

BANGALORE UNIVERSITY
B.Sc SERICULTURE SYLLABUS UNDER
CHOICE BASED CREDIT SYSTEM

FIRST SEMESTER

PAPER – I: GENERAL SERICULTURE & MORICULTURE

OBJECTIVES:

52 Hours

- 1) To introduce the concepts of origin & growth of sericulture & study sericulture as science.
- 2) To acquaint with general aspects of sericulture industry.
- 3) To understand the scientific approach of mulberry cultivation & production.

UNIT – 1

- 1) Introduction to Sericulture – Definition, Origin & history – spread of sericulture – Distribution of sericulture in world – silk route 2 hrs
- 2) Scope of sericulture science : Sericulture as an inter-disciplinary subject – science, social sciences, arts & management – Importance of sericulture in rural development & Indian economy – employment generation & role of women in sericulture 2 hrs
- 3) Components of sericulture & silk industry : Mulberry cultivation – silkworm rearing –silkworm egg production – silk reeling & weaving – end products of each component & their economic importance. Sericulture – as an organised economic sector 3 hrs
- 4) Global silk production: trends in silk production in China, Indian, Japan, South Korea, Russia, Brazil, Thailand – past & present. 1 hr
- 5) Geographical concepts of tropical, temperate, sub – temperate/ tropical sericulture – Classification of countries – merits & demerits 2 hrs
- 6) Types of silks : distribution of mulberry & non – mulberry silks in India, Food plants – primary & secondary – non-mulberry sericulture & tribal development – role of social forestry 2 hrs
- 7) Sericultural practices in India : Concepts of traditional & non – traditional – meaning, traditional practices & areas – advantages & disadvantages. 2 hrs

UNIT – 2

- 1) Study of soils : definition – process of soil formation – taxonomy of soils in brief 2 hrs
- 2) Soil properties : Soil profile – texture – textural class – structure – permeability – soil air – soil temperature – soil water fractions – soil moisture – water holding capacity – soil microorganisms Soil reaction: soil PH – acidity – alkalinity – characters of alkali soils & saline soils – remedial measures. 4 hrs
- 3) Modern system of plant classification in brief: Bentham & Hooker – binomial nomenclature – taxonomic terminologies – technical description of plant – floral biology – modern trends in taxonomy in brief. 3 hrs
- 4) Taxonomy of mulberry – popular cultivars in India. 2 hrs

UNIT – 3

- 1) Anatomy: Anatomy of root, stem & leaf of typical dicot & monocot secondary growth – anatomy of root – stem (primary & secondary) – leaf – petiole in mulberry. 2 hrs
- 2) Brief account of photosynthesis, types of carbon fixation in relation to productivity, brief account of photorespiration and its significance 2 hrs
- 3) Agroclimatic Zones of Karnataka, Agroclimatic factors suitable for mulberry cultivation in brief 2 hrs
- 4) Establishment of mulberry plantation: selection of land – topography – preparation of land; digging, ploughing – tilling – leveling – orientation & layout for irrigated & pit system (implement – machineries used) 2 hrs
- 5) Planting materials: procurement of planting material – preparation of planting material – cuttings – sapling – nursery bed preparation & maintenance – sapling raising – propagation of mulberry – grafting & layering – types. 3 hrs
- 6) Planting System : row system – pit system – spacing in planting – advantages & disadvantages – tree planting – block system, paired row system – recommended spacing under improved method of mulberry cultivation – significance of spacing – impact of spacing and leaf productivity. 2 hrs

UNIT – 4

1. Nutrients: brief account of essential macro and micro nutrients – organic manures, green manures & fertilizers: sources – types – time & method of application – foliar nutrition – technique & significance. Impact of foliar nutrients on leaf yield & chemical composition of leaf – biofertilizers types & importance - application methods & limitations – concepts of integrated nutrient management. 4 hrs
2. Irrigation: Methods of irrigation, water requirement for mulberry under different seasons – sources of irrigation – impact of over irrigation & under irrigation – fertigation – concept & significance. 5 hrs
3. Package of practices for irrigated & rainfed mulberry garden: planting systems – manorial & fertilizer schedule – recommended dosage, Irrigation – types – frequency, mulching practices – methods & significance – intercultivation & weeding, pruning – methods & significance – pruning methods in India with special reference to Karnataka – leaf harvesting methods – advantages & disadvantages – leaf transportation – storage of mulberry leaves – importance. 5 hrs

References:

1. Synthesized Science of Sericulture, By Yokoyama, Published by Central Silk Board – 1954.
2. Sericologia By Tanaka Y.Pub., C.S.B. – 1964.
3. Culture and Sericulture by Prof. S.R.Charshly.
4. Sericulture for Rural Development Edited by H.G.Hanumappa.
5. Handbook on silkworm Rearing, Fuji Publications, 1972.
6. The Development of Indian Silk, Sanjay Sinha, 1990.
7. Introduction to Silkworm Rearing, The Japan Silk Association, Inc. Tokyo, Japan.
8. Silk by H.T.Gaddum and Company Ltd., Macchs field, Chestrin.
9. Sericulture Manual – I (Mulberry Cultivation) – 1972.
10. Text book of Tropical Sericulture – 1975, Pub. By Japan Overseas Corporation Volunteers, Sibuya-ku, Tokyo, Japan.
11. Jaisawal P.L 1980. Hand book of agriculture, Indian Council of Agriculture Research, New Delhi.
12. Krame (Paul.J) 1969: Plant and Soil Water Relationships; Modern Synthesis, New York, McGraw Hill.
13. Krishna Moorthy H N 1975; Gibberellins and Plant growth; Wiley Eastern, New Delhi
14. The Nature and Properties of Soils (9th edition) N C Brady (Mac Millan Pub. Co. Inc., New York.)
15. Studies on Soils of India; S V Govinda Rajan and H G Gopala Rao (1970), Vikas Publ. House Pvt. Ltd., New Delhi / Bombay.
16. Boraiah G 1986; Mulberry cultivation; Lectures on Sericulture
17. Dandin et al. 1988; Bibliography on mulberry (1900-1984) CSR & TI, (Central Silk Board) Mysore.
18. A Shankar and H R Shiva Kumar 2000; Drip and fertigation to the mulberry Geethanjali Printers.
19. S.Shankar 1997; Principles of Agronomy. The Bangalore Printing and Publishing Company.
20. FAO manual 1987; Soil and Water conservation in semi – arid areas. Oxford IBH
21. S. Krishnaswami 1993; A practical guide to mulberry silk cocoon production in tropics.
22. Hisao Aruga 1994; Principles of Sericulture; Oxford IBH.
23. M C Devaiah et al., 1998; Advances in mulberry sericulture; CVG, Publications.

SECOND SEMESTER

PAPER – II : SILKWORM BIOLOGY & REARING TECHNOLOGY

OBJECTIVES:

52 Hours

- 1) To understand the classification and biology of silkworm *Bombyx mori*.
- 2) To acquaint with ecology and ethology of silkworm rearing.
- 3) To familiarize with improved technologies in silkworm rearing & its impact on cocoon productivity.

UNIT – 1

- 1) General account and outline classification of animal kingdom; general characters and outline classification of class Insecta 3 hrs
- 2) Detailed classification of sericigenous insects: characteristic features of order Lepidoptera, families Bombycidae & Saturniidae – economic importance of insects 4 hrs
- 3) Classification of silkworms: based on origin & geographic distribution – based on voltinism & moulting – based on cocoon colour – popular mulberry silkworm varieties of India. 4 hrs
- 4) Biology of silkworm *Bombyx mori*: Life cycle of *Bombyx mori* 2 hrs

UNIT – 2

- 1) Morphology of egg, larva, pupa & moth. Metamorphosis : organ-inter-relationship in metamorphosis. 4 hrs
- 2) Anatomy & physiology: anatomy & physiology of digestive, circulatory, Excretory, respiratory, nervous & reproductive system of silkworm *B.mori*, Structure & function of silk glands – brief account on secretion of silk. 9 hrs

UNIT – 3

12 hrs

- 1) Mulberry silkworm rearing: rearing house: location, plan, orientation types. Model rearing house; ground plan, salient features & advantages. Rearing appliances & equipments – uses 4 hrs
- 2) Disinfection: concept, definition & objectives – methods – fumigation, spraying. Disinfection: classification, formulation dosage calculation – effective disinfection – process & significance 6 hrs
- 3) Selection of race / breed of silkworm & Procurement, transportation procedure 2 hrs

UNIT – 4

- 1) Chawki Rearing: concept, objectives & principles 5 hrs
 - Incubation methods – black boxing – significance – role of environmental conditions for incubation
 - Preparation for brushing, brushing methods – advantages – disadvantages
 - Methods of chawki rearing – optimum environmental conditions for chawki rearing
 - Methods & frequency of feeding, bed cleaning & spacing – significance
 - Co-operative chawki rearing – importance
 - Commercial chawki centers and their management

- 2) Late age silkworm rearing: 6 hrs
 - Objectives & principles
 - Methods of rearing adult silkworm
 - Quality of feed, methods of feeding, frequency of feeding
 - Bed cleaning & spacing – methods & significance
 - Bed disinfectant: types & application methods – significance
 - Care at moulting.

- 3) Spinning and mounting: 2 hrs
 - Spinning behaviours of silkworm
 - Environmental factors influencing spinning
 - Types of mountages – reasons for defective cocoon formation

- 4) Cocoon harvesting: 1 hr
 - Harvesting – sorting & transportation procedure
 - Environment conditions & timing of transportation of cocoon – significance – Quality inspection and grading of cocoons.

References:

- 1) Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- 2) Appropriate Sericultural Techniques Ed. By M S Jolly, Director, CSR & TI, Mysore.
- 3) Handbook of Practical Sericulture, S R Ullal and M N Narasimhanna, CSB, Bangalore 1987
- 4) Text Book of Tropical Sericulture, Pub. Japan Overseas Corporation Volunteers, 1975.
- 5) Handbook on Silkworm Rearing, Agriculture & Technical Manual-1, Fuzi Pub. Co. Ltd., Japan 1972.
- 6) Silkworm rearing : Wupang – Chun and Chen Da – Chung; Pub. By FAO, Rome 1988.
- 7) New Technology of Silkworm Rearing: S.Krishnaswamy, Reprinted by CSB, Bangalore 1986
- 8) Improved method of rearing young age silkworm: S Krishnaswamy, Reprinted by CSB, Bangalore 1986
- 9) The Principles of Insect Physiology: V B Wigglesworth. Pub. By English Language Book Soc., Chapman & Hall 1972.
- 10) Principles of Insect Morphology: R E Snodgrass, Tata Mc Graw Hill Pub. Co. Ltd., Bombay, 1935
- 11) Insect Biology in the future, VBW 80, Ed by Michael Locke, David S Smith, Academic Press, 1980.
- 12) Silkworm Biology and Rearing, A K Dhole, Project Co-ordinator, NCERT, New Delhi, 1990.
- 13) An Introduction to Sericulture, Ganga G and J Sulochana Shetty – Oxford & IBH Pub. 1991
- 14) China Sericulture 1972, FAO, Rome.
- 15) Silkworm Rearing and Diseases of Silkworm, 1956 Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore.
- 16) Handbook of Sericulture-1; Yonemua M and Rama Rao N 1925; Mysore Govt. Ptg. Press.

THIRD SEMESTER

PAPER – III: MULBERRY CROP PROTECTION

OBJECTIVES:

52 Hours

- 1) To study the incidence, symptoms & damage caused by different pests and diseases of mulberry
- 2) To acquaint with the management of pests and diseases through different methods to prevent crop loss (cocoon)

UNIT – 1

- 1) Importance of plant protection, brief classification of fungi, bacteria, viruses and classification of mulberry diseases. 4 hrs
- 2) Pathogenesis – inoculation, penetration, infection, invasion, growth and reproduction of pathogen 3 hrs
- 3) Fungal diseases of mulberry – incidence, symptoms, causative organism, life cycle and integrated control measures – leaf spot, leaf rust, powdery mildew, leaf blight, stem canker, root rot. 6 hrs

UNIT – 2

- 1) Bacterial, viral, mycoplasma and root knot nematode diseases of mulberry, Incidence, symptoms, causative organism, life cycle and integrated control measures. 6 hrs
- 2) Nutritional disorders in mulberry, symptoms and remedial measures 4 hrs
- 3) Influence of biotic and abiotic factors on the incidence of mulberry diseases 3 hrs

UNIT – 3

- Pests of mulberry 13 hrs
- a) Definition of pests, parasitoid and predator.
 - b) Collection, fixing, identification, preservation / mounting of mulberry pests.
 - c) Insect pests of mulberry – Classification, distribution, occurrence, identification, life cycle, alternate host plants, nature of damage and integrated control measures – leaf eating caterpillars, mealy bugs, leaf rollers, jassids, thrips, scale insects, beetles, grasshoppers, girdlers, termites, white fly and acarids.

UNIT – 4

- 1) Defence mechanism against pathogens - Structural and biochemical 5 hrs
- 2) Disease and pest forewarning systems 2 hrs
- 3) Fungicides / pesticides – classification, chemical composition, mode of action, forms, formulations and residual toxicity on mulberry and applications. 6 hrs

References:

- 1) Manual on Sericulture (Vol – I); Food and Agriculture Organisation, Rome, 1976
- 2) Appropriate Sericultural Techniques Ed. By M S Jolly, Director, CSR & TI, Mysore.
- 3) Handbook of Practical Sericulture, S R Ullal and M N Narasimhanna, CSB, Bangalore 1987
- 4) Text Book of Tropical Sericulture, Pub. Japan Overseas Corporation Volunteers, 1975.
- 5) Plant Pathology – R S Mehrotra, Tata, McGraw Hill Publishing Co. Ltd., New Delhi (1980)
- 6) Introduction to Principles of Plant Pathology – R S Singh, Oxford and IBH Publishing Co., New Delhi
- 7) Handbook on Pest and Disease Control of Mulberry and Silkworm – Son Gupta, Pradeep Kumar, Muathuza Baig and Govindaiah, United Nations Publication (ESCAP), Bangkok, Thailand (1990).
- 8) Principles of Insect Morphology, R S Snodgrass, Tata, McGraw Hill Pub. Co. Ltd., Bombay, 1935
- 9) An Introduction to Sericulture, Ganga, G & J Sulochana Shetty – Oxford & IBH Pub. 1991. China Sericulture 1972, FAO, Rome
- 10) Handbook of Pests & Diseases of Mulberry and Silkworm (1990) Pub., by UNESCAP, Bangkok, Thailand.
- 11) Pradan.S (1983) Agricultural Entomology and Pest Control, published by ICAR, New Delhi
- 12) Diseases and Pests of Mulberry and their Control (1991) Pub. By Director CSR & TI, Mysore
- 13) Plant pathology, George N Agrios, Harcourt Asia Pvt. Ltd. And Hartcourt Publishers Internationals Co. Singapore (2000)
- 14) S B Chattopadyay, 1991, Principles and Procedures of Plant Protection, Oxford IBH Co. Pvt. Ltd.

FOURTH SEMESTER

PAPER – IV: SILKWORM CROP PROTECTION

OBJECTIVES:

52 Hours

- 1) To study the incidence, symptoms & damage caused by different pests and diseases of Silkworm
- 2) To acquaint with the management of pests and diseases through different methods to prevent crop loss (cocoon).

UNIT – 1

- 1) Introduction to Parasitology, Host Parasitic relationship, types, classification, origin and evolution of parasitism – types of parasites and hosts 5 hrs
- 2) Diseases of silkworm – introduction, mode of infection, pathogenesis, disease development and spread 4 hrs
- 3) Disinfection – types of disinfectants, method & time of application. Concentration of Disinfectants 3 hrs

UNIT – 2

- 1) Fungal diseases of silkworm – occurrence, types, symptoms, causative organism, predisposing factors, mode of infection, disease cycle – prevention and control measures 4 hrs
- 2) Bacterial diseases of silkworm – occurrence, types, symptoms, causative agents, predisposing factors, source and mode of infection, prevention and control measures 4 hrs
- 3) Viral diseases of silkworm – occurrence, types NPV, CPV, IFV (Kenchu and DNV), symptoms, causative agents, structure of virus, source and mode of infection, prevention and control measures. 6 hrs

UNIT – 3

- 1) Protozoan diseases of silkworm – occurrence symptoms, causative agent, life cycle, source and mode of infection, prevention and control measures 6 hrs
- 2) Insect Immunity system – cellular and non-cellular, phagocytosis, Antibacterial & Antiviral factors 3 hrs
- 3) Toxicology – Insecticides, history, classification, forms & formulations and method of applications. Pesticide calculation and insecticides used in sericulture 4 hrs

UNIT – 4

- 1) Pests & predators – Definition, Distribution, systematic position and method of protection, IPM 5 hrs
- 2) Life cycle, nature of damage, prevention and control measures (IPM) of Indian Uzi fly and Dermisted beetles. 5 hrs
- 3) Predators of silkworm – cockroaches, ants, lizards, rodents and birds – systematic position, nature of damage and control measures. 3 hrs

References:

- 1) Manual on Sericulture (Vol – II); Food and Agriculture Organisation, Rome, 1976
- 2) Appropriate Sericultural Techniques Ed. By M S Jolly, Director, CSR & TI, Mysore.
- 3) Handbook of Practical Sericulture, S R Ullal and M N Narasimhanna, CSB, Bangalore 1984
- 4) Text Book of Tropical Sericulture, Pub. Japan Overseas Corporation Volunteers, 1975.
- 5) Handbook on Pest and Disease Control of Mulberry and Silkworm – Son Gupta, Pradeep Kumar, Muathuza Baig and Govindaiah, United Nations Publication (ESCAP), Bangkok, Thailand (1990).
- 6) Principles of Insect Morphology, R S Snodgrass, Tata, McGraw Hill Pub. Co. Ltd., Bombay, 1935
- 7) An Introduction to Sericulture, Ganga, G & J Sulochana Shetty – Oxford & IBH Pub. 1991.
China Sericulture 1972, FAO, Rome.
- 8) Silkworm Rearing and Diseases of Silkworm, 1956 Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore.
- 9) Cytoplasmic Polyhedrosis Virus of the Silkworm, Hissa Aruga and Tanaka, Y 1971, Univ of Tokyo Press, Japan.
- 10) Pebrine – Monitoring and Disease Management Strategies – CSB Publication, Samson, M V Sridharan, T O & Singh R N
- 11) Bacterial Flacherie of Silkworm, CSB Publication – Govindan R and Devaiah M C
- 12) Ayyar T V R (1987) Handbook of Economic Entomology for South India, Pub. By International Books and Periodicals Supply Service, New Delhi
- 13) Mahi M S (1982) General Entomology, Oxford and IBH Pub. Co., New Delhi.
- 14) Handbook of Pests & Diseases of Mulberry and Silkworm (1990) Pub., by UNESCAP, Bangkok, Thailand.
- 15) Pradan.S (1983) Agricultural Entomology and Pest Control, published by ICAR, New Delhi
- 16) Diseases and Pests of Mulberry and their Control (1991) Pub. By Director CSR & TI, Mysore
- 17) Applied Entomology – P G Fenemore and Alka Prakash, Newage International (P) Ltd., New Delhi, Bangalore.
- 18) S B Chattopadyay, 1991, Principles and Procedures of Plant Protection, Oxford IBH Co. Pvt. Ltd.

FIFTH SEMESTER

PAPER – V: SILKWORM SEED TECHNOLOGY AND VANYA SERICULTURE

OBJECTIVES:

52 Hours

- 1) To introduce the concept of seed cocoon and understand the principles of seed technology
- 2) To acquaint with silkworm seed organisation & importance
- 3) To understand the importance of silkworm seed production & supply.
- 4) To study non-mulberry sericulture

UNIT – 1

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| 1) Introduction to seed technology - Concept and general account of silkworm seeds, grainages, Production and demand trends – their importance in India. Norms of preservation of seed cocoons and marketing of seed cocoons. | 05 hrs |
| 2) Seed Organisation – Concept & significance, maintenance of parental stock and multiplication, Norms for P ₄ , P ₃ , P ₂ & P ₁ Centres. | 07 hrs |

UNIT – 2

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| 1) Seed areas and seed cocoon rearers – concept, importance. Seed legislation act-rules and regulation. Seed cocoon markets – classification, transaction procedure – price fixation – importance. | 06 hrs |
| 2) Planning for seed cocoon – mass disinfection – significance – importance of disinfection and hygiene in seed production units. Synchronized brushing of races in villages | 04 hrs |
| 3) Model grainage – ground plan – grainage equipments – uses & maintenance | 03 hrs |

UNIT – 3

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| 1. Grainage activities – Environmental factors, their significance – programme for hybrid egg production – sorting of cocoons – preservation – pupa testing – sex separation at pupal stages / sex separation at cocoon stage. Moth emergence and synchronization – sex separation in moth – coupling and decoupling – oviposition – egg preparation (sheet & loose) – surface sterilization of eggs – refrigeration of male moths – moth examination – importance – types of moth examination (individual, mass & random) | 10 hrs |
| 2. Artificial hatching – Cold and hot acid treatment – physical and chemical methods – postponement of hatching – refrigeration – short term chilling and ordinary chilling methods. Hibernating and non-hibernating eggs. Hibernation schedule for 3, 4, 6 & 10 months duration. | 04 hrs |

UNIT-4

1. Types of non-mulberry silkworms and their distribution in India and other z countries. 01 hrs
2. Primary and Secondary food plants of Tasar, Muga and Eri silkworms and their distribution. 01 hrs
3. Taxonomy of non-mulberry food plants: Technical description of *Terminalia arjuna*, *Terminalia catapa*, *Litsea polyantha*, *Machilus bombycina*, *Ricinus communis*. 02 hrs
4. Life cycle of Tasar ,Muga and Eri silkworm-Morphology of egg, larva, pupA and moth. Rearing of Tasar,Muga and Eri silkworms 09 hrs

References:

- Dandin S B, Jayant Jayaswal and Giridhar K 2000; Handbook of Sericulture technologies, CSB, Bangalore.
- Ullal and Narasimhanna, 1978; Handbook of practical sericulture, CSB Pub., Bangalore
- Narasimhanna M N 1988; Manual on silkworm egg production, CSB Pub., Bangalore
- Wang San – Wing, 1994; Silkworm seed production Vol. III Oxford and IBH Pub., New Delhi.
- Manual of Sericulture, FAO, Volume IV
- Jolly M S (1983) Organisation of Industrial Bivoltine Grainage for Tropics, Sericulture Project No.3, CSR & TI, Mysore.
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- Pavan Kumar and Dwarakinath, 2000; Price fixation for seed cocoons, NSSP, CSB, Bangalore.
- Manual on Sericulture (Vol – IV); Food and Agriculture Organisation, Rome, 1976
- Thangavelu K et.al; Hand book of Mugaculture,CSB Bangalore.
- Jolly M.S. et.al.;Tasar culture,Bombay,1974.
- Sarkar D.C. Ericulture in India,CSB,Bangalore,1980.

FIFTH SEMESTER

PAPER – VI: SILK TECHNOLOGY, EXTENSION EDUCATION & ECONOMICS

OBJECTIVES:

52 Hours

- 1) To introduce the concept of cocoon as raw material & its significance in reeling technology
- 2) To acquaint with the technologies of silk reeling & importance of reeling devices.
- 3) To understand the significance of raw silk production & processing of yarn.

UNIT – 1

- 1) Characteristic features of cocoon: Structure & nature of cocoon – physical & Commercial characters – factors influencing physical & commercial characters
Cocoon testing & grading: Scientific method – objectives & principles. Systems in China, Japan & India. Assessment of renditta – shell ration, price fixation – Kakame cost – cocoon grading. 03 hrs
- 2) Sorting of cocoon – objectives & principles – procedure – estimation of good & defective cocoons in terms of percentage 01 hr
- 3) Cocoon processing: stifling & conditioning – objectives & principles – definition- Methods – conventional & advanced – advantages & limitations – significance of conditioning. Determination of standard drying percentage – degree of optimum drying – relationship between level of drying & cocoon quality. 04 hrs
- 4) Cocoon cooking: objectives & principles. Cooking methods – conventional – monopan, two three pan – advantages & disadvantages. Advanced – pressurized & conveyor system – advantages & limitations. Brushing – objectives & method 03 hrs
- 5) Reeling: Definition – brief history & evolution of reeling – objectives - Reeling machineries – charaka, cottage basin – multi-end – semi-automatic & automatic – design & construction (charaka cottage basin and multi-end) 03 hrs

UNIT - 2

- 1) Reeling process: Components of reeling 03 hrs
 - Croissure – definition – objectives, formation types – functions & efficiency. Factors influencing efficiency.
 - Jetteboute – origin – design & construction – types – function – advantages
 - Yarn passage path in charaka, cottage basin & multi-end
- 2) Reeling water: sources, properties, pH, conductivity – hardness – alkalinity, reeling water standards, permissible limit, rectifications – consumption rate – impact of water quality on reeling efficiency & quality of raw silk. 01 hr
- 3) Re-reeling – objectives – definition & process. Machineries – conventional & Modern – grant reeling. 01 hr
- 4) Silk lacing – skeining. Objectives – process – book making, bundling – bale making International & ISI standards. 01 hr
- 5) Raw silk testing & grading. Objectives & methods – visual & mechanical tests 02 hrs
- 6) Silk throwing: Throwing – definition & objectives. Twisting, drying – winding 03 hrs

& doubling – types of twists.

Silk weaving : Concept & definition – preparation of warp & weft – components of loom – weaving process – comparative study of handloom & power loom mechanism in brief.

- 7) Chemical processing of silk. Degumming – definition, objectives. Methods & Process – conventional & advanced – effects of degumming. 02 hrs
Bleaching: definition, objectives – methods & processes – effects of bleaching,
Dyeing: definition & objectives.
- 8) Bye-products of silk industry: Stages of bye-product generation, types & extent - 02 hrs
utilisation.

UNIT – 3

1. Extension education 2 Hrs
a) Meaning
b) Principles
c) Philosophy
2. Extension methods 4 Hrs
a) Individual contact method
b) Group contact methods
c) Mass contact methods
d) Application of extension methods in sericulture
3. Extension organization and its linkage in sericulture with special reference to Karnataka –
a) central and state level organization 3 hrs
b) extension services; TSCs, CRCs, Cocoon markets, silk exchanges
4. Financial institution; 3 hrs
a) Commercial banks
b) Co-operatives
c) Karnataka state co-operative apex bank and agriculture and rural development bank
d) NABARD

UNIT – 4 - Economics

- 1) Cost and returns of Irrigated & Rainfed mulberry garden 02 hrs
2) Cost and returns of silkworm egg production 02 hrs
3) Cost & returns of silkworm rearing 02 hrs
4) Cost and returns of raw silk production in charaka, cottage basin & multiend 03 hrs
5) Comparative economics of Sericulture versus paddy, ragi, sugarcane 03 hrs

References:

1. FAO Manual of Sericulture Vol. III
2. Raw Silk reeling – B H Kim
3. Silk Textile Engineering – B H Kim 1989, Seoul National University Press, Rep. of Korea.
4. Silk Biology, Chemistry, Technology – Paolo Carbonic
5. Silk reeling techniques tropics – S.Omorh
6. Silk dyeing, printing and finishing – Gulrajani M L 1990, IIT, Dept. of Textile Technology, New Delhi
7. Silk production, processing and marketing – Mahesh N Nanavaty.
8. Handbook of Textiles Testing ISI – (BIS) Bureau of Indian Std.
9. Principle of Textile Testing – J E Boothe
10. Silk Production and weaving in India, C C Ghosh.
11. Appropriate Sericulture Technique, M S Jolly 1987, ICTRTS, Mysore, India
12. Dyeing of wool and manufacture R S Prayag
13. Development of Indian Silk, Sanjay Sinha 1990
14. Sericulture and Silk Industry. Tripurari Sharma 1984, Consortium on Rural Technology, New Delhi.
15. Silk Industry problem and prospects. A Ajas H Lawpper
16. Textile Fibres, Hess
17. Silk Processing – Kim
18. Dyeing of Textile Fibres – Shenoy.
19. Anon, 1972; Manual on Sericulture, Vol 3, Silk Reeling, FAO, Agricultural Service Bulletin No. 72/3
20. Byong Ho Kim, 1989, Filature water Engineering, Seoul National University Press, Republic of Korea.
21. Huang Guo Rul. 1998, Silk Reeling, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi
22. Mahadevappa D, Halliyal, V G Shankar A G and Bhandiwad R, 2000 Mulberry Silk Reeling Technology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
23. Song K E and Lee Y W, 1973; Modern Silk Reeling Technology, Sericulture Expt. Station, Republic of Korea.
24. Yong Woo Lee 1999; Silk Reeling and Testing Manual, FAO Agricultural services Bulletin No. 136, Rome, Italy.
25. ZSEI, 2002, Silk Weaving, Oxford IBH Publishing Co. Pvt. Ltd.
26. Akira Nakamura, 2002; Fibre Science and Technology, Oxford IBH Publishing Co. Pvt. Ltd.

SIXTH SEMESTER

PAPER – VII: GENETICS AND BREEDING OF MULBERRY

OBJECTIVES:

52 Hours

- 1) To familiarize with the basic Principles and recent approaches in mulberry genetics and breeding.
- 2) To introduce the fundamentals of embryology and cytology of mulberry.
- 3) To acquaint with the application of tissue culture techniques and their practical usefulness.

UNIT – 1

- 1) Mendel's laws of heredity – monohybrid inheritance and principle of Segregation – dihybrid inheritance and principle of independent assortment- test cross – interaction of genes and environment. 05 hrs
- 2) Chromosomes – Number and structure – mitotic and meiotic studies in mulberry. 03 hrs
- 3) Microsporogenesis and Megasporogenesis – development of male and female gametophyte – pollination – fertilization – Endosperm – embryogenesis – polyembryony – Parthenocarpy with special reference to mulberry. 05 hrs

UNIT – 2

- 1) Genetic resources of mulberry: Germplasm – Collection – Characterization- Evaluation – Conservation and Utilization. 02 hrs
- 2) Aims and objectives of plant breeding: Mode of reproduction in relation to breeding methods – Parameters associated with yield and quality of mulberry leaf. Genetic variability and heterozygosity. 05 hrs
- 3) Selection methods – Mass selection, Pure line selection and clonal selection. Merits, demerits and achievements. 05 hrs

UNIT – 3

- 1) Hybridization – Definition and types – Application and objectives – Hybridization Techniques – Pedigree, Back cross, Bulk, Synthetic cross methods – Advantages, Disadvantages and achievements. 06 hrs
- 2) Plant introduction and acclimatization – purposes – procedure – uses, advantages and disadvantages. Quarantine measures 03 hrs
- 3) Mutation breeding – Artificial induction of mutation – procedure of mutation Breeding – Application – limitation and achievements. 05 hrs

UNIT – 4

- 1) Polyploidy breeding: types – induction and its significance in mulberry. 04 hrs
- 2) Breeding for disease and drought resistance – a brief account & its Significance in mulberry breeding. 03 hrs
- 3) Tissue culture – a brief account on techniques of tissue culture – culture 04 hrs

Media – micro propagation – somaclonal variations – protoplast fusion –
Somatic hybridization – hybrids – transgenic plants.

- 4) Brief account of Genetic engineering, concept and technique – application in Sericulture. 02 hrs

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23. Genes and Genotypes in the germplasm bank – 1990 (a report of the committee for the fixation of norms) Central Silk Board, Bangalore
24. Feltwell J (1990) The story of silk. Alan Sutton Publ. Phoenix Gloucestershire
25. Dandin et al., (1988) Bibliography on mulberry (1900-1984) CSR & TI, Mysore
26. Thangavelu K et. al. 1997; Catalogue on Mulberry germplasm Pub. By CSR, Bangalore

SIXTH SEMESTER
PAPER – VIII: GENETICS AND BREEDING OF SILKWORM

OBJECTIVES:

52 Hours

- 1) To know the basic concept and recent approaches of Genetics and breeding of silkworm.
- 2) To understand the developmental Biology of silkworm
- 3) To acquaint with the importance of silkworm breeding.
- 4) To familiarize with the breeding techniques of silkworm

UNIT – 1

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| 1) Silkworm as a laboratory tool for genetic studies | 01 hr |
| 2) Chromosomes – Structure and number of chromosomes in mulberry and non mulberry silkworms | 01 hr |
| 3) Spermatogenesis & oogenesis- fertilization, egg membrane – blastoderm & germ band formation – Blastokinesis – eye spot & Blue egg stage embryo in silkworm B.Mori | 04 hrs |
| 4) Sex determination – Theories, Sex chromosomes
Role of Z and W chromosome in determination of sex in silkworm | 04 hrs |
| 5) Linkage and crossing over – Linkage groups & Linkage maps with special reference to Bombyx mori. | 04 hrs |

UNIT – 2

13 hrs

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|--|--------|
| 1) Parthenogenesis – Androgenesis and Gynogenesis, polyploidy, mosaicism in silkworm | 03 hrs |
| 2) Mutations – types – radiation and chemical mutagens. Radiation sensitivity in different developmental stages. Economic utility of induced mutants | 03 hrs |
| 3) Inheritance of voltinism and moulting | 03 hrs |
| 4) Inheritance of voltinism of cocoon colour, pleiotropism, E-alleles and multiple alleles | 04 hrs |

UNIT – 3

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|--|--------|
| 1) Hereditary traits of silkworm – Egg, larva, pupae and adult characteristics | 04 hrs |
| 2) Molecular approach and recent development in silkworm genetics | 03 hrs |
| 3) Germplasm Bank – Aims, scope and maintenance of silkworm races | 02 hrs |
| 4) Sex limited characters in silkworm – egg colour, larval marking and cocoon colour. | 02 hrs |
| 5) Present status of silkworm breeding in India, problems and priorities. Tropical races versus temperate races, advantages and disadvantages. | 04 hrs |

UNIT – 4

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| 1) Breeding of silkworm, pre – requisites and objectives, Methods of silkworm – selection, inbreeding, outbreeding and mutation breeding – Advantages and disadvantages | 08 hrs breeding |
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| 2) Heterosis – Theoretical basis of heterosis. Hybrid vigour in different crossing systems, Hybrid vigour and environment, Utilization of heterosis in sericulture | 03 hrs |
| 3) Evolution of silkworm races, new silkworm breeds, race authorisation system in India. | 02 hrs |

References:

- 1) Textbook of tropical sericulture – 1975; Japan Overseas Corporation Volunteers 4-2-24, Hiroo Sibuya-Ku, Tokyo-Japan.
- 2) Strickberger M W, 1976; Genetics, Millon, New York.
- 3) Falconer D S, 1972; Introduction to Quantitative Genetics, Oliver and Boyd, Edinburgh
- 4) Kovalev P A, 1972; Silkworm Breeding Stocks Pub. By CSB, Bombay
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- 11) Kovolov P A 1970; Silkworm Breeding Stocks, CSB, Mumbai
- 12) UNESCAP, 1997; Principles and techniques of silkworm Breeding, Oxford & IBH Pub.
- 13) Srirama Reddy, 1997; Silkworm Breeding, Oxford & IBH Pub.
- 14) Thangavelu K, 1997; Catalogue on Silkworm Bombyx mori, Germ plasm, Pub. By CSB, Bangalore.

FIRST SEMESTER
PRACTICAL – I: GENERAL SERICULTURE & MORICULTURE

16 PRACTICALS

1) Sericulture maps :	01
a) World map & silk route	
b) India: mulberry & non-mulberry belts.	
2) Preparation of Pie charts : different types of silk production in India	01
3) Land area measurement – conversions & calculations	01
4) Soil analysis: for pH & electrical conductivity	01
5) Determination of water holding capacity of soils	01
6) Farm Implements	01
7) Technical description of mulberry	01
8) Anatomy of root, stem & leaf of mulberry	03
9) Mulberry propagation: nursery propagation – grafting & layering	02
10) Mulberry cultivation: all aspects in detail (field work)	03
11) Common weeds of mulberry garden.	01

SECOND SEMESTER
PRACTICAL – II : SILKWORM BIOLOGY & REARING TECHNOLOGY

16 PRACTICALS

1) Life cycle of <i>B.mori</i> , morphology of egg, larva, pupa & adult	02
2) Dissection of digestive system, nervous system & silk gland of silkworm larva	03
3) Dissection of male & female reproductive system of silk moth	02
4) Model rearing house – ground plan & chawki rearing / late age rearing	01
5) Rearing appliances	02
6) Disinfection – formulation, disinfectants – types – formulation – calculation – Methods of application	01
7) Silkworm races – morphological study of BV & MV cocoons	01
8) ***Silkworm rearing – brushing – methods Chawki – rearing – late age rearing, feeding, bed cleaning, spacing moulting	02
9) Mounting & spinning – types of mountages	01
10) Cocoon harvesting and quality assessment	01

Note: ***Silkworm rearing – compulsory rearing & submission of report

THIRD SEMESTER
PRACTICAL – III: MULBERRY CROP PROTECTION

16 PRACTICALS

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|--|----|
| 1) Studies of fungal diseases of mulberry – leaf spot, leaf rust, fungal and bacterial blight, powdery mildew (free hand sectioning, staining and temporary mounting). | 05 |
| 2) Studies on root knot nematode disease – mounting of eggs and adult females | 01 |
| 3) Collection of diseased samples and their preservation, identification of fungal and bacterial pathogens. | 02 |
| 4) Identification of mineral deficiency symptoms in mulberry and their remedial measures. | 01 |
| 5) Pests of mulberry – collection identification and preservation / mounting (Field Work) | 03 |
| 6) Studies on common insect pests of mulberry – leaf eating caterpillars, scale insect, mealy bugs, thrips, beetles, jassids, leaf rollers. | 04 |

FOURTH SEMESTER
PRACTICAL – IV: SILKWORM CROP PROTECTION

16 PRACTICALS

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|---|----|
| 1) Studies on larvae, pupae, and moth infected with fungal diseases
Collection, staining and microscopic examination. | 02 |
| 2) Identification / visual examination of larvae infected with NPV, CPV, Kenchu & DNV – collection & microscopic examination of polyhedral bodies - staining of polyhedral. | 02 |
| 3) Morphological features of larvae infected by different bacteria. Staining and Microscopic examination and identification of bacteria. | 02 |
| 4) Morphological features of Pebrine infected eggs, larvae, pupae and moths - Isolation and microscopic examination. Staining spores (Giemsa staining), gut examination in pupa and dry moth examination. | 02 |
| 5) Studies on Indian Uzi fly, dermestid beetle, identification of maggot pupa, adult and larva infested by Uzi fly and dermestid beetle. | 02 |
| 6) Identification of bio control agents for pests and diseases of silkworm | 02 |
| 7) Collection of diseased silkworms & silkworm pests (field work) | 04 |

FIFTH SEMESTER
PRACTICAL – V: SILKWORM SEED TECHNOLOGY AND VANYA SERICULTURE

16 PRACTICALS

1) Model grainage plan	01
2) Grainage equipments	01
3) Selection of seed cocoons, sorting and preservation	01
4) Sex separation of cocoon, pupa and moth	01
5) Moth emergence – pairing, depairing, ovi position – preparation of egg cards / loose eggs – surface sterilization of egg.	02
6) Moth examination for Pebrine spores – gut examination of pupa	01
7) Identification of different types of eggs : Diapause and non-diapause egg, fertilized and unfertilized eggs, dead, hatched and unhatched eggs determination of fecundity and hatching percentage	01
8) Taxonomy of food plants of non-mulberry silk-worms	03
9) Visit to Grainage	02

FIFTH SEMESTER
PRACTICAL – VI: SILK TECHNOLOGY, EXTENSION EDUCATION AND ECONOMICS

16 PRACTICALS

1) Classification and sorting of cocoon – percentage calculation of Good and different defective cocoons.	01
2) Determination of commercial characters of cocoon	02
a) Cocoon weight, shell weight, floss weight, pupal weight, estimation of shell Weight percentage, floss percentage & pupal percentage	
b) Determination of average filament length and nn-breakable filament length, Denier & renditta, raw silk percentage & recovery.	
3) Cooking methods – demonstration	01
4) Reeling machineries – visit to reeling centre	01
5) Reeling water analysis – determination of pH, conductivity, alkalinity, Total hardness & permanent hardness	02
6) Identification by physical, microscopic observation & chemical tests for polyester, Cotton, wool and silk textile fibres.	02
7) Estimation of fibroin & sericin percentage	01
8) Wet processing	02
a) Degumming	
b) Bleaching	
9) Identification of different types of wastes – charaka, cottage, basin, filature waste, basin refusal, reeler's waste.	01
10) Identification of parts of reeling & weaving devices.	01
11) Visit to CRCs, TSCs, and Cocoon markets	03
12) Study tour and report preparation	01

SIXTH SEMESTER
PRACTICAL – VII: GENETICS AND BREEDING OF MULBERRY
16 PRACTICALS

1) Identification of different stages of megasporogenesis and Microsporogenesis – Nuclear endosperm – Dictyo embryo	02
2) Mulberry germplasm – Study of leaf yield and quality parameters of mulberry accessions by referring to CSGRC catalogue	02
3) Mitotic and meiotic chromosomes of onions in comparison with mulberry chromosome.	02
4) Use of micrometers and study of pollen size, pollen viability and fertility in mulberry genotype	01
5) Hybridisation technique: demonstration of emasculation, bagging & crossing (field work)	01
6) Colchicine treatment of bud for induction of tetraploidy and mutagenic treatment for mulberry seeds & cuttings	01
7) Study of stomatal size, index and frequency in mulberry varieties	01
8) Estimation of chlorophyll – a, chlorophyll – b, total chlorophyll content in Mulberry leaf	01
9) Estimation of protein content in mulberry leaf	01
10) Estimation of carbohydrate content in mulberry leaf	01
11) Determination of moisture percentage and moisture retention capacity of mulberry leaf	01
12) Tissue culture and Biotechnology (demonstration) – visit to a research institute	01
13) Separation of chlorophyll by paper chromatography method	01

SIXTH SEMESTER
PRACTICAL – VIII: CYTOGENETICS AND BREEDING OF SILKWORM

16 PRACTICALS

1) Cytological techniques – pre-treatment – fixation – staining - squashes and smears.	02
2) Study of mitosis and meiosis in silkworm Bombyx mori.	02
3) Study of mitosis, meiosis and polytene chromosome in Uzi fly.	03
4) Identification of mutants of silkworm varieties	01
5) Racial characters of bivoltine & multivoltine breeds.	01
6) Selection of cocoons for breeding based on racial characters.	01
7) Calculation of Inbreeding depression	01
8) Heterosis calculation.	01
9) Analysis of quantitative traits (cocoon weight and shell weight)	01
10) Chi square test and t- test.	01
11) Morphology of Silkworm eggs	01
12) Study of different embryonic stages through temporary mounting – 7 th , 8 th & 9 th day egg stages.	02

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