulberry production & Silkworm Rearing Technology	4X2	4	15	35	50	4
	SR - 107	Biochemistry & Biochemical techniques & Vanya Sericulture	4X2	4	15	35	50	4
<b>TOTAL CREDITS</b>								26

Semester	Paper Code	Title of the Paper	Instruction hours	Duration of Exam (Hrs)	Marks Credits		Total	Credits
					IA	Exam		
<b>Papers( Hard Core)</b>								
<b>II<sup>nd</sup> Semester</b>	SR - 201	Genetics & Breeding of Mulberry	4	3	30	70	100	4
	SR - 202	Genetics & Breeding of Silkworm	4	3	30	70	100	4
	SR - 203	Physiology of Mulberry and silkworm	4	3	30	70	100	4
	SR - 204	Silkworm Seed production	4	3	30	70	100	4
<b>Paper (Soft Core)</b>								
	SR - 205	Women empowerment in Sericulture	3	3	30	70	100	2
<b>PRACTICALS</b>								
	SR - 206	Genetics Breeding of Mulberry & Silkworm	4X2	4	15	35	50	4
	SR - 207	Physiology of Mulberry and silkworm & Silkworm Seed production	4X2	4	15	35	50	4
<b>TOTAL CREDITS</b>								26

**BANGALORE UNIVERSITY**  
**SYLLABUS OF M.Sc SERICULTURE (2 years)**  
**CHOICE BASED CREDIT SYSTEM**

Semester	Paper Code	Title of the Paper	Instruction hours	Duration of Exam (Hrs)	Marks Credits		Total	Credits
					IA	Exam		
<b>Papers (Hard Core)</b>								
III Semester	SR - 301	Mulberry Corp Protection	4	3	30	70	100	4
	SR - 302	Silkworm Crop Protection	4	3	30	70	100	4
	SR - 303	Cocoon processing technology	4	3	30	70	100	4
<b>Paper (Open Elective)</b>								
	SR - 304	Entrepreneurship in Sericulture	4	3	30	70	100	4
<b>PRACTICALS</b>								
	SR - 305	Mulberry Corp Protection & Silkworm Crop Protection	4X2	4	15	35	50	4
	SR - 306	Cocoon processing technology	4X2	4	15	35	50	4
<b>TOTAL CREDITS</b>								24

Semester	Paper Code	Title of the Paper	Instruction hours	Duration of Exam (Hrs)	Marks Credits		Total	Credits
					IA	Exam		
<b>Papers (Hard Core)</b>								
IV Semester	SR - 401	Seri biotechnology	4	3	30	70	100	4
	SR - 402	Computer Application and Bioinformatics	4	3	30	70	100	4
	SR - 403	Economics of Sericulture industry	4	3	30	70	100	4
	SR - 404	Silk Processing technology	4	3	30	70	100	4
	SR - 405	<b>PROJECT:</b>	---	---	15	35	50	4
<b>PRCTICALS</b>								
IV Semester	SR - 406	Seri biotechnology	4X2	4	30	70	100	2
IV Semester	SR - 407	Computer Application and Bioinformatics	4X2	4	15	35	50	2
<b>TOTAL CREDITS</b>								24

**OBJECTIVES:**

- To study the influence of various factors in leaf quality and productivity.
- To acquaint with the know-how of mulberry garden establishment under different agro-climatic conditions.
- To know various new technologies of mulberry production.

**Unit 1: Influence of Agro-climatic factors on growth and development of mulberry. - 11 hrs**

**Edaphic factors:** Soils of mulberry gardens, types soil, profile structure, topography, Porosity, aeration, soil water, organic matter and soil micro-organisms

Soil reaction: salinity, acidity and alkalinity, soil amendments.

**Climatic factors:** Role of light, temperature, wind velocity, altitude, rainfall, relative humidity on growth and development of mulberry.

**Unit 2: Mulberry cultivation practices (under irrigated and dry Forming-conditions): - 15 hrs**

Selection and preparation of land, serial testing machinery employed in mulberry cultivation.

Selection of elite varieties for irrigated and rainfed conditions with their characteristic features and yield potentialities.

Planting material (cuttings, saplings, grafts, layers) and their practical utility.

Spacing systems and their importance in leaf productivity under different field conditions.

Planting systems: Pit system, row system, paired row system, & Kolar system.

Inter- cultivation: objectives, methods, and periodicity.

Weeding: common weeds of mulberry plantations. Problems posed by weeds. Preventive and control methods. Physical, chemical, biological, and integrated weed control measures.

Mulching: Mulches and their significance in soil conservation.

**Unit 3: Manuring: - 8 hrs**

Organic manures and their application: (FYM, compost, tank silt, night soil, sewage sludge, oil cakes, vermicompost). Method of compost and vermicompost preparation. Organic manuring in mulberry cultivation and organic farming.

Green manuring: green manure crops and their relevance in soil productivity.

Biofertilizer: Types (Nitrogen, phosphate, cellulosytic), importance, application and limitation.

Cropping pattern- mono, companion cropping, mixed cropping, inter cropping and their uses.

Mineral nutrition:

Functions of essential macro and micronutrients.

Nutritional deficiency in crop plants-causes.

Nutrition disorders-diagnostic symptoms-Correcting nutrient deficiency.

Mineral toxicity.

**Unit 4:** Chemical fertilizers: Types (straight, compound, complex and complete fertilizers). Chemical composition of different fertilizers. Application methods, dosage, calculation, fertilizer schedules. Merits and demerits.

10 hrs

**Irrigation and drainages:** Water requirement of mulberry, water resources, water quality, irrigation systems (surface, subsoil, sprinklers, and drip system) and practical utility in mulberry management.

Scheduling of irrigation for mulberry.

Fertigation in mulberry.

Drainages-need, benefits, and methods.

**Pruning:** Types, Objectives, methods and practical relevance.

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

Schedules of packages of practices for mulberry cultivation under rain fed and irrigated conditions.

Soil and water conservation.

Watershed area concept and water management practices in dryland mulberry cultivation.

**Unit 5:** Growth regulators (Auxins), GA, Cytokinins, ABA, Ethylene and plant phenolics)-Chemistry , structure, distribution, transport, bioassay, physiological function and mode of action, plant growth regulating substances (natural and synthetic) in the improvement of mulberry.

8 hrs

Phytochemical constituents of mulberry with special reference to silkworm nutrition.

Mechanization in mulberry production.

#### REFERENCES

1. Bongale, U.D (1995) Fertilizers in mulberry cultivation. Pushpa Sree Publications, Thalaghattapura, Bangalore.
2. Dokuhon, Z.S (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co, Pvt. Ltd, New Delhi, Calcutta.
3. Gupta, R.K & Mittal, R.K (1983) Bibliography of Indian Weeds. Associated Pub. Co. New Dehli.
4. Hasao Aruga (1994) Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co, Pvt. Ltd, New Delhi.
5. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
6. Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
7. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
8. Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
9. A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central Silk Board, Bangalore-68, India. 2005.
10. Rajanna L, Das P.K, Ravindra S, Bhogेशha K, Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology Central Silk Board, Bangalore, Dec.2005.

**OBJECTIVES:**

- To know the influence of various factors on silkworm growth and development.
- To know the new techniques silkworm rearing.
- To understand the methods of non mulberry silkworm rearing.

**Unit 1: Different races in mulberry silkworm**-classification based on voltinism, moultnism and geographic origin. Popular silkworm breeds and hybrids for commercial rearing, their adaptability, productivity etc. - 13 hrs

**Silkworm rearing technology:** prerequisite planning for rearing and programme of mulberry leaf production.

Importance of Types of rearing, seed crop rearing and commercial rearing, pre-requisites for rearing.

Rearing house, model rearing house, construction of different types of rearing houses, modification to control Uzi fly infestation, sanitation, disinfectants and their effects, and their role in disease management, importance of disinfection-physical, chemical, and gaseous types-formalin requirements for effective disinfection.

Rearing equipments for shelf rearing and shoot rearing methods.

Methods and importance of incubation, black boxing techniques, brushing of silkworm,

**Unit 2: Mulberry leaf quality:** Various factors affecting leaf quality (tender, medium and coarse leaves) nutritional requirements, harvesting and transportation- preservation of mulberry leaf, chopping of mulberry leaves, requirements at different instars-artificial diet, their advantage and limitations role of hormones and the chemicals on rearing performance. - 11hrs

Environmental factors for rearing, measurements, and regulation of environmental factors such as photoperiods, temperature, and humidity. Effect of temperature and humidity on young and late age silkworm-control of temperature and humidity, controlling devices, effect of air and light on rearing.

**Unit 3: Young age silkworm rearing:** Characteristics of young age larvae (chawki), different methods adopted including isolation chamber method, co-operative chawik rearing, and importance of chawki rearing centers. Method adopted in sericulturally advanced countries. - 13 hrs

**Late age silkworm rearing:** Characteristics-different methods (shoot and tray rearing), their merits, and demerits-importance in sericulture economics.

**Cleaning and Spacing:** Objectives and methods of cleaning. Time and frequency of cleaning for different instars, objectives of spacing, optimum spacing for different ages, molting, care during molting.

**Recent/Modern concepts** in chawki and late age silkworm rearing (Isolation chamber, single feeding shoot, pit, and floor rearing), merits and demerits. Improved techniques of rearing over traditional practices.

**Unit 4: Spinning:** Characteristics of spinning larvae, mechanism of silk formation, cocoon formation - 15 hrs  
different their. Advantages and disadvantages, mounting-different methods-merits and limitations, care during mounting, environmental conditions during spinning.

Harvesting of Cocoons: Time of harvesting of Cocoons, defective cocoons-double, and flimsy. Deformed, stained and melted cocoons-characteristics and their impact on cocoon quality, remedial measures to avoid defective cocoons, cocoon assessment-transportation and marketing of cocoons-leaf cocoon ratio.

Rearing technology for non-mulberry silkworms Tasar, Oak tasar Muga, Eri and silkworm varieties.

#### **REFERENCES:**

1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India
3. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd. Calcutta.
4. Hamamura, Y. (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
5. Hasao Aruga (1994). Principles of Sericulture (Translated from Japanese ) Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
6. Jolly, M.S. Chowdhuty, S.N and Sen. (1975). Non-Mulberry Sericulture in India. Central Silk Board, Bombay, India.
7. Jolly, M.S (1998). Tasar Culture. Central Silk Board, Bangalore, India.
8. Sarkar, D.C. (1998) Eri Culture. Central Silk Board, Bangalore
9. Techniques of Silkworm rearing in the tropics. Economic and Social commission of Asia and the Pacific. United Nations, New York. 1993.
10. Veda, K. Nagai, I., Horikomi, M (1997) Silkworm Rearing (Translated from Japanese. Oxford & IBH publishing co., Co., Pvt. Ltd. New Delhi.
11. Wu Pang-Chuan and Chen Da-Chuang. (1994) Silkworm rearing. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
12. Proceedings of the 20<sup>th</sup> Congress of the International Sericulture Commission-2005. Volume-2. Published by Central Silk Board, Bangalore-68, India.
13. Rajan, R.K. Hemanth Raju 2005, Text Book on silkworm rearing, Central Silk Board, Bangalore.

**OBJECTIVES:**

- To know about significance of Biological chemistry.
- To understand about various biomolecules and their function.
- To acquaint with various biological techniques.

**BIOCHEMISTRY**

**Unit 1:** 1) **The cell environment**-Acids, bases, and Water in cell environment, salts electrolytes, pH scale, Henderson Hasselbach equation, buffers, Buffering capacity, and Zwitterions. - 12 hrs

2) **Biomolecules:**

- a) Carbohydrate- Classification, Structure and properties of different classes, chemical tests, derived sugars.
- b) Amino acids and proteins-structure, classification and properties of standard amino acids of proteins, rare amino acids of proteins and non-protein amino acids, essential amino acids, amphoteric property of amino acids, dissociation, chemical reactions, absorption spectra and its applications.
- c) Lipids – classification, structures and biological role of lipids, Fatty acid, phospholipids, sphingolipids, glycolipids and steroids, chemical reactions, fluid mosaic model.

**Unit 2: Enzymes:** - 9 hrs

- I. History, classification and nomenclature, specificity of enzyme
- II. Kinetics of enzyme catalyzed reaction – chemical kinetics, Michaelis – Menten equation, transformation of M-M equation, quantitative assay of enzyme activity, factors affecting enzyme activity.
- III. Mechanism of enzyme action – hypothesis, catalytic mechanisms, acid base and covalent catalysis, ping-pong mechanism.
- IV. Regulation of enzymes – covalent and allosteric modulation – activation and inhibition of enzymes (reversible and irreversible inhibition). Coenzymes and isoenzymes.

**Unit 3: Bioenergetics-** Laws of thermodynamics and their application to biological processes, basic concepts of metabolic energy capture and transfer, biochemical energetic – free energy concept, high energy phosphate compounds (ATP and others) - 8 hrs

**Biological oxidation** – oxidation – reduction reactions, biological redox potentials. Mitochondrial electron transport chain, oxidative phosphorylation, chemiosmotic hypothesis.

**Unit 4: Carbohydrates Metabolism:** - 10 hrs

- i) Biosynthesis of carbohydrates, synthesis of glycogen, regulation of glycogen synthesis, gluconeogenesis.
- ii) Catabolism of carbohydrates, glycogenolysis, regulation of phosphorylase, glycolysis, fermentation reaction, citric acid cycle, pentose phosphate pathway, glyoxylate pathway.
- iii) Metabolism of carbohydrates in relation to embryonic diapause in *Bombyx mori*.



### a) **Proteins and amino acid metabolism:**

1. Enzymatic and chemical hydrolysis of proteins protein phosphorylase.
2. General metabolism of amino acids- transamination, de-amination, decarboxylation, urea cycle, uric acid biosynthesis in insects.

### c) **Lipid Metabolism:**

1. Biosynthesis of fatty acids- -fattyacid synthetase system, regulation of fatty acid synthesis.
2. Oxidation of fatty acids-scheme for B-oxidation, energetic of B-oxidation, omega oxidation.

Vitamins-Chemistry of fat and water soluble vitamins.

## Unit 5: **BIOCHEMICAL TECHNIQUES:**

- 13 hrs

**Chromatography:** Introduction- Principle and applications of – Partition chromatography (paper chromatography) and Adsorption chromatography (Thin Layer Chromatography). Gas Liquid Chromatography (GLC), Ion-exchange Chromatography, Molecular Sieve Chromatography and Affinity Chromatography, and High Performance Liquid Chromatography (HPLC).

**Centrifugation:** Principle, Types of centrifuges. Differential and density gradient centrifugation.

**Electrophoresis:** Principle, procedure and applications of – Polyacrylamide gel electrophoresis (PAGE), Sodium dodecyl sulfate- Polyacrylamide gel electrophoresis (SDS-PAGE) and Isoelectric focusing (IEF).

**Spectrophotometry:** Principle and biochemical applications of UV – Vis spectrophotometry, fluorimetry and spectrophotometry.

### **REFERENCES:**

1. Denton, V. (1975) Orientation of the male silkworm to the sex attractant bombycol In: Olfaction and Taxis, academic Press, New York.
2. Goldsmith, M. and Wilkins, A.S. (1996) Molecular model systems in the Lepidoptera. Cambridge Press, London.
3. Guthrie, R.D. (1974) Introduction to Carbohydrate Chemistry. Clarendon Press, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, Calcutta.
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5. Powar and Chatwal. (2000) Biochemistry. Himalayan Publishing House.
6. Stryer, L. (1999) Biochemistry. IV edition. W.H. Freeman and company, New York.
7. Vance, D.E and Vance, J.E (1991) Biochemistry of Lipids, Lipoproteins and Membranes. Elsevier.

**OBJECTIVES:**

- **To know about the importance of non mulberry silkworms.**
- **To understand about the rearing non mulberry silkworms.**
- **To acquit with food plants of vanya silkworms.**

- Unit 1:** Status of vanya a silk in India-characteristic features, advantages, income and production and demand. - **13 hrs**  
Host plants of vanya silkworms- Distribution and Economic importance.  
Classification of non-mulberry silkworms: Geographical distribution, moultinism, voltinism, cocoon colour and shape.
- Unit 2:** Establishment of Host plants of vanya silkworm and package of parcties for their cultivation. - **13 hrs**  
Pests and diseases of Primary host plants of Vanya silkworms and their management/  
Disinfection and hygiene practices in grainages and silkworm rearing house.
- Unit 3:** Egg production technology of vanya silkworms - **13 hrs**  
Rearing technology of young and late-age vanya silkworm  
Pest and Diseases of vanya silkworm and their management.
- Unit 4:** Cocoon Reeling and spinning of vanya silkworms - **13 hrs**  
Economics of vanya sericulture and their utilization  
By products of vanya sericulture and their Utilization.

**REFERENCES :**

1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India
3. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd. Calcutta.
4. Jolly, M.S. Chowdhuty, S.N and Sen. (1975). Non-Mulberry Sericulture in India. Central Silk Board, Bombay, India.
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6. Sarkar, D.C. (1998) Eri Culture. Central Silk Board, Bangalore
7. Wu Pang-Chuan and Chen Da-Chuang. (1994) Silkworm rearing. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.

**OBJECTIVES:**

- To acquaint with the importance of extension education in community development
- To train with different extension methods for effective diffusion of innovations in sericulture.
- To abreast with field problems for better planning, communication and extension.
- To develop overall management skills.

**Unit 1: Extension education**

- **15 hrs**

Extension education  
Meaning  
Principles  
Philosophy

**Communication**

Definition and meaning  
Role of communication in extension education  
Communication process-the SMCRE Model  
Determinants of communication

**Extension methods**

Individual contact model  
Group contact methods  
Mass contact methods  
Application of extension methods in sericulture

**Extension programme planning**

Principles of programme planning and its process.  
Programme formulation-concept of PRA techniques-mapping, season diagramming, extension, programme historical transact walk.  
Programme extension, steps in extension programme planning, group profiles, ranking scoring etc.

**Unit 2: Role of state Government:** In sericulture extension programme, sericulture extension organization and infrastructure, NGOS, self-help groups and quality clubs. - **10 hrs**

An overview of extension system in the world –USA, Japan, China & India  
Problems of extension systems and client systems in diffusion of sericultural innovations.

**Unit 3: Management:**

- **12 hrs**

Management – Concept, definition, objectives and principles of Management. Functions of management  
Planning – Importance of planning in extension organization – definition, importance and advantages of planning six ps of planning, characteristic of good plan. Definition and concept.

Organizing and staffing (Meaning and steps in staffing): Importance, principle, requisites of an efficient business organization.

**Staffing:** Meaning and steps in staffing.

Direction and coordination: Definition, importance and technique of effective co-ordination and direction.

Budgeting: Meaning and types of budget role of budgeting in effective management.

**Unit 4: Farm management.**

- 15 hrs

Concept and meaning  
FM as a decision making process  
Resource management and record maintenance

**Application of management technique in sericulture.**

Management of mulberry leaf production and its supply  
Rearing programme and input management  
Management of cocoon marketing  
Management of Grainages.

**Management techniques in silk industry**

Management of reeling units-procurement of raw material and human resource management.  
Management of by-products  
Marketing of raw silk.  
Management in fabric production, finishing and marketing.  
Human resource management.

**REFERENCES:**

1. Taylor (1961) Agricultural extension –world wise institutional and force of change. Amsterden.
2. Fulmer, R.M (1976): Supervision-principles of professional management, Gleucoe Press Lodon.
3. Adavi Reddy (1978): Extension education, Sree Lakshmi Press Bapatla.
4. Kahlon and Singh (1983): Farm management
5. Mc Grath, E.H (1986): Basic managerial skill for all. Prentice Hal of India Pvt, Ltd.,New Delhi
6. Mories (1991): Extension alternatives in tropical agriculture, ODI, London.
7. Supe, S.V (1999): An introduction to extension education. O &IBH, New Delhi (Second edition)
8. Dhama, O.P. and Bhatnagar (1984): Education and communication for development
9. FAO Agricultural Extension Manual (Second edition)

## **Paper (Practical) LS -106: Mulberry Production Technology & Silkworm Rearing Technology**

**16 hrs**

1. Stem cutting preparation and raising mulberry saplings adopting nursery bed and polythene bag methods. **1**
2. Production of grafts and layers. **2**
  - a) Stem and root grafting: Whip and tongue grafting techniques.
  - b) Budding: Patch and T-budding techniques.
  - c) Layering: Ground and air layering techniques.
3. Observation on Agricultural implements, tools and machinery used. **2**
  1. Farming practices (field work/demonstration).
  2. Land preparation (Digging, ploughing, hoeing, harrowing, leveling, bund making etc.,).
  3. Pit, row, paired row and Kolar systems of mulberry cultivation.
  4. Inter-cultivation and surface mulching.
  5. Pruning, leaf harvesting and preservation.
  6. Water management Practices in Mulberry cultivation.
  7. Surface irrigation.
  8. Sprinkler and drip irrigation systems.
4. Effect of Foliar formulations (Urea solution, Zimag, Multiplex, Green leaf, Grint, etc.,) on mulberry productivity. **1**
5. Primary food plants of Tasar, Muga, Era silkworm – pests and diseases locally available. **1**
6. Identification of common weeds of mulberry gardens. Weed competition & control in mulberry (mechanical, chemical & integrated weed control trials). **2**
7. Studies on the effect of root- initiating hormones (IAA, NAA, 2,4-D, IBA, CA, Quick root, Keradix, etc., ) on mulberry cuttings. **1**
8. a). Estimation of mulberry leaf yield in one acre under different spacing patterns (Exercise). **1**
  - b). Calculation of fertilizer dose required for one-acre rainfed and irrigated mulberry plantations (Exercise). **1**
9. Determination of water potential of potato tuber tissue by volumetric method. **1**
10. Determination of Stomatal frequency in mulberry genotypes **1**
11. Determination of moisture content and moisture retention capacities of mulberry leaves (tender, medium and coarse leaves). **2**

**Paper (Practical) LS -107: Biochemistry & Biochemical techniques & Vanya Sericulture**

**16 hrs**

- |  |          |
|--|----------|
| 1. Estimation of Protein by Folin method.  | <b>1</b> |
| 2. Estimation of amino acid by ninhydrin method  | <b>1</b> |
| 3. Estimation of reducing sugar by DNS method  | <b>1</b> |
| 4. Estimation of inorganic phosphate by Fiske-Subbarao's method  | <b>1</b> |
| 5. Determination of Molecular weight of Mono Carboxylic amino acid by Sorenson's formal titration method | <b>2</b> |
| 6. Estimation of Glycogen by Anthrone method   | <b>1</b> |
| 7. Extraction and estimation of RNA (Orcinol method)   | <b>1</b> |
| 8. Extraction and estimation of DNA (Diphenylamine method)   | <b>2</b> |
| 9. Determination of the activity of digestive enzyme in the midgut of silkworm larva                     | <b>2</b> |
| 10. Identification of Tasar, muga, Era silkworms Egg, larvae, pupae and moths                            | <b>2</b> |
| 11. Identification of food plants of non mulberry silkworm such as Tasar, muga, Era Silkworm             | <b>2</b> |

**PAPER SR: 201 GENETICS AND BREEDING OF MULBERRY (Hard core)**

52 hr

**OBJECTIVES:**

- To understand the genetic mechanism of inheritance of yield and quality traits in mulberry.
- To use different crop improvement methods as tools in qualitative and quantitative improvement of mulberry.
- To understand the regional adaptability of improved mulberry varieties

**Unit 1: Cytological techniques**

**\_ 10 hrs**

Mitotic and meiotic chromosomes.  
Pre-treatment, fixation and staining smear technique.  
Pollen fertility and pollen- stigma incompatibility.  
Microscopy: principles and application  
Microscopes- Light Polarising, Phase contrast, SEM and electron microscopes, imaging technique.  
  
Micrometry-Micrometers (stage and ocular) and Camera Lucida.  
  
Microphotography.

**Unit 2: Biometrical techniques in plant breeding:**

**\_ 14 hrs**

(Selection of elite genotypes: Correlations, path analysis and discriminate section analysis. Choice of parents and breeding procedures: Dialed, partial diallel line x tester analysis and bioparental mating. Assessment of varietal adaptability: Stability analysis and different models of stability analysis). Plant exploration and germplasm collection. Crop evaluation and bio- diversity.

**Germplasm bank** objectives, Collection, characterization and introduction of mulberry Germplasm.

Plant introduction and acclimatization: Definition, types, purposes, history, organizations, Procedures, advantages and disadvantages, achievements and quarantine.

Selection: Mass selection, pure-line and clonal selection.

Hybridization: Definition, types of hybridization, application and objectives, hybridization Procedures, methods of detecting hybrids, effect of hybridization and achievements.

**Unit 3: Mutation breeding:** Definition, spontaneous and induced mutations, artificial induction of mutations, procedures of mutation breeding, Application of mutation breeding in mulberry improvement.

**\_ 10 hrs**

Polyploidy in plant breeding: Types of changes in chromosome number, history of heteroploidy, autopolyploidy & application of aneuploidy in crop improvements. Polyploidy and mulberry improvement, segmental polyploids.

**Unit 4: Tissue culture techniques in evolving mulberry varieties.**

**\_ 10 hrs**

Biotechnological techniques and plant breeding.  
*In-vitro* multiplication of hard wood and elite genotypes.  
Development of haploids and triploids.  
Introduction of desirable genes through transformation (Transgenic plants).

**Unit 5: Participatory plant breeding:** Approaches involving farmers in bio-diversity conservation and plant breeding strategies.

**\_ 8 hrs**

Evaluation and release of new varieties

Evaluation-preliminary yield trial (PYT), final yield trial (FYT).  
Multi location tests- All India Co-ordinated experimentation programmes. Authorization of varieties.  
Role of National and International Institutes / Organizations for crop improvement.

## REFERENCES

1. Broeritjes, C. and Vanhasten, A.M (1978) Application of mutation breeding methods in the improvement of vegetatively propagated crops. An interpretive literature review. Elsevier Scientific Publishing Company.
2. Callow, J.A., Ford-Loyd, B.V. and Newbury, H.J (1970) Biotechnology and Plant Genetic Resources, Conservation and use. CAB International (Available through Oxford University Press).
3. Chopra, V.L (1985). Plant Breeding: Theory and Practice. Oxford & IBH Publishing Co, Pvt. Ltd. New Delhi.
4. Darlington, C.D. and Wylie, A.P (1970). Handling of chromosomes. George Allen and Unwin Ltd, London.
5. Gupta, P.K (1995). Cytogenesis. Rastogi Publication, Meerut.
6. Kuckuch, H., Kobabe, G. Wenzel, G (1993) Fundamentals of plant Breeding. Narasa Publishing House, New Delhi, Bombay, Calcutta.
7. Narayanaswamy, S (1994) Plant Cell and Tissue culture. Tata Mc graw-Hill Publishing Co. ltd. New Delhi.
8. Shantharam, S. and Montgomery, J.F (1999) Biotechnology, Biosafety and Biodiversity, Science Publisher, Inc. USA.
9. Sharma, A.K and Sharma, A (1970) Chromosome Technique: theory and Practice. Butterworth and Co., London University Park Press, Baltimore.
10. Singh, B.D (1990) Plant Breeding. Principle and Methods. Kalyani Publishing Co., New Delhi.



**PAPER SR: 202 GENETICS AND BREEDING OF SILKWORMS (Hard core)**

52 hrs

**OBJECTIVES:**

- To study the heredity and the influence of environmental factors on silkworm genotypes.
- To learn the prospective breeding strategies for the improvement of silkworm races.

**Unit 1: SILKWORM GENETICS**

- 13 hrs

**An overview of mendelian principles of inheritance**

**Heredity and Environment:** Interaction of genotype with environment and Special reference to silkworms, Hereditary traits, mutants of egg, larva, pupa and adult: hereditary lethal,

**Linkage and crossing over**-linkage groups, Construction of linkage maps.

**Multiple alleles.** Pleiotropism- mechanism of pleiotropic action of 'E' group alleles, Sex determination, role of Z and W chromosome.

**Genetics of Cocoon colors**- inheritance of green and yellow colors-physiology of carotenoids and flavonoids. **Maternal inheritance** and its biochemical aspects-pigment formation.

**Unit 2: Genetic control of hormonal mechanism**- relation between genes and hormones-genetics of voltinism, moultnism, maturity, genes-diapauses-environmental influence on the expression of these characters. **Mosaicism-types**-theories-nature of mosaics, induction of mosaics

- 15 hrs

**Biochemical genetics:** studies of amylase, catalase, tryptophan and Uric acid metabolism. **Relationship between amylase and economic traits.**

**Parthenogenesis** with reference to silkworm-types and methods, induction of parthenogenesis. Merits and limitations.

**Polyploidy**-induction and nature of polyploids-practical importance of polyploids in breeding.

**Mutation** – radiation and chemical mutagenesis – measurement of mutation frequency – radiation sensitivity – mutation response – dose rate dependence – types of chemical mutagens, importance of mutagens in induction of mutations.

**Genetics of non-mulberry silkworms**

**Unit 3: SILKWORM BREEDING**

- 14 hrs

**History of breeding**-Objectives and principles of silkworm breeding-New approaches to bivoltine silkworm breeding,

**Silkworm races** and their distinct characters- maintenance of germplasm bank and its importance.

**Breeding methods**-Linein Breeding, Cross Breeding, selection breeding and mutation breeding and

their advantages, disadvantages-consequence of homozygosity. Breeding plan.

**Sources of variation**-variability in silkworm breeds-methods of selection for qualitative and quantitative traits-assessment and significance in the improvement of silkworm races. Qualitative and quantitative inheritance in silkworm, Sex limited varieties-advantages.

**Unit 4:** Heterosis-theories-manifestation of hybrid vigour for economic characters-estimation of heterosis- **- 10 hrs**  
Exploitation of heterosis in silkworm *Bombyx mori*-Hybrid vigour and Environment-Hybrid vigour in different crossing systems- utilization of hybrid vigour in the evolution of new races. General and specific combining ability-line and tester analysis and diallele analysis. Evaluation and authorization of new race. Maintenance & multiplication of Silkworm breeds.

#### **REFERENCES:**

1. CHRISTOPHER Howe. (1995). Gene Cloning and Manipulation Cambridge Univ. Press.
2. Goldsmith, M and Wilkinson, A.S. (1996) Molecular model system in Lepidopteron. Cambridge Press, London.
3. Hiratsuka. (1999) Silkworm Breeding Oxford & IBH publishing Co, Pvt. Ltd. New Delhi. Calcutta.
4. Morohoshi, S (2000) Development, and Physiology of Silkworm. Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi.
5. Sreeramreddy (ed), G. (1998). Silkworm Breeding. IBM Publishers, New Delhi.
6. Strickberger, M.W.(1996). GENETICS. Prentice-Hall of India, New Delhi.



**OBJECTIVES:**

- To study various biochemical phenomena happening inside the mulberry plant.
- To understand various biochemical & Physiological process occur in silkworm.

**Unit – 1: Bio-geochemical cycles** (nitrogen, carbon, phosphorus and sulphur) and their role in mineral recycling and plant productivity. - 13 hrs

Biological nitrogen fixation (symbiotic, non-symbiotic and associative) mechanism, biochemistry and genetics of the process. National scenario, methods of estimation of nitrogen fixation in culture, potted plants and in the field.

**Unit – 2: Plant productivity**, photosynthesis-history & outline. Pigments & their characteristics. Electron transport. Carbon fixation mechanism (C3, C4 & CAM). - 13 hrs

**Role of water potential. Movement** of water in soil and plants Evapotranspiration. Stomatal, frequency and dynamics. Anti-transpirants.

**PHYSIOLOGY :** Physiology of various organ systems with special reference to silkworm.

**Unit – 3: Nutrition :** Feeding behaviors – phagostimulants – nutritional requirements of silkworm – ultrastructure of cell types in silkworm intestine – mechanisms of gut movements – digestive enzymes in phytophagous insects – absorption and transport of nutrients across gut epithelium – digestion and assimilation efficiencies artificial diet. - 13 hrs

**Excretion:** Cryptonephric arrangement of malpighian tubules in insects – accessory function of malpighian tubules – production and composition of urine – storage excretion – role of water in the excretory, metabolism.

**Respiration:** Mechanism of respiration in insects – tracheal respiration – gas exchange in insects- active and passive ventilation – factors affecting respiration.

**Unit – 4: Circulation:** Types of circulatory mechanism in insects – composition of haemolymph and its buffering capacity- blood PH - 13 hrs

**Muscle Physiology:** Types of muscle – ultrastructure of insect striated muscle-molecular mechanism of muscle contraction, energy metabolism during flight.

**Neurophysiology:** Structure of the neuron – maintenance of resting potential – generation of action potential – conduction of nerve impulse – structure of synapse – synaptic transmission neurotransmitters – physiology of silkworm nervous system during metamorphosis.

**Sensory physiology:** Structure of photo, chemo, and mechano receptors in insects- physiology of photoreception, chemoreception, and mechano reception.

**REFERENCES**

1. Denton, V. (1975) Orientations of the male silkworm to the sex attractant bombycid In: Olfaction and Taxis, academic Press, New York.
2. Journals of advances in Insect Physiology (Annual).
3. Journals of Insect Physiology (Monthly).
4. Journals of Physiological Reviews (Quarterly).
5. Wigglesworth, V.B. (1972) . The principles of Insect Physiology. Pub. By English language book soci. Chapman and hall.

**OBJECTIVES:**

- To study the process involved in the development of embryo.
- To know the concept of seed area & organization of production of quality Dfls.
- To have a scientific knowledge of producing the quality eggs.

**Unit 1: Developmental biology:** Gametogenesis-A detailed account of spermatogenesis and oogenesis-fertilization, egg membranes-cleavage, blastoderm and germ band formation-differentiation of embryos-blast kinesis-organogenesis. - 14 hrs

**Silkworm seed production**-seed cocoons-maintenance of basic stocks-characteristics of pure races multiplication-parent seed cocoons of multi and bivoltine varieties-norms of preservation of seed cocoons-statistical methods and sampling methods-marketing of seed cocoons-norms and price fixation.

**Disinfection activities in grainages**-significance of disinfection – fumigation, mechanism of action of disinfectants.

**Model grainage:** grainage plan-grainage equipments- description, utilization and maintenance.

**Unit 2: Grainage activities sorting of cocoons**- synchronization of eclosion-Sex Separation-pupa test- - 15 hrs

environmental conditions for healthy egg production-moth examination, importance and types (random and individual)-Preparation of eggs and sheet eggs, surface disinfection of eggs-hibernating and non hibernating eggs, egg cocoon ratio-cold storage of non diapausing eggs-cross breeding production technology.

**Artificial hatching**-hot water electric stimulus, hot and cold acid treatment. Acid treatment after ordinary and short chilling. Maintenance of diapauses and its termination. Hibernation schedule for 4, 6 & 10 months. Aestivation, intermediate care and its importance.

**Incubation of eggs-methods**, environmental conditions required for incubation, postponement of hatching of eggs by temporary consignment.

**Unit 3: Seed organization**- principles-characteristics of silkworm breeds for seed maintenance of basic stocks-three tier seed multiplication programme-norms of maintaining seed cocoons in P<sub>3</sub>, P<sub>2</sub> & P<sub>1</sub> stations-seed crop rearing-requirements. - 11 hrs

**Seed area**-importance-criteria for organizing seed area-transportation of seed cocoons-silkworm seed act. Control of pests and predators in grainage.

**Unit 4: Grainage activities** in non-mulberry silkworm varieties-techniques of egg production in tropical and temperate Tasar, Muga and Eri varieties (Tropical and Temperate). - 12 hrs

**Marketing of non-mulberry seed cocoons-norms**-price fixation-Non mulberry.

**Grainage management**-importance of productivity and quality-production, planning and control. Role of LSP's.

## REFERENCES

1. Anon. (1972). Manual on Sericulture.. Vol. II Silkworm Rearing FAO, Agriculture Services. Bulletin No. 72/2, Rome, Italy.
2. Narasimhanna and Ullal (1978). Handbook of silkworm egg production, CSB Publications,
3. Ullal and Narasimhanna (1978). Handbook of practical sericulture, CSB Publications, Bangalore.
4. Wang San-Wing (1994). Silkworm seed production Vol. III Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Narasimhanna. M.N. (1998). Manual on Silkworm egg Production. CSB., Govt. of India, Bangalore
6. Silkworm egg production, (Translated from Japanese), (1997), Oxford & IBH Publishing Co. New Delhi.
7. Tazima, Y. The silkworm egg.
8. Chapman, R.F. (1992). The Insects: Structure and functions.
9. Agrell, I.P.S (1964). Physiological and Biochemical changes during insect development. Academic Press, New York.
10. Counce S.J. (1973). The Causal analysis of Insect embryogenesis, Academic Press. New York.

**OBJECTIVES:**

To give comprehensive understanding about empowerment process of women in relation to sericulture.

- Unit 1: Empowerment-** - 15 hrs
- (i) Concept, ii) levels (iii) processes (iv) Empowerment measures.
- Unit 2: Women work and empowerment** – Concept of work – Productive and unproductive work, measurement of womens’ participation in production process and participation of women in sericultural activities. - 10 hrs
- Unit 3: Role of Women in Sericulture-** - 11 hrs
- Mulberry cultivation, silkworm rearing, Grainage operation, Reeling sector,  
Role of Sericulture in empowering women through sustainable livelihood security.  
Employment and income generation for women in sericulture
- Unit 4: Environmental issues in Sericulture** – Health hazards in various sericultural activities and their impact on empowerment of women - 8 hrs
- Unit 5: Role of state is capacity building of women Sericulturists** – 8hrs
- (i) Extension programmes  
(ii) Institutional finance – micro credit and credit support  
(iii) Womens’ development programme

**REFERENCES**

1. Karl, M. women and empowerment participant and decision making.
2. Kothari Jay (1995). Women and empowerment. Gjan publishing House, New Delhi.
3. Sangeetha Purushotham (1998). The empowerment of women in India, Sage publication, New Delhi.
4. Surhma Sahay (1998) women and empowerment Approaches and strategies, Discovery Publishing House, New Delhi.
5. Hall C.M (1992). Women and empowerment, hemisphere, Publishing Corporation, London.

## Paper (Practical) SR 206: GENETICS AND BREEDING OF MULBERRY AND SILKWORM

16Classes

1. Cytological techniques: Choice of material, pre-treatment, fixatives, staining, squashing & smearing techniques (demonstration). 1
2. Preparations of pre-treating chemical (olchicines, 8-hydroxy quinolin, paradichloro benzene), carnoy's fixative, Aceto-orcein, Aceto-carmin, and Feulgen stains. 1
3. Mitotic studies (Onion, Mulberry): identification and characterization of different stages of mitotic division. Determination of chromosome number and karyotypic studies. 2
4. Meiotic studies (Onion, Mulberry): identification and characterization of different stages of Meiotic-I and Meiotic-II. Chromosomal aberrations like laggards, chromatin bridges, and micronucleus and polysporic condition. 1
5. Evaluation of mulberry genotypes (agro botanical and yield contributing parameters). 1
6. Production of callus, haploids, triploids and somoclonal variants through tissue culture technique (visit to plant breeding stations like IIHR, CSR & TI, Seribiotech, Biotechnology centre for observation) 1
7. Procedures followed in maintenance of genotypes of mulberry and silkworm in germplasm banks. Field visit to CSGRC, Hosur, TN 1
8. Procedures of mitotic, meiotic and polytene chromosomes (Silkworm, Uzifly). 3
9. Salient features of different silkworm races mutants. 1
10. Assessment of cocoon characters for breeding. 1
11. Estimation of heterosis, chi-square test, inbreeding depression for selected traits. 3

## Paper (Practical) SR 207: Physiology of Mulberry and Silkworm & Silkworm Seed Production

16 hrs

1. Measurement of rate of oxygen exchange during photosynthesis & respiration 1
2. Measurement of rate of carbondioxide exchange during photosynthesis and respiration 1
3. Measurement of water potential and stomatal conductance 1
4. Measurement of transpiration and stomatal resistance 1
5. Estimation of total chlorophyll content 1
6. Determination of the activity of digestive enzyme in the midgut of silkworm larva 1
7. Analysis of excretory products in silkworm 1
8. Analysis of mulberry leaf for carbohydrate, protein and amino acid 1
9. Model grainage plan and grainage equipments – wooden stand bamboo trays, wooden boxes, ant wells, thermometer, hydrometer, hygrometer, basin stand, cellulose, moth crushing set, microscope, acid treatment equipment. 1
10. Handling of seed cocoons – selection and storage, sex separation in pupa and moth, moth emergence, refrigeration of male moths. Moth examination –individual and random moth examination-preparation of loose eggs and sheet eggs. – surface disinfection – cold storage- hibernation schedule –time of release. 2
11. Different methods of incubations- black boxing, Cold and Hot acid treatment for silkworm eggs 1
12. Identification of silkworm eggs-unfertilized, diapausing, non-diapausing, dead, eye spot, blue egg and hatched eggs. 1
13. Determination of fecundity and hatching percentage, maintenance of records for grainage 1
14. Preparation and identification of different stage of embryonic development in eggs of *B. mori* and *P. ricini*. 2



**OBJECTIVES**

- To understand the occurrence, distribution and crop loss due to mulberry pests and diseases.
- To know about the influence of biotic and abiotic factors on the outbreak of pests and diseases
- To study the management of pests and diseases through various approaches like cultural, chemical and biological methods.

**Unit 1: Introduction** :Importance and scope of plant protection in sericulture and classification of plant diseases - 12 hrs

**Pathogenesis** –Inoculation, penetration, infection, invasion, growth and reproduction of the pathogen, Dissemination, over wintering/ over summering of the pathogens.

**Influence of abiotic** factors on the incidence of diseases, disease forecasting, disease assessment, scoring and estimation of losses.

**Unit 2: Detailed studies on major mulberry diseases** leaf spot, powdery mildew, leaf blights (fungal & bacterial), stem canker, root rot and root knot. The studies include causal organisms, aetiology, crop loss and management. - 14 hrs

**Nutritional disorders symptoms and corrective measures.**

**Unit 3: Effect of infection on physiology of the host:** uptake and translocation of water and nutrients, respiration and photosynthesis. - 12 hrs

**Defence mechanism (Host) against pathogens-structural and biochemical**

**Unit 4: Classification of mulberry pests based** on their groups and feeding habits - 14 hrs  
Pest forewarning systems.

Studies on the life cycle, occurrence, damage and management of major pests of mulberry- Bihar hairy caterpillar, cutworm, leaf roller, wingless grasshopper, mealy bugs, jassids, thrips, white fly and scale insects. Brief account of the following minor pests-stem borers, stem girdlers, root grubs, termites and snails.

**Forms and formulations** of fungicides and pesticides, their preparation, application and safe period.

**REFERENCES:**

1. Plant pathology-R.S. Mehrotra, Tata, M.C. Graw-Hill Publishing Co. Ltd. New Delhi. (1980).
2. Plant pathology –George N Agrios, Harcourt Asia Pvt., Ltd. And Harcourt Publishers International Co. Singapore. (2000).
3. Mulberry cultivation – FAO manual I- G. Rangaswmi, M.N. Narasimhanna, K. Kasiviswanathan, C.R. Sastry and Manjeet .S. Jolly. Oxford and IBH Publishing Co. Ltd. Rome (1976).
4. Hand Book of Practical Sericulture –Ullal and M.N. Narasimhanna, CBS Publicationa, Bangalore (1978).
5. A Text Book of Morden Plant Pathology – K.S Bilgrami and H.C Dube. (1980).
6. Diseases and Pests of mulberry and their control. Sen Gupta, Govindaiah and Pradeep Kumar CSR & TI Mysore (1991).
7. Hand Book on Pest and diseases of mulberry and silkworm Sen Gupta, Pradeep Kumar, Nuathuza Baug & Govindaiah. United Nations Publication (ESCAP). Bangkok, Thailand.
8. Entomology and Pest management. Pedigo (Lorry, P) Macmillon Publishing.
9. Plant Pests and their control. Fenemone, P.G. Butterworths, London.
10. Agriculture Insect Pests of the tropics and their control. Dennis. S. Hill. Cambridge University Press.

**OBJECTIVES**

- To identify the symptoms of various diseases and pests of silkworm and understand the lifecycle and incidences of pest and diseases causing organisms.
- To increase the yield of silkworm cocoon crops by preventing and controlling the various diseases and pests of silkworm.

**Unit 1: Introduction to Parasitology,** Host-parasite relationship, Types, classification, origin and evolution of parasitism-types of parasites and hosts. - 10 hrs

**Diseases:** Types, disease development and influence of biotic and abiotic factors, spread of disease-silkworm crop loss assessment, mulberry pest as an alternative host of silkworm diseases, disinfection and hygiene, crop protection methods- Forecasts.

**Physiological disorders and corrective measures.**

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**Unit 2: Silkworm diseases, prevention and management.** - 15 hrs

**Protozoan disease:** Pebrine-history, causative agent, life cycle, mode of transmission and symptomology-prevention and management.

**Fungal diseases:** types-causative agent, mode of infection, symptoms, life cycle- prevention and management.

**Bacterial diseases:** types- causative agent, infection, symptoms-cycle-prevention and Management.

**Viral disease:** Types, causative agent, mode of infection, symptoms-prevention and Management.

Integrated Management of Silkworm diseases (IDM).

**Disinfection:** Types of disinfectants, method of application, time of application, concentration of disinfectants-Health hazards.

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**Unit 3: Toxicology:** Insecticides- history – classification, forms and formulations – method of application - 13 hrs

– mode of physiology tests- toxic disorders, toxicosis – resistance to insecticides –mode of action and insecticide resistance and its management, pesticide calculation, plant based materials and silkworm protection against poisoning. Insecticides used in sericulture.

Insect immunity system – cellular and noncellular, phagocytosis, antibacterial and antiviral factors.

**Unit 4: Pests and predators:** Definition, distribution, systematic position and method of protection – - 14 hrs  
cultural, mechanical, physical, biological, and chemical methods. Integrated pest management –  
Principles, component and advantages.

**Pests of silkworm** –Indian uzifly (its biology in detail) – Korean Uzifly, Japanese uzifly, Tasar uzifly-lifecycle, habitat, nature of damage, prevention and management.

**Predators of silkworm**-beetles, cockroach, ants, rats, mites, etc. their systematic position-nature of damage and management.

**Application of Biotechnology** for the control of pests and diseases-Genetic control –Sterile male technique, Sex ratio distortion, feminization-Gene cloning (Bacterial & Viral).

#### REFERENCES:

1. Hand book of pests and disease control of mulberry and silkworm; United Nation Publication, Bangkok, Thailand (1990).
2. Microbial control of insect and mites. Ed. H.D. Burges and N.W. Hussey; Academic press London.(1971).
3. Lu Yup Lian (1995). Silkworm diseases: oxford and IBH Publication. Co. Pvt. Ltd.
4. Narasiomhanna, M.N., Suryanarayana, S.K. and Kumararaj, S.(1988) Manuals on Sericulture Vol. II Silkworm Rearing; oxford and IBH Publication. Co. Pvt. Ltd.
5. Samson, M.V., Sridharan, T.O and Singh, R.N; Pebrin-monitoring and disease management strategies; CSB Publication.
6. Lectures on Sericulture. Ed. G. Boraiah.
7. Silkworm Rearing: Translated from Japanese. Oxford and IBH Publication. Co. Pvt. Ltd. New Delhi.
8. Govindan, R. and Devaiah, M.C: Bacterial flacherie of silkworm. CBS publication Bangalore.
9. Abstracts of the 20<sup>th</sup> Congress of the International Sericulture Commission -2005. Published by Central Silk Board, Bangalore -68, India.
10. Govindan, R . and T.K. Narayanaswamy, Devaiah (1998). Principles and silkworm pathology-text book.

**OBJECTIVES:**

- To familiarize with the properties of the cocoons.
- To acquaint with the technologies adopted in reeling
- To acquaint with the importance of raw silk quality

**Unit 1: SILK INDUSTRY**

- 14 hrs

Activities of silk industry in India, China, Japan and S. Korea.

Silk production, export and import of silk and silk products. Cocoons, Cocoon classification

Cocoon characteristics-Mulberry, eri, tasar and muga. -colour, shape, size, compactness, grains, weight, shell ratio, filament length, denier, reliability, raw silk percentage, neatness

Factors influencing cocoon quality.

Composition and structure of mulberry and non-mulberry cocoon filament

Scientific methods of cocoon testing and grading -Methods practiced in India, China and Japan. Estimation of renditta, kakame cost.

**Cocoon drying/stifling**

Introduction, objective of cocoon drying/stifling, techniques of drying.

Methods of drying / stifling-sun drying, steaming, hot air-conveyor system, methods.

Merits and demerits of different methods.

Cocoon conditioning and its importance.

Cocoon sorting and storage.

**Unit 2: Pre-reeling process.**

- 13 hrs

Cocoon Cooking-basic principles, objectives, cocoon cooking equipments and processes-open pan, three pan, pressurized system.

Factors influencing cocoon cooking basin.

Chemical reactions in cocoon cooking basin.

Evaluation of cooked cocoons.

Cocoon brushing-objectives, various methods of brushing.

**Reeling water:** Consumption of water in silk reeling

Properties of filature water, Influence of water quality on cooking and reeling efficiency, Water quality standards for silk reeling, Treatment methods.

**Unit 3: SILK REELING TECHNOLOGY**

- 13 hrs

Introduction, Direct and Indirect system of reeling, various devices charaka, cottage basin, multiend, automatic reeling machines.

Reeling devices for tasar and muga cocoons.

Important parts of the reeling machine and their functions Jetteboute, button, guide pulleys, tension pulley, denier-controlling devices.

Reeling process-Passage of thread in different reeling devices

Influencing factors for quality raw silk.

Reeling speed, calculation of production efficiency.

**Silk re-reeling**

Objectives, re-reeling machine, pretreatment, process of re-reeling

Skein finishing and packing

**Unit 4: RAW SILK TESTING**

- 12 hrs

Introduction to raw silk testing, importance of raw silk testing

Conditioned weight test, boil off test

Quality tests-visual examination, winding, size, evenness, cleanness and neatness, tenacity and elongation, cohesion and exfoliation tests

Raw silk grading-Aims, BIS and ISA standards

Yarn numbering-Direct and Indirect systems-Dinier, tex Count (Ne)

By-products, and their utilization in silk industry for value addition

**REFERENCES**

1. Anon. 1972 Manual on Sericulture, Vol.3 Silk Reeling FAO, Agriculture Service Bulletin No. 72/3.
2. Byong Ho Kim. 1989. Filature water Engineering, Seoul national University Press, Republic of Korea.
3. Huang Guo Rui. 1988. Silk reeling, Oxford and IBH Publishing Co. Pvt. New Delhi.
4. Mahadeveppa, D., Halliyal, V.g., Shankar, A.G. and Bhandiwad, R. 2000 Mulberry Silk Reeling Technology, Oxford and IBh publishing Co. Pvt. Ltd. New Delhi.
5. Song, K.E and Lee, Y.W. 1973. Modern Silk Reeling Technology. Sericulture Expt. Station, Republic of Korea
6. Sonwalker, T.N. Handbook of silk Technology, New Age International Pvt.,ltd.
7. Yong Woo Lee. 1999. Silk Reeling and Testing Manual, FAO Agricultural services bulletin No. 136, Rome, Italy.

**OBJECTIVES:**

- To give a comprehensive understanding of the concept and characteristic features of viable entrepreneurship
- To identify different entrepreneurship opportunities in sericulture to promote self employment.

**Unit 1: Entrepreneurship- 10 hrs**

1. concept
2. characteristic features of entrepreneurship
3. Factors contributing to women entrepreneurship – Social, cultural and economic factors
4. Role of family in capacity building of women entrepreneurship

**Unit 2: Entrepreneurship Development programmes and institutional support- 10 hrs**

- a. Women entrepreneurship development – trends, patterns and development
- b. Role of Central Silk Board and the State to promote Entrepreneurship in Sericulture.

**Unit 3: Technical knowhow pertaining to: 16 hrs**

- (i) mulberry cultivation
- (ii) seed production and
- (iii) chawki rearing
- (iv) silkworm rearing
- (v) Reeling and twisting
- (vi) Weaving

**Unit 4: a. Entrepreneurship opportunities in Sericulture – 16 hrs**

- (i) SWOT analysis
- (ii) Management techniques – planning, budgeting, coordinating, controlling and decision making
- (iii) Management of seri-entrepreneurship activities –
  - Entrepreneurship in sericulture production of vermicompost, disinfect, Biofertilizers and grainages.
  - Mulberry and cocoon production, seed production, chawki rearing, silk reeling and weaving Achievements in sericulture by progressive farmers.

**REFERENCES:**

1. David E. Gumpert, How to Create a successful Business Plan, Inc. Publishing, 1990.
2. Robert D. Hisrich and Michael P. Peters, Entrepreneurship: Starting, Developing, and Managing a New Enterprise, 3<sup>rd</sup> edition, Irwin, 1995.
3. Ronald E. Merrill and Henry D. Sedgwick, The New Venture Handbook: Everything you Need to Know to start and Run Your Own Business, new and updated edition, AMACOM, 1993.
4. Karl, H. Vesper, (1990) New Venture Strategies, revised edition, Prentice Hall.

## Paper (Practical) SR 305: MULBERRY PROTECTION AND SILKWORM CROP PROTECTION

16 hrs.

### MULBERRY PROTECTION

1. Collection of disease samples (leaf spot, rust, mildew, leaf blight, root-rot, root knot etc), identification and preservation methods. **1**
2. Preparation of culture media, isolation of fungi from diseased samples maintenance of pure cultures and proving of Koch's postulates. **1**
3. Diagnosis of major foliar diseases of mulberry, hand sectioning, staining, temporary mounting of sections and spores. **1**
4. Diagnosis of major soil-borne diseases of mulberry, hand sectioning, staining, temporary mounting of sections, spores, nematode eggs, larvae and adult. **1**
5. Methods of disease scoring in field and calculation of disease index (Field study) **1**
6. Collection, identification and preservation of mulberry pests (caterpillars, jassids, thrips, mealy bugs, scale insects etc. **1**
7. Forms and. Formulations of fungicides and pesticides, their preparation and application. **1**
8. Mass production of bio-control agents and their applications (Demo) **1**

### SILKWORM PROTECTION

1. Disinfection: Bed disinfectants, room disinfectants and its application procedure. Determination of strength of formalin & bleaching powder. **1**
2. Identification of various silkworm diseases, symptoms at various developmental stages, Pebrine, Grasseri, flacherie and muscardine. **1**
3. Collection, isolation, identification, and characterization of NPV, CPV, fungal spores, Bacteria, and Pebrine spores. **2**
4. Mother moth examination-individual and mass mother moth examination. **1**
5. Staining of bacteria grams and endospore staining. **2**
6. Collection, identification, and lifecycle of Uzifly, symptoms of Uzifly infested hosts, demonstration of Uzifly control methods, and other predators of silkworm. **1**

## Paper (Practical) SR 306: COCOON PROCESSING TECHNOLOGY

16 classes

1. Evaluation of cocoons.
  - a. Sorting of cocoons, percentage determination of good and defective cocoons by weight of different races and varieties. **3**
  - b. Estimation of renditta on the basis of shell percentage and defective cocoons of different varieties. **1**
  - c. Commercial characteristics of different varieties of cocoons. **3**
    - Assessment of single cocoon weight, shell weight, shell percentage, average filament length, non breakable filament length, raw silk percentage, denier, and renditta.
2. Estimation of drying percentage of cocoons. **1**
3. Estimation of fibroin and sericin percentage of polyvotine, bivoltine and cross breed cocoons. **1**
4. Assessment of water pH and water hardness. **2**
  1. Commercial reeling of cocoons on charaka, cottage basin, multiend reeling machine-assessment of renditta, raw silk percentage, waste percentage, production efficiency for bivoltine and cross breed cocoons. **4**
  2. Re-reeling of raw silk-lacing and skeining. **1**

**OBJECTIVES:**

- **To understand the Principles of biotechnology**
- **To understand the cell, tissue and organ culture techniques.**
- To acquaint with the molecular marker aided breeding techniques

- Unit 1: Scope and importance of biotechnology, in Sericulture** - 15 hrs
- Recombinant DNA Technology: cloning and expression of vectors-cloning vectors for recombinant DNA (plasmids, phages, cosmids, virus, transposons, YAC, MAC). Binary and shuttle vectors.
- Gene transfer methods in plants;** Target cells for transformation; Gene transfer techniques using *Agrobacterium*. Selectable and scanable markers; Agro infection and gene transfer in mulberry; DNA mediated gene transfer (DMGT).
- Transgenic plants in crop improvement, molecular farming and regulated gene expression.
- Unit 2: Insect cell and tissue culture:** History and scope of animal cell and tissue culture; advantages and disadvantages. Culture media for cell and tissues: Culturing procedures. 12 hrs
- Polymerase chins reaction (PCR):** Gene amplification, application of PCR in silkworm biotechnology.
- Unit 3: Plant cell and Tissue culture techniques:** Introduction and historical background of plant morphogenesis and tissue culture, laboratory requirement for plant tissue culture, culture media. Cell culture; applications of cell and tissue culture. 12 hrs
- Application of fundamental principles of biotechnology** for improving silk production. Use of translocated W-chromosome for sexing animals-genetic correlation of traits. Making new textile fibres, improvement of silkworm strains, marker assisted breeding. Application of biometrical genetics. Quantitative trait loci (QTL) in silkworm.
- Unit 4: Genetic resistance of silkworm, *Bombyx morito*** bacterial and viral diseases. Immune response against bacterial and viral diseases in the silkworm, *Bombyx mori*; Regulation of host gene expression, inducible anti-bacterial and anti-viral proteins of *Bombyx mori*. - 13 hrs
- Non-mulberry silkworm and biotechnology:** Preservation of endangered non-mulberry silk through biotechnological approach.

**REFERENCES:**

- Plant Molecular biology. Grierson D.and Lovely S.N.Blackie, London, 1984
- Genetic Engineering in plants. Kosuge T.Meredith, C.P and Hollender S.Plenum press, New York, 1989.
- Cellular and molecular biology. Goldberg R B. Alan R.Liss Inc. New York, 1982.
- Plant biotechnology. Ignacimuthu V.L. Oxford IBH Publishing Company, New Delhi, 1995.
- Genetic manipulation for crop improvement. Chopra V.L Oxford IBH publishing company, New Delhi, 1985.
- Molecular Biotechnology. B.R Glick. and Pasbernak. J. J.American Society for molecular biology (ASM press), 1994.
- Recombinant DNA (2nd Ed.) Watson J.D Gilmanm, workowski J. and Zoller M. Scientific American Books, 1992.
- Principles of gene manipulation. Old, R.W. and Primrose S.B Blackwell Scientific Publications 1994.
- Drosophila-A practical Approach. D.B. Roberts, IRL Press, 1989.
- Animals with Novel genes. Maclean.N. Cambridge's Univ. Press, London, 1987.
- Plant Tissue Culture: Applications and Limitations by S.S. Bhojwani (1990), Elsevier, Amsterdam.
- Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.
- Plant biotechnology in Agriculture by K. Lindsey and M.G.K. Jones prentice hall, New Jersey 1990.
- Plant Molecular biology by D. Grierson & S.N. Covey Blackie, London



**PAPER SR: 402 COMPUTER APPLICATION AND BIOINFORMATICS (Hard core)**

52 hrs

**OBJECTIVES:**

- To introduce computer as a tool to carry out various statistical and analytical packages.
- To use computer techniques for computing and analyzing Sericulture data.
- To understand the recent developments of bio-technological methods.

**Unit 1: Computer Fundamentals:**

12 hrs

1. Organization and working of a computer stored program concept.
2. Computers and their evolution-Generation, Personal, Mainframe, Mini and Super computers.
3. Basic definitions-hardware, software, firmware, program, flowchart. Data representation & conversions, basic binary arithmetic.

**Computer Architecture Fundamentals (Definitions and their purpose)**

1. Internals- CPU, memory, motherboard, disk drives, system bus, plug in cards.
2. Externals- I/O devices, connection cables (RS-232C,...etc.,)
3. Network Peripherals –Modem, Network cards and basic components of a network.

**Software requirements and classification of software.**

System software- OS, Editors, Compilers and interpreters, Batch processing, Multi programming, multi tasking, time-shared working, personal computers working. Flow chart and coding, computer languages- Review of High level languages.

**Unit 2: Hardware issues:**

10 hrs

- 1) Types of memory-Primary and Secondary.
- 2) Primary: RAM, ROM, PROM, EEPROM.
- 3) Secondary: Floppy, Diskette, Hard Disk, CD & DVD.
- 4) Video terminals, OMR, OCR, Bar Coding, Printers & Plotters.
- 5) LCD.

**Software Issues:**

1. Types of Operating Systems & Their applications.
2. DOS fundamentals, Windows O/S, Unix
3. Important features of packages like MS-WORD, MS-EXCEL & MS-POWERPOINT.
4. Popular computer brands-specifications and selection criteria.

**Unit 3: Information technology:**

13 hrs

Information, types, quality of good information, data processing, computer as a tool for data processing, information gathering

**Computer network & Internet Issues.**

1. Advantages of Networking & Internet
2. Sending and receiving E-mail
3. WWW, Browsing the web
4. Accessing & surfing the net, Downloading files from web

## 5. Principles of file transfer, chat & remote log-in

### **Computer Application in Sericulture:**

1. Application of computer in silkworm biology and moriculture, scope of statistical methods in breeding. Methods of central tendency & dispersion, linear regression & correlation-test of significance. ANOVA, Bio-statistical programme.
2. SPSS/Statistical package and Various applications.
3. Use of formulae in MS-EXCEL for computing, mean Sericulture yield, cost of silkworm rearing, silk production and cocoon/silk marketing.

### **Unit 4: Computer-aided design exclusively for textiles system for design concept**

- 15 hrs

Planning, Advantages of CAD over woven textile designing, Software companies. Computer – aided colouring system: Visualization of colour related tasks, colour creation, new shade creation, simulation of dyeing and printing, colour match, production, & management information.

#### **4. Computer aided silk testing (workshop).**

#### **Computers in handloom and power loom (workshop).**

#### **5. Databases:**

Basic concepts

Designing of databases

Off-line and on-line databases

Sequence analysis and molecular modelling

i) Genome Project initiatives

ii) Sequence analysis: Nucleic acids and protein Molecular modeling.

### **REFERENCES**

1. Attwood, T.K (1997) Explaining the language of Bioinformatics. In Oxford Dictionary of Biochemistry and Molecular Biology, Stanbury, H. (ed). Oxford University Press.
2. Baldi, P. and Brunk, S. (1998). Bioinformatics: The Machine Learning Approach (Adaptive computation and machine Learning). MIT Press.
3. Baxevanis, A and Ouellette, B.F.F. Eds. (1998). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. John Wiley and Sons.
4. Brown, T.A (1994) DNA Sequencing). IRL Press, Oxford.
5. Setubal, J.C and Meidanis, J. (1997) Introduction to Computational Molecular Biology. PWS Publishing Company.
6. Swindoll, S.R., Miller, R.R. and Myers, G.S.A. (1996) Internet for the Molecular Biologists. Horizon Scientific Press.
7. Waltherman, M.S (1995) Introduction to Computational Biology: Maps, Sequences and Genomes. Chapman and Hall.
8. Wen- Hsiung, L. and Graur, D (1991) Fundamentals of Molecular Evolution. Sinauer Associates, Inc.

**OBJECTIVES**

1. Acquaint with the various development programmes undertaken by the State to help sustain the industry.
2. To introduce various economic parameters for better management of the industry at various levels and entrepreneur.
3. To understand the policy decisions involved to augment the Indian silk exports and impact of globalization on silk industry.

**Unit 1: Sericulture scenario in India- History and region wise pattern of growth Sericulture in Karnataka - 13 hrs**

History, Recent trends, development programmes, problems and prospects.

Infrastructure development –Grainages, TSC, Cocoon markets, Silk exchange, institutional finance, R & D base, filature, weaving factories and spun silk mills.

Principles of farm management cost concepts and cost computation techniques. Law of diminishing marginal returns as applied to sericulture.

**Unit 2: Economics of mulberry cultivation and silkworm rearing - 13 hrs**

Costs & returns under rain fed and irrigated conditions, leaf –cocoon ratio.

Cost – benefit ratio of improved sericulture practices vis – a- vis traditional practices

Income and employment generation in sericulture vis- a- vis other compotative crops

Economics of seed production

**Unit 3: Cost and returns - 12 hrs**

Cocoon-Dfls ratio

Economics of silk reeling

Comparative economics between charaka, cottage basin and multi-end basin

Economic viability of filature in public sector of Karnataka

Silk by –products; their nature, extent and re-utilization (value addition)

**Unit 4: Economics of silk weaving - 14 hrs**

Comparative economics between hand loom and power loom

Value addition due printing, dyeing and finishing

Economics of tasar

Eri and

Muga cultivation

## Unit 5: Exports of silk products

- a. Extent, composition, and direction of India silk trade.
- b. Export and import policies.
- c. Impact of silk import on domestic silk industry.
- d. Impact of WTO on sericulture industry.

### Environmental issues in sericulture industry.

Entrepreneurship development- identification of potential entrepreneurial activities in sericulture from egg production to weaving.

Project evaluation techniques.

### REFERENCES:

Rajapurohit and Govindaraju (1980). Employment generation in Sericulture, Ashish Publication. New Delhi.

Charsley SR(1982): Culture and Sericulture Academic Press Inc; New York, USA

Sanjay Sinha (1984): Development of India Silk, Oxford & IBH Publishing, Co Pvt Ltd, New Delhi.

Aziz, A. and Hanumappa, H.G (1985): Silk industry- Problems and prospects, Ashish Publishing House New Delhi.

Hanumappa, H.G. (1986). ‘Sericulture for rural development’.

Gopal (1991): Demand and supply Prospects for high quality raw silk. Oxford & IBH

Ramanna, D.V (1992) “Economics of Sericulture and silk industry” Deep & Deep publication, New Delhi.

Kahlon and Singh (1984). ‘Farm Management’

Changappa (1994): “Strategies for export of Indian silk in the changing environment” in Global Silk Scenario-2001, Oxford and IBH

Hanumappa , H.G. (1993). Sericulture Society and Economy. Ashish Publishing House New Delhi

Puttaraju H.P. (1997). Roshme Krushi hagu Graminabhivrudhi (in Kannada). Bangalore University Prasara, Bangalore, India.

Puttaraju, H.P.(1997) Reshme Krushi Hagu Graminabhivrudhi (in Karnnada). Bangalore University Prasara, Bangalore, India.

**OBJECTIVES:**

1. To understand the fundamental properties of natural and synthetic fibers.
2. To acquaint the students with yarn manufacturing.
3. To familiarize with the fabric manufacturing process.
4. To familiarize with the chemical processing from degumming to finishing of silk.

**Unit 1: Textile Fibers**

- 12 hrs

Introduction to textile fibers, classification of textile fibers, basic requirement of textile fibers.

Comparative properties of natural, regenerated and synthetic fibers- vegetable fibers, protein fibers, regenerated celluloses, regenerated protein fibers, polyamide fibers, polyester fibers, poly olefin fibers, vinyl fibers, high performance fibers, inorganic fiber and end users. Physical and chemical properties of silk and uses.

**Unit 2: SPUN SILK YARN.**

Introduction to spinning, importance of silk spinning w.r.t. wastes and non-mulberry cocoons.

Processing of silk wastes for yarn spinning-hand spinning-mill spinning.

Processes in spun silk mills-degumming-dressing-preparatory-spinning-finishing.

Spinning of non mulberry cocoons.

**SILK THROWING**

Objectives, Types and methods, winding-doubling-twisting setting of twist, rewinding.

Types of twisted yarns-singles, organzine, tram, crepe, voile, georgette. Blended yarns.

**Unit 3: SILK WEAVING**

Preparatory processes-Preparation of warp and weft.

Different machinery employed in small scale and organized sectors.

Handloom, powerloom- shuttle looms shuttles looms.

Weaving process and its mechanism.

Special loom attachments-Dobby, Jacquard, Pile, Leno.

Application of computers in weaving and designing.

General characteristics of fundamental weaves, fabric properties.

Fabrics-Different types.

**Silk knitting:** Introduction to knitting warp and weft knit structures, knitting machines

#### **Unit 4: Silk wet processing**

gumming –objectives, methods of degumming-hot water extraction, soap, soap-soda, enzymatic, acid, amines-Degumming process.

**Bleaching –objectives, methods, process, whitening agents.**

**Dyeing-Dye classification-Acid, basic, azoic, direct, disperse, mordant, premetallized, reactive, sulphur, vat.**

-Natural dyes-importance, application on silk.

-General theory of dyeing silk.

-Process of dyeing yarn and fabric

-Evaluation of colour matching.

-Computer colour matching.

Printing-objectives, auxiliaries, printing methods-block printing, screen printing, discharge printing, batik, roller, rotary printing.

**Marketing of silk materials.**

**Planning and Management**

Factors to be considered before setting up of silk reeling, throwing, weaving, dyeing, printing and spinning, units-Availability of raw material-water source-labour, marketing facility, source of goods, staff, maintenance.

Silk law enforcement.

#### **REFERENCES**

1. Gohl, E.P.G. and Vilensky, L.D. 1987. Textile science, CBS Publishers and Distributors, Delhi, India.
2. Grayson and Martin. 1984. Encyclopedia of Textiles, fibers and Non woven fabrics, John Wiley and sons, New York.
3. Kadolph, S.P. and Langford, A.C. 1998. Textiles. Prentice hall Inc, New Jersey USA.
4. Mishra, S.P 2000. A Text book of fiber science and technology. New Age International Publishers, New Delhi.
5. Moncrieff, P.W. 1988. Manmade fibres, 6<sup>th</sup> ed. Newness Butterworth's, London.
6. Trotman, E.R. 1984. Dyeing and chemical Technology of Textile fibers. John Wiley and sons, New York.
7. Venkatraman, K. 1971. The chemistry of synthetic dyes. Vol. I & II, Academic Press, London.

## PAPER SR: 405 PROJECT REPORT

1. Dissertation has to be submitted by each student.
2. The maximum marks for the dissertation will be 70 with 30 marks as internal assessment.
3. Each student will work under the guidance of a staff member who will assign a topic and monitor the work and certify the dissertation before submission.
4. Submission of the dissertation shall be before conclusion of the 4<sup>th</sup> semester term
5. Evaluation of the dissertation will be in the same manner as that of theory paper.

### Paper (Practical) SR 406: Seri biotechnology

16 classes

- |  |   |
|--|---|
| 1. Preparation of media for plant and animal cell cultures.                            | 2 |
| 2. Trypan blue exclusion cell viability.   | 1 |
| 3. Trypsinisation of monolayer and sub culture. (Tissue for cell-separation)           | 2 |
| 4. Isolation of genomic DNA from microbial, animal and plant cells.                    | 2 |
| 5. Restriction digestion of DNA – agarose gel electrophoresis of DNA fractions.        | 2 |
| 6. SDS – 2 Dimensional electrophoresis of proteins                                     | 1 |
| 7. DNA amplification by PCR and gel documentation.                                     | 2 |
| 8. DNA sequencing (Demonstration) DNA finger printing (RAPD & universal primer method) | 1 |
| 9. Southern and Northern blotting & DNA cloning  | 1 |
| 10. Artificial seed production   | 2 |

### Paper (Practical) SR 407: Computer application & Bioinformatics

16 hrs

- |   |   |
|---|---|
| 1. Mitosis: study of mitotic stages (Drosophila / onion root tip)   | 1 |
| 2. Meiosis: study of meiotic stage (grasshopper / onion floral bud) CHIASMA FREQUENCY   | 2 |
| 3. Polytene chromosomes:<br>a. Preparation of salivary gland chromosomes (drosophila)   | 2 |
| 4. Vital staining: Mitochondria (yeast cells / earth worm ovaries)  | 1 |
| 5. Solving mendelian genetic problems   | 1 |
| 6. Study on karyotype (Humans) - normal male & Female, Down's syndrome, klinefelters syndrome cri-du-chat syndrome, turners syndrome (Demonstration). | 2 |
| 7. Spread sheet calculations using MS-EXCEL & statistical analysis of MS-EXCEL  | 1 |
| 8. Database preparation and queries using MS.ACCESS   | 1 |
| 9. Use of biological database for bioinformatics  | 1 |
| 10. Sequence analysis using biological databases  | 1 |
| 11. NCB Database – Data retrieval   | 1 |
| 12. Page wise alignment   | 1 |
| 13. Multiple sequence alignment, BLAST, FASTA, RASMOL,  | 1 |