

REVISED SYLLABUS
FOR THREE YEARS B.Sc. (MAJOR) COURSE
IN
SERICULTURE
According to the New Examination Pattern
Part – I, Part- II & Part- III
WITH EFFECT FROM THE SESSION
2016 – 2017

University of Kalyani
Revised Syllabus of Sericulture (Major Course)
(w.e.f. the session 2016 -2017)

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PART - I**Paper – I****Full Marks – 100****Group – A: General Sericulture****50 Marks**

	<u>No. of Lectures</u>
1. Sericulture-Definition-Characteristics-Scope	1
2. Origin and history of Sericulture, silk route	2
3. World output of silk, other natural fibres and man made fibres. Importance of natural fibres vis -à-vis man made fibres – Role of silk fibres amongst natural fibres.	2
4. Silk industry in the World - Silk industry in China, Japan, South Korea, Brazil, Thailand, Uzbekistan, Vietnam and other countries	3
5. Silk industry in India, West Bengal, Jammu & Kashmir, Karnataka, Tamil Nadu, Andhra Pradesh and other states (Mulberry and non - Mulberry Sericulture). Mulberry area Cocoon production, silk production, Number of reeling units (Charka, Cottage, Basin, Filature basin, Handlooms and Powerlooms.	4
6. Prospects and problems of Sericulture, Advantages of silk fibres over other fibres – International demand for silk – constraints in silk production like labour, land, environmental conditions, skill and production cost.	4
7. Organisation of Sericulture industry in India – Government of India – Central Silk Board – State Departments of Sericulture	4
8. Mulberry silkworm and its food plants – Mulberry sericulture – Silkworm races Classification of Mulberry silkworm on the basis of its origin and voltinism.	4
9. Non-mulberry – their food plants. Different species of non -mulberry silkworm. Brief account of : a) Tasar food plants b) Muga food plants c) Eri food plants Types of cocoon and silk produced by them	5
10. Processing of Cocoon- Cocoon Market-Testing and Grading of Cocoon-Different types of Cocoon Stifling-Preservation of stifled Cocoon-Different types of Cocoon Cooking-Brushing of Cocoon	4
11. Outline of different reeling machineries- Charka- Cottage basin- Filature basin- Multi end basin---Semiautomatic and Automatic Reeling Machine	4

	<u>No. of Lectures</u>
12. Marketing of silk – Marketing set-up in different States – — Silk grading – Brief idea of silk conditioning and testing.	3
13. Processing of Silk- Twisting and weaving-Twisting machinery and processing-different types of hand loom and power loom weaving.Degumming-Bleaching-Dyeing-Printing –Finishing Silk. - Utilization of by products and Seri wastes.	5
14. Employment Generation in different sectors of Sericulture	2
15. Seed organization-Significance of seed organization-Maintenance and multiplication of basic stock-Different steps of commercial egg production.	5
16. Role of women in Sericulture-Women participation in mulberry cultivation, silkworm rearing-silk reeling-weaving and finishing.	2

Group – B: Biology of Silkworm and Silkworm rearing Technology 50 Marks

Silkworm Biology

	<u>No. of Lectures</u>
1. Systematic position of silkworm, salient features of silkworm order. Geographical distribution of serigenenous insects.	2
2. Life cycle of <u>Bombyx mori</u> - morphology of egg, larva, pupa and adult	3
3. Morphology and anatomy of following organ systems of silkworm a) Digestive including mouth parts b) Reproductive c) Excretory	5
4. Silk gland-Morphology-Silk Proteins and their significance	4
5. Moulting-Classification of silkworm according to moulting-Hormonal Control	3
6. Silk moth Metamorphosis-hormonal control.	3
7. Nurition- Nutritional requirement of young age and late age silkworm	2
8. Growth-Factors influencing silkworm growth and development	3

<u>Rearing Technology</u>	<u>No. of Lectures</u>
9. Rearing House : Requirements for ideal rearing house – site selection- size of rearing house. Orientation – Model rearing house - B Model – advantages and disadvantages rearing houses.	2
10. Rearing appliances – design and cost requirements of caring appliances for 100 dfls.	1
11. Disinfection – Importance – different disinfectants – types – effective Concentration – method of preparation – usage – time of disinfections – Requirement – disinfections per unit area – estimation of surface area of rearing house.	2
12. Selection of silkworm races/breeds for rearing – advantages and disadvantages of bivoltine, multivoltine and their hybrids.	2
13. Estimation of leaf quality – time for estimation of leaf yield – calculation of brushing capacity based on yield.	1
14. Incubation (brief idea) – environmental conditions required for incubation – their influence in egg development – incubation method – low cost- incubation devices – earthen pot, double brick wall chamber –black boxing.	2
15. Brushing – methods – loose eggs and short eggs – capping and net Method – selection of Leaf brushing – advantages and disadvantages of different types of brushing – cellular and mass brushing.	2
16. Harvesting of leaf – method- time- transportation and storage of leaf for chawki.	2
17. Chawki rearing – importance-environmental conditions required -leaf requirement- selection of different chawki - use of nets and feeding schedules - spacing- chawki rearing centers - labour requirements.	2
18. Moulting –symptom – care during pre moulting – moulting and post moulting periods.	2
19. Late age rearing, spacing – leaf requirement-environmental conditions required – frequency of feeding - bed cleaning schedule.	2
20. Rearing methods – shelf, shoot and floor rearing –advantages and disadvantages - rational utilization of mulberry leaves – bed clearing methods – appliances – labour requirement.	2
21. Preparation of moulting – methods- manual, shelf and jobrai methods - advantages and disadvantages -types of mountages –bamboo, plastic, revolving and rotary collapsible brush mountages - advantages and disadvantages of their use, spinning – environmental Conditions required for spinning.	3
22. Harvesting of cocoons – time harvesting – hybrid crop of cocoons – preservation and transportation of cocoons.	2
23. Cocoon assessment – significance –cost of cocoon production cocoon ratio - maintenance of rearing records.	2

Paper – II (Practical)**Full Marks – 100****A. General Sericulture : (Marks 25)**

1. Sericulture maps -
 - a) World map of silk road
 - b) Countries
 - c) India
2. Organisation set up in India –
 - a) Government of India
 - b) Five traditional states- Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal, Jammu and Kashmir.
3. Identification and study of sericulture production :
 - a) Cotton and silk yarn types
 - b) Pupae
 - c) Silk waste
 - d) Spun yarn
 - e) Nail yarn
 - f) Other byproducts
4. Preparation of Histograms on World out put :
 - a) of silk and other textile fibre
 - b) World out put of silk fibre of different countries
5. Preparation of line graph on trend of silk yarn and other textile fibre production over a period of 5 years.
6. Preparation of bar diagram, multiple bar diagram trend of silk yarn and other textile fibre production over a period of 5 years.]
7. Preparation of pie chart on out put of different types of silk production in India and on Mulberry silk production in different States.
8. Preparation of column diagram, frequency polygon, histogram from frequency distribution

B. Silkworm Biology : (Marks 25)

9. **Morphology :**
 - a Mouth parts of silkworm
 - b External morphology of egg, larva, pupa and moth
 - c Sex separation of larva, pupa and moth
10. **Anatomy :**
 - a. Digestives system, silk gland, nervous system, reproductive system of silkworm.
 - b. Reproductive system of male and female moth
11. Cocoon characters of uni, bi and multivoltine races.
12. Identification of different non mulberry cocoons

Rearing Technology : (Marks 25)

13. Study of a model rearing house
14. Study of the different types of rearing appliances-their design and uses.
15. Study of cost and requirements of rearing appliances for 100 dfls.
16. Preparation and study of various room disinfectants and their application in Sericulture Industry.
17. Preparation and study of various bed disinfectants and their application in Sericulture Industry.
18. Estimation of total surface area and calculation of requirement of disinfectant solution
19. Estimation of leaf yield and brushing capacity of 1 acre mulberry land.
20. Study different types of brushing methods.
21. Selection of leaves for different instar
22. Calculation of leaf moisture
23. Chopping of leaves
24. Bed cleaning
25. Identification of moulting larvae
26. Care during moults
27. Identification of spinning larvae
28. Studies of different types of mountages and their efficiency
29. Preparation of harvest report

D. Viva – Voce : (Marks 15)**E. Laboratory note book : (Marks 10)**

PART – II**Parer – III****Full Marks - 100****Group – A : Soil Science & Biology of Mulberry****Unit – I : Soil Science****25 Marks****No. of Lectures**

1. Soil-Definition of soil- Soil forming factors-soil forming agents.	2
2. Classification of Soil	2
3. Physical properties of soil	5
i) Volume constitution of soil	
ii) Soil texture – a) Soil separates b) Soil textural Classes	
iii) Soil Structure- a) Type b)Importance c) Ways to improve soil structures	
iv) Soil colour	
v) Soil permeability- a)Soil bulk and particle density b) soil porosity c) permeability As related to soil texture and structure.	
vi) Soil air.	
4. Soil Water:	4
i) Importance of water	
ii) Physical and biological classification of soil water	
iii) Soil moisture content and their measurement	
iv) Water requirements of mulberry	
v) Factors affecting soil water holding capacity including capillary rise and leaching	
vi) Soil water conservation and management.	
5. Soil organic matter:	3
i) Soil organic and chemical nature of its constituents.	
ii) Importance of soil organic matter	
iii) Carbon : Nitrogen ration of organic matter and its significance	
iv) Soil micro organism : Types role in mineral nutrition.	
6. Mulberry growth and nutrition:	3
i) Elements (nutrients) essential for plant growth and their classification	
ii) Forms of elements taken up by plants, their absorption and utilization	
iii) Sources of nutrient elements in the soil	
iv) Role of essential elements in plant growth	
v) Deficiencies/ and toxicity	
7. Importance of soil types of India related to mulberry cultivation	3
i) Alluvial soils	
ii) Black soils	
iii) Red soils	
iv) Laterites and lateritic soils	
8. Soil Testing-Soil sampling-Method of soil sampling- Relevant information regarding soil sampling-Precaution-Physical and Chemical Properties of soil- Improvement and reclamation-	3

Unit-II:	Biology of Mulberry-25 Marks	<u>No. of Lectures</u>
9.	<ul style="list-style-type: none"> i) Taxonomy of mulberry and popular mulberry cultivars ii) Morphology and anatomy of mulberry (stem, root and leaf) iii) An outline of floral biology of mulberry: flower, fruit and seed development 	2
10.	Different Agro climates of mulberry	1
11.	Propagation of mulberry <ul style="list-style-type: none"> i) Seedlings : Collection of viable seeds, methods of raising seedlings variability. ii) Saplings : Selection of material for cuttings and its anatomical and physiological criteria : preparation and selection of cuttings iii) Grafting: Selection of stock and scion materials and their anatomical and physiological: Types of grafting- Stem, Root and bud grafting techniques. iv) Layering : Types and techniques v) Raising of nursery: preparation, layout, bed size, soil composition, importance of drainage. vi) Use of growth regulators in mulberry propagation 	4
12.	Establishment of mulberry gardens: <ul style="list-style-type: none"> i) Strategies of long term basis: Intensive cultivation for high leaf productivity and quality ii) Cropping patterns : mono crop and mixed crop iii) Selection and preparation of site iv) Selection of varieties for cultivation v) Different planting materials and their practical relevance in various agro climate conditions vi) Planning systems : advantages and disadvantages and recommended systems. vii) Spacing of mulberry and its significance in leaf productivity and quality under various field conditions. viii) Time and type of initial harvests and their effect on the young plant ix) Measures to promote development of root system and long term significance 	7
13.	Mulberry cultivation practices : (under irrigated and dry land conditions) <ul style="list-style-type: none"> i) Irrigation : <ul style="list-style-type: none"> a) Water requirement of mulberry in different field situations and seasons b) Water resources, irrigation systems (surface, sub soil, sprinkler and drip systems) and their practical relevance c) Water quality and its effects on soil productivity d) Periodicity and quantity of irrigation e) Over irrigation and its effects f) Drainage : Methods and importance g) Sewage water irrigation and its effects. Treatment for irrigation ii) Water management practices in dry land mulberry : <ul style="list-style-type: none"> a) Land leveling, bunding, contour bunding. <i>In situ</i> moisture conservation practices and rain water re-cycling. b) Mulching : Purpose, methods(surface and sub -soil mulching). Mulching materials and cost effectiveness. iii) Manures and their applications : <ul style="list-style-type: none"> a) Basic approaches in mulberry cultivation b) Natural farming and vermiculture c) Organic manures : types (FYM ; Compost). Method of compost preparation and its use in mulberry fields, Advantage and constraints. d) Biofertilizers : Types, importance, application methods and limitations. 	8

- e) Chemical fertilizers : role of major nutrients and trace elements in plant growth. Types . Importance of chemical fertilizers in mulberry cultivation. Chemical composition of different fertilizers, Fertilizers doses and schedules of application for irrigation and rain fed gardens. Calculation of required dosages for a given unit area. Soil test based fertilizers application and its significance. Storage of chemicals fertilizers.
- f) Foliar nutrition : Foliar nutrients and commercial formulations, scope and limitations.
- iv) Inter-cultivation practice; Purpose, methods, time and frequency.
- v) Common weeds of mulberry, their effect on mulberry, productivity and quality and control measures.
- vi) Pruning and training objectives : Types and methods of pruning and importance, utility of mulberry pruning in sericulture management practices.
- vii) Harvesting : Effects of harvest on mulberry plant. Harvesting methods (Leaf and shoot harvest) in relation to cultivation and rearing practices. Stages and times of harvest. Transportation and preservation methods.
- viii) The schedules of package of practices of mulberry cultivation.
 - a) Irrigated gardens
 - b) Rain fed gardens

14. Mulberry Management :

3

- a) Significance of 'leaf cocoon ratio' concept
- b) Measures of the maintenance of high soil productivity
- c) Exclusive mulberry garden for chawki rearing : concept and methods.
- d) Maintenance of mulberry plots in relation to rearing schedules
- e) Requirements, organization and management of labour
- f) Maintenance of farm records and their relevance
- g) Farm implements and machinery

Group – B : Diseases and pests of mulberry & Silkworm**Unit – III : Diseases and pests of Mulberry****25 Marks**

- | | | |
|----|---|---|
| 1. | Concept of plant diseases and importance of plant protection | 1 |
| 2. | Classification of diseases of mulberry | 1 |
| 3. | Influence of biotic and abiotic factors on the incidence of mulberry diseases | 1 |
| 4. | fungal diseases of mulberry, occurrence, symptoms, epidemiology and control | 4 |
| 5. | diseases of mulberry, occurrence, symptoms, epidemiology and Minor control | 2 |
| | <ul style="list-style-type: none"> a) Leaf spot b) Leaf rust c) Powdery mildew d) Leaf blight e) Root rot | |
| 6. | Bacterial - viral and mycoplasmal diseases of mulberry control measures. | 2 |
| 7. | Root knot nematode diseases of mulberry – its occurrence, symptoms and controls. | 2 |
| 8. | Mineral deficiency symptoms in mulberry reclamation. | 3 |
| 9. | Mulberry pests: Classification, life cycle, symptoms of attack, period of occurrence and types of damage caused by Mealy Bug, Thrips, Whitefly, Bihar hairy caterpillar, jassid and termites. | 5 |

10. Management: Essential component, principles and concepts - physical-Machanical, photo tropical and cultural.
 Chemical - types of insecticides, forms and formulations. Pesticides
 Calculat ions and useful formulae. Application techniques and wetting periods.
 Biological – principles and concept, Useful natural enemies of pests of mulberry. 4

Unit – IV : Diseases and pests of Silkworm

25 Marks

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|-----|---|---|
| 11. | Introduction and classification of different types of silkworm diseases
Influence of environment and Nutrition on the incidence of diseases. | 3 |
| 12. | protozoon disease and pebrino - symptomology, structure and life history of
Nosema bombycis- sources and mode of infection - prevention and control. | 3 |
| 13. | Bacterial diseases flacherie - symptoms of different types flacherie disease -
causative agents, factors influencing Flacherie, sources and mode of infection -
prevention and control. | 3 |
| 14. | Viral diseases- grasserie- symptoms of different types of viral diseases, causative
agents, structure and life cycle of NPV, CPV - Kenchu & DNV viruses, sources
and mode of infection, protection and control. | 3 |
| 15. | Fungal diseases- Muscardine-symptoms of different types of fungal diseases - causative
agents, structureand life cycle of <i>Beauvaria</i> , mode of infection, prevention
and control. | 3 |
| 16. | Aspergillus disease - Symptoms, causative agents, s tructure and life cycle of Aspergillus
Sp. , mode of infection, prevention and control. | 3 |
| 17. | General account of disinfection and relative efficienctions of different disinfectants. | 2 |
| 18. | Silkworm pests : Life cycle of tachinid fly -Nature of damage, alternate host and other
important behaviors in relation to mating, oviposition and flight, prevention, chemical
control (ovicidal and chemical attractants), useful natural enemies of Tachinid flies,
integrated management against tachin id fly, dermestid beetles : biology, prevention
and control . Nature of damage, Prevention and control of other pests like ants,
rodents and lizards. | 3 |
| 19. | Life cycle and methods o f important natural enemies of pests of silkworm and mulberry.
New strategies, use of kairomones, pheromones, growth regulators, autocidal methods.
Necessity and concept of IPM with case studies against : Tachinid fly and Meal y bug. | 2 |

Paper – IV (Practical)**Full Marks – 100****Unit – I : Soil Science****20 Marks**

1. Study of different types of soil
2. Soil Sampling
3. Determination of saturation capacity of soil
4. Soil analysis for pH and electrical conductivity
5. Determination of organic carbon by Walky Black Method
6. Determination of Soil Moisture from the given soil sample
7. Determination of soil texture from the given soil sample.

Unit – II : Biology of Mulberry**20 Marks**

1. Morphology and Identification features of popular Mulberry varieties of West Bengal
2. Preparation of Nursery Beds.
3. Preparation, planting and raising of cuttings in nursery bed.
4. Preparation of different types of grafting
5. Different methods of Planting
6. Calculation regarding irrigation
7. Identification of different types of fertilizers, Calculation of doses
8. Identification of common weeds of mulberry and weeding
9. Estimation of leaf yield and harvesting methods.
10. Farm implants and machinery
11. Preparation of flow chart of Annual schedules of operations for 1 ha. Of Irrigated mulberry and also of rain fed mulberry

Unit – III : Disease of Mulberry & silkworm**20 Marks**

1. Identification of Powdery mildew disease of mulberry
2. Identification of Leaf spot disease of mulberry.
3. Identification of leaf rust disease of mulberry.
4. Identification of Root knot disease of mulberry.
5. Identification of Root rot disease of mulberry.
6. Formulation of different types of fungicides.
7. Numerical problems related to preparation of fungicides.
8. Identification and preparation of Permanent slide of the Pathogen-*Nosema bombycis*.
9. Identification and preparation of Permanent slide of the Pathogen-*Bombyx mori* Nuclear Polyhedrosis Virus (BmNPV)
10. Identification and detection of a pathogen causing white muscardine disease in silkworm .
11. Identification of Common Bacterial Disease of Silkworm.
12. Disinfectants-Preparation and their application in Sericulture.
13. Numerical problems related to preparation of disinfectant.
14. Mother Moth Examination.

Unit- IV : Pests of Mulberry & Silkworm**20 Marks**

1. Identification of Mealy bug infested leaf of mulberry .
2. Identification of Thrips infested leaf of Mulberry.
3. Identification of White fly infested leaf of Mulberry.
4. Identification of Bihar Hairy caterpillar infested leaf of mulberry.
5. Identification of developmental stages of pests of mulberry with special reference to mealy bug , whitefly and thrips.
6. Formulation of Insecticides.
7. Numerical problems related to preparation of insecticides.
8. Identification of developmental stages of pest of Uzi fly.
9. Controls of Uzi fly.

Unit- V :**20 Marks**

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|---------------------------------------|----|
| 1. Submission of Laboratory note book | 5 |
| 2. Viva- vice | 10 |
| 3. Field report | 05 |

PART - III

Theoretical	<u>Paper – V</u>	100 marks
Group – A	I. Genetics and Breeding of Mulberry II. Genetics and Breeding of Silkworm	- 50 marks
Group – B	Silkworm Seed Technology	- 50 marks

	<u>Paper – VI</u>	100 marks
Group – A	Silk Technology	- 50 marks
Group – B	I. Non-mulberry Sericulture ; II Sericulture Extension, Organization and Management	- 50 marks

Practical	<u>Paper – VII</u>	100 marks
Group – A	Genetics and Breeding of Mulberry Silkworm Silkworm Seed Technology Silk Technology Non-mulberry Sericulture	- 50 marks
Group – B	On the Job Training	- 50 marks

PAPER-VIII **100 marks****Entrepreneurship Development**

PART -III**Paper – V****Full Marks - 100****Group – A : Genetics and Breeding of Mulberry & Silkworm****Marks 50****I. Genetics and Breeding of Mulberry :****No. Lectures**

- | | |
|--|---|
| 1. Genetic variability in mulberry – sources of variability
Wilde species – hybrids. Popular varieties of India -
chromosomal variations. | 2 |
| 2. Germ plasma conservation – significance and methods. | 2 |
| 3. General information to plant breeding – objectives of mulberry
breeding – parameters associated with growth, yield and quality
of mulberry. | 4 |
| 4. Selection – characters and importance of a) pure line selection
b) clonal selection c) mass selection | 3 |
| 5. Methods of plant breeding – a) Hybridization b) Polyploidy
c) Mutation | 3 |
| 6. Breeding stress resistance – draught, disease, pest , salinity & alkalinity. | 3 |
| 7. Tissue culture – meristem, callus, auther, pollen, endosperm, encapsulation of shoot buds and
cryopreservation of germ / | 4 |
| 8. Seed organization – types of seed, nucleus seed, foundation seed, certified seed, seed
testing, certification – seed multiplication and distribution, concept of seed farms. | 4 |

II. Genetics & Breeding of Silkworm :**Silkworm genetics :**

- | | |
|--|---|
| 1. Silkworm is a laboratory tool for genetic studies | 1 |
| 2. Mendel's principles – Dominance, Law of Independent assortment and segregation,
Test cross and back cross. | 3 |
| 3. Inheritance of cocoon colour, larval markings, E -alleles, multiple alleles. | 1 |
| 4. Inheritance of voltinism, material inheritance, inheritance of
moultinism, environmental influence and hormonal control. | 2 |
| 5. Sex determination, sex linked and sex limited traits their special
significance in sericulture. | 2 |
| 6. Chromosome number and nature of chromosomes in different
types of silkworm. | 1 |
| 7. Mutation – use of induction-mutation in sericulture. | 2 |
| 8. Prospects of Biotechnology to improve silk production – preliminary idea of | |

Genetic Engineering-Preliminary idea of Restriction Endonuclease and Plasmid –Steps in Gene Cloning.	3
9. Origin, distribution and differentiation of silkworm races – Chinese, Japanese, European and tropical races – characteristic features.	2
10. Parameters relevant to silk production – qualitative and quantitative characters and its used in breed selection.	2
11. Breeding of silkworm – prerequisites, aims and objectives - Types of Breeding- Methods- present status of silkworm breeding in India. Problems, priorities and goals.	2
12. Selection methods – individual and family selection – indirect, stabilizing and directional selection.	2
13. Inbreeding and out breeding- advantages and disadvantages -effects of inbreeding-consequences of homozygosity.	2
14. Development of auto sexing breed for egg colour, larval marking and cocoon colour-its significance in sericulture.	2
15. Heterosis – theoretical basis- utilization of heterosis in sericulture – hybrid vigour in different crossing system - hybrid vigour and environment - combining ability tests.	2
16. Maintenance of races, breeds and strains.	1
Group – B : Silkworm seed Technology	Marks 50
1. Morphology of silkworm egg : Size, shape, weight and colour of egg, structure of egg -its constituents	3
2. Embryology of silkworm egg : Characteristics of different stages – critical stages of development.	3
3. Seed organization : Significance ; maintenance of parental stock and multiplication.	2
a) Seed areas : identification – concept of selected seed rearers and villages	2
b) Seed legislation : acts, rules and r egulation.	2
c) Monitoring of seed crop : screening of egg shells, larval, faecal matters for disease. Disinfection and maintenance of hygiene during rearing.	2
d) Seed cocoon market – pupal examination – certification of seed cocoon lots- price fixation for seed cocoons.	2
	<u>No. of Lectures</u>
4. Commercial Egg Production	
a) Plan of a model grainage building	1
b) Disinfection and hygiene in seed production units.	1
c) Procurement and transportation of seed cocoon	1

- | | | |
|----|--|---|
| d) | Sorting and preservation of seed cocoon -role of temperature, humidity, light and air on seed cocoon preservation. | 3 |
| e) | Early test for detection of patria disease papal gut examination and forced eclosion test. | 2 |
| f) | Sex separation in seed production | 1 |
| g) | Synchronizations of emergence – synchronized brushing of roles in villages- Old storing of cocoons/pupal and moths | 3 |
| h) | Eclosion or emergence of moth -manipulating of photo - periodic condition - collection of male and female moth – influence of light or emergence . | 2 |
| i) | Pairing or coupling of moths - rejection weak and deformed moths, duration of pairing –potency of male moths – number of pairing – depairing and decoupling. | 2 |
| j) | Ovipositor – ideal condition for ovipositor – calculation of age of eggs. | 1 |
| k) | Mother moth examination – individual and mass method – green and dry moth – identification of patria spores – surface sterilization of eggs. | 2 |
5. Handling and Preservation of Silkworm eggs.
- | | | |
|----|---|---|
| a) | Handling of multivoltine eggs – ideal embryonic stages for cold storing. | 1 |
| b) | Handling bivoltine egg – methods for early hatching – hot and cold acid treatment – advantages – relationship between temperature and specific gravity of acid – ideal age of eggs for acid treatment – precautions during acid treated eggs. | 3 |
| c) | Preservation of bivoltine egg – short term chilling and long term chilling –hibernation schedules – 4 months, 6 months and 10 months hibernation schedules – importance of intermediate temperature-relationship between aestivation period and duration of cold stage. | 3 |
6. Preparation of loose eggs – advantages and disadvantages -handling of loose eggs. 1
7. Economics of seed production-Cost control in a commercial grainage 1
8. Protection measures on seed production. 1

Paper – VI**Full Marks - 100****Group – A : Silk Technology****Marks 50**

- | | | |
|----|---|---|
| 1. | Introduction to textile fibres – Natural fibres vs man made fibres. | 2 |
| 2. | Physical and chemical properties of silk – uses of silk. | 2 |
| 3. | Raw materials for silk reeling - selection of cocoon for reeling, assessment of renditta, raw material valuation Procedures of cocoon procurement, transportation of cocoon | 3 |
| 4. | Processing of cocoon: | |
| a) | Stifling-definition-objective-different methods-sundrying-black cloth sundrying, steam stifling hot air drying, Mshuakothi. | 3 |
| b) | Sorting- separation of defective cocoons. | 1 |

- c) Conditioning and preservation -methods of preservation of stifled cocoons. 3
- d) Cocoon boiling/cooking -definition and objective, different methods - open pan, three pan and six pan cooking/boiling methods. 3
- e) Cocoon brushing-methods-manual and mechanical building. 3
5. Reeling of cocoon
Objective – different types of reeling machineries comparative account of reeling in different reeling machineries-study of yarn passage in different reeling machineries. 4
6. Re-reeling and packing.
Objective-importance of rereeling ; book making and bail making; factors Influencing the quality of fibre. 3
7. Quality of water required for silk reeling - effects of water in silk reeling - Japanese standards for silk reeling water -corrective measures. 3
8. Quality control in silk reeling and its necessity. 2
9. Cocoon testing and grading – objectives-different relevant methods adopted in India. 3
10. Raw silk testing and grading -different tests for raw silk quality measurement, methods of testing, condition for testing and grading. 3
11. Cocoon market and silk exchange - a general account. 2
12. Chemical processing of silk yarns and fabrics -degumming, bleaching and dyeing. 3
13. Silk industrial by products. Reeling waste classification and its utility in spun silk industry. Utility of pupae. 3
14. Silk testing-winding, warping and weaving - a general account; powerloom and handloom weaving. 2
15. Numerical Calculation regarding production of silk in filature. 1

Group – B:

- | I. <u>Non-mulberry Sericulture</u> | Marks 25 |
|---|-----------------|
| 1. Type of non-mulberry silkworm and their distribution in India and other countries. Prospects and problems of Non Mulberry Sericulture. 1 | 1 |
| 2. Non-mulberry Sericulture and its relevance to social forestry; Industrialization vs non-mulberry sericulture in India-Existing forest potential and their relevance to non -mulberry Sericulture and employment potential. | 2 |
| 3. Primary and secondary host plants of Tasar, Eri and Muga silkworm. | 2 |
| 4. Propagation of primary food plants of Tasar, Eri and Muga silkworm -Ecoraces of Tasar, Eri and Muga silkworms. - | 3 |
| 5. Morphology of egg, larva, pu pa and moth of various non - mulberry silkworm – silk glands of Tasar, Eri and Muga silkworm. - | 3 |
| 6. Rearing : Ecological conditions that influence rearing of non - mulberry silkworms – Improved rearing methods for young st age and late stage silkworms. | 3 |
| 7. Muga culture and its endemic nature to Assam State. | 1 |
| 8. Commercial egg production in Tasar, Eri and Muga silkworms -seed organization in Tasar, Eri and Muga silkworms. | 1 |

9. Diseases of non- mulberry silkworms- Protozoon, bacterial, viral and fungal-symptoms- Causative agents-prevention and control measures. General account of common diseases of host plants. 2
10. Pests and predators of non- mulberry silkworms- their bionomics, seasonal abundance, nature and extent of damage of their various pests and their control.
11. Reeling : Reeling of cocoons -basis difference between mulberry and non - mulberry Silks-different reeling machines- Traditional and modern methods of reeling. Spinning- principles of spinning, different methods and different types of spun silk. 2

II. Sericulture Extension, Organization and management .

Marks-25

1. Extension :
Extension education, Definition –meaning-origin and growth principles and attributes of extension education- community development programmes -role of extension in rural developments-sericulture as a tool for rural development. 2
2. Extension education methods and communications :
Extension as an education purpose – Learning and teaching in extension, formal, informal and non-formal education. Extension -Principle-merit and limitations : Extension communication method-Farmers training methods -Trainer dominated method, Trainee dominated method and co-operative method. 3
3. Diffusion of innovations in Sericulture :
Concept of diffusion and adoption –lab to land programmed sources of information and adoption stages. Attributes of innovations and their impact on technology adoption. 3
4. leadership and motivation :
importance of leadership in sericulture -Identification of local leaders -importance of motivation in sericulture-key motivation facts in sericulture. 4
5. Marketing management :
Sericulture marketing organization – cocoon market and silk exchange - regulated and non regulated market – stabilization of price in cocoon market and silk exchange. 4
6. Sericulture co-operative :
Definition , characters and types of cooperative – principles of cooperative- advantages of cooperative-present status of co-operatives and sericulture - financing agencies in sericulture – short term, mid term and long term financing. 3
7. Feed back system :
Survey – types, merits and limitations Selection of data evaluation. 3
8. Project formulation/and evaluation Definition and characterization of a project – project formulation - Evaluation/appraisal of a project – project analysis. 3

PAPER – VII (Practical)**Full Marks - 100****Group – A :****Marks 50****Genetics and Breeding of Mulberry**

1. Morphology of mulberry plant-Anatomy of root, stem and leaf of mulberry.
2. Determination of Moisture Retention percentage and moisture retention capacity of mulberry leaf.
3. Determination of soluble protein of mulberry leaf.
4. Estimation of chlorophyll from unknown sample .
5. Estimation of soluble sugar from given plant extract.
6. Estimation of Leaf-Shoot and Leaf-Petiole ratio from the given leaf sample
7. Estimation of carotenoid from unknown sample.
8. Hybridization techniques -sexual polymorphism -selection of parents- pollen fertility and viability - bagging, collection of pollen and crossing -harvest of hybrid seeds raising and preliminary screening of F1 progeny.
9. Commercial characters of mulberry – some evolved varieties.

Genetics & Breeding of Silkworm

1. Evaluation of Heterosis.
2. Chi-square Test.
3. Genetics of Cocoon Colour.
4. Breeding Plans.
5. Identification of different types of cocoons.

Silkworm Seed Technology .

1. Plan of grain age building and grain age equipments –visit. to the commercial grainage.
2. maintenance of records in grainage.
3. Visit to the seed cocoon markets, commercial grainage, multivoltine and bivoltine.
4. Processing of seed cocoons - defocusing-sorting-selection of good cocoons – assessment of seed cocoons – pupa examination.
5. Cutting of seed cocoons-sex separation by pupal method -preservation of cocoon/pupa -Maintenance of temperature, humidity and light factors.
6. Emergence of moths –selection of moths- pairing and depairing – Oviposition-Maintenance of required environmental conditions -preservation of male moths.
7. Mother moth examination – individual and mass –whole and sampling, method – surface sterilization of silkworm eggs.
8. Sheet eggs and loose egg preparation - preparation of starch coated paper – washing of loose eggs - Drying-Treatment of eggs with acid –weighting and packing.
9. Acid treatment of bivoltine eggs -Hot acid and cold acid treatment.
10. Preservation of eggs-short term and ordinary chilling - hibernation schedules 3,4,6 and 10 months.

Silk Technology .

- 1.) Sort out the good cocoons and defective cocoons in the supplied cocoons lot and determine good and defective cocoons percentage.
- 2.) Single cocoon reeling-determination of average filament length and average denier (size).
- 3.) Calculate S.R percentage of the supplied cocoon sample (green weight basis). Also calculate the estimated renditta
- 4.) Calculate the degree of cooking, dropping percentage and grouping percentage of the supplied cocoon lot.
- 5.) Calculate the average-size, maximum size deviation, standard size deviation and CV% from the supplied data. 19.75, 21.25, 21.50, 21.30, 21.50, 21.25, 21.25, 20.25, 20.80, 21.00
- 6.) Degumming of raw silk yarn and silk waste by soap and soda method and estimation of degumming.
- 7.) Water analysis – pH Total hardness, Total alkalinity

Non – mulberry Sericulture.

1. Identification of major food plants of non mulberry silkworms.
2. Identification of different stages of Tasar Silk moth
3. Identification of different stages of Eri silk moth.
4. Identification of different stages of muga silk moth.
5. Identification of different cocoons produced by non mulberry silk worm.

Group – B :**On –the- Job Training****Marks 50**

Every candidate shall be required to undertake on -the-Job Training for a period of about 8(eight) weeks at the end of the second years of study. The purpose of the on -the-Job Training is to expose the students to the different aspects of sericulture in real situation. Following are the probable sites for on -the-Job training :-

- Silkworm seed production center/Central Silk Board, Berhampore/Department of sericulture, Govt. of W.B.
- Central sericulture Research and training Institute, Central Silk Board, Berhampore.
- Any Sericulture Firm/Technical Service Centres (Sericulture etc.)

One faculty member of the colleges will maintain liaison with the organization implanting the training. The candidate shall be under administrative control of the organization regarding site of work and duty hours etc.

Every candidate shall be required to maintain a daily diary of his attendance and work done/experience acquired during the training. The head of the organization/ s will furnish a confidential report regarding attendance and an assessment of the performance in respect of every student to the principal of the college concerned on completion of the training which will be taken into account at the time of final evaluation.

The candidate shall have to submit two copies of bound and typed/neatly handwritten report on the training undertaken by him/her in the form of a Along with a certificate of the guide from the college duly Endorsed by the Course. Co -ordinator and principal of the college for evaluation. The report shall have to be submitted to the college concerned at least seven days before the commencement of the University examination which will be jointly evaluated by the internal and external examiners.

PAPER-VIII**Full Marks - 100****ENTREPRENEURSHIP DEVELOPMENT**

[Common paper for Three -Year B.A./B.Sc./B.Com.(Major) Degree Course subjects.]

Six Questions to be answered taking three from each group.

Group A**50 Marks****No. of periods.****1. ENTREPRENEURSHIP BUILDING :**

- | | | |
|----|---|-----------|
| a) | Meaning-Importance-Psychological Sociological Factors and Distinctive Competence. Entrepreneurship Process. Identification of Opportunities -Choice of Technology- Make or Buy Decision -Biography of Indian Entrepreneurship –Status of Worldwide Entrepreneurship. | 3 |
| b) | Need, Scope and Characteristics of Entrepreneurship, Special Schemes for Technical Entrepreneurs, STED. | 2 |
| c) | Social responsibility and business ethics. | 1 |
| d) | Environmental Awareness. | 1 |
| e) | Human Resource Management, Management of self and understanding human behavior. Leadership, Motivation Attitude – Belief, Communication, Group Dynamics, Delegation, Setting of Goals, Self assessment, Organizational / Psychology- Transactional approach and Analysis Creativity , Problem Solving – Strength Weakness Opportunity and Threat (SWOT) Techniques – Decision Making –Stress Management – Positive Reinforcement, Recruitment, Selection, Training. | 5 |
| | Total : | 12 |

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College.
- ii) Director, Cottage & Small Scale Industries, W.B., New Secretariat Building (9th floor), 1, Kiron Sankar Roy Road, Calcutta – 700 001.
- iii) SISI, Calcutta, 111 & 112, B.T. Road, Calcutta – 35.
- iv) GM / DIC of respective District.
- v) GNCCI / NEBCON.
- vi) Any successful Entrepreneur of the locality.
- vii) IIM, Calcutta.
- viii) Experts from Bengal Engineering & Science University.
- ix) IISWBM, Calcutta.

2. <u>TECHNOLOGY MANAGEMENT :</u>	<u>No. of periods.</u>
a) Criteria for principles of product, selection and development.	2
b) Choice of technology, plant and equipment.	2
c) Energy requirement & utilization.	1
d) Resource Management –Men, Machine and materials.	1
e) Critical Path Method (CPM) & Project Evaluation Review Techniques (PERT) as planning tools for establishing SSI.	3
f) Plant Layout & Process Planning for the product.	1
g) Quality control/quality assurance and testing of product.	1
h) Production Management : Elements of production process, production planning and control, product development testing facilities, patents, Quality Assurance, Time control and Cost control, Total Quality Management.	3
i) Materials – Purchasing Management : Materials Planning and budgeting, Source selection, Public buying, Value engineering, Value analysis, Economic ordering quantity, Inventory control, Linkage with Import & Export Management.	2
Total :16	

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College. ii) Experts from Bengal Engineering & Science University iii) Experts from Jadavpur University. iv) SISI, Calcutta, 111 & 112, B.T. Road, Calcutta – 35. v) IIM, Calcutta. vi) IISWBM

3. <u>PROJECT FORMULATION :</u>	<u>No. of periods.</u>
a) Needs, scopes and approaches.	1
b) Stages and methodology in project Identification -, selection of a project format, Project Report Writing.	1
c) Analysis and evaluation of a project report.	1
d) Critical decision making areas- Money-Market-People.	1
e) Interaction with appraisal authority and Financial Institutions, project outline of relevant professions.	1
f) Economic viability and financial feasibility.	2
g) Business and industrial laws, labour relations.	1
h) Entrepreneurs and society, changing concept of social responsibility, shift to ethics, institutionalizing & challenge of relativism.	2
Total : 10	

SOURCE OF FACULTY :

- i) In house resource persons and faculty members of the College. ii) SISI, Calcutta iii) GM/DIC of respective district. iv) Directorate of Cottage & Small Scale Industries, W.B. v) Experts from Bengal Engineering & Science University vi) Experts from Jadavpur University.

Group B**50 Marks****1.FINANCIAL MANAGEMENT :****No. of periods**

a)	Institutions, financing procedure and financial incentives, Banking norms as in vogue.	2
b)	Financial ratios & their significance.	2
c)	Costing and pricing.	2
d)	Knowledge of capital market and mobilization thereof	1
e)	Funds flow & cash flow concept.	1
Total :		8

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College.
- ii) Cost Accountant Institutes.
- iii) Training Institutes of Bank.
- iv) Directorate of Cottage & Small Scale Industries, W.B., New Secretariat Buildings (9th floor), 1, Kiron Sankar Roy Road, Calcutta – 700 001.
- v) Reputed consultants.
- vi) BNCCI / WEBCON.
- vii) Business Management Deptt., C.U.

2. MARKETING MANAGEMENT :**No. of periods**

a)	Exposure to demand based, resource based, service based, Import substitute & Export promotion Industries.	3
b)	Market survey techniques.	
c)	Elements of marketing & Sales management.	1
d)	Nature of product and market strategy - Packing & advertising – After sales service.	2
e)	Touch an Import-Export procedure & methods.	1
f)	Analysing marketing opportunities, planning marketing strategy, forecasting, marketing mix, advertising the marketing programme & sales management.	4
Total :		14

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College.
- ii) IIM, Calcutta.
- iii) Deptt. of Business Management, C.U.
- iv) Experts from Bengal Engineering & Science University
- v) SISI, Calcutta.
- vi) GM/DIC of respective district.
- vii) IISWBM

3. MONITORING & FOLLOWUP :

- | | | |
|----|---|---|
| a) | Sickness in small scale industries and their remedial measures. | 1 |
| b) | Coping with uncertainties and managing the situation. | 1 |

Total : 2

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College.
- ii) Directorate of Cottage & Small Scale Industries, W.B.
- iii) Experts from Bengal Engineering & Science University
- iv) Experts from Jadavpur University.

4. DATA BASE MANAGEMENT :**No. of periods**

- | | | |
|----|---|---|
| a) | Books of accounts, financial statements. | 2 |
| b) | Creation of data base/Management Information System (MIS) | 2 |

Total : 4

SOURCE OF FACULTY :

- i) In house experts and faculty members of the College.
- ii) Experts from Bengal Engineering & Science University
- iii) Experts from Jadavpur University.
- iv) IIM, Calcutta.
- v) Business Management Deptt, C.U.
- vi) IISWBM, Calcutta.

5. STATUTORY PROVISION :**No. of periods**

- | | | |
|----|---|---|
| a) | Licensing, registration – Municipal bye laws and Insurance coverage. | 1 |
| b) | Important provisions of factory Act, Sales of goods Act, partnership Act. | 1 |
| c) | Pollution control & Environmental Act. | 2 |
| d) | Income Tax, Sales Tax and Excise Rules. | 1 |

Total : 5

SOURCE OF FACULTY :

- i) Faculty with Industrial Relation Management / Experience background.
- ii) Tax Practitioner / Lawyer.
- iii) Member from WBPCB, Calcutta.

6. KNOWLEDGE INPUT :**No. of periods**

- | | | |
|----|---|---|
| a) | Industrial and economic policy declared by Govt. from time to time. | 2 |
|----|---|---|

SOURCE OF FACULTY :

- i) Directorate of Cottage & Small Scale Industries, W.B.
- ii) SISI, Calcutta.

N.B. : The students shall be required to visit to linked institutions & promotional agencies, like Commercial banks, WBFC, SISI, DIG, Commercial Tax Offices, WBPCB & some testing centers for getting practical exposure.

Suggested Reading Material :

1. Deshpande M.V. : Entrepreneurship of Small -Scale Industries : Concept, Growth & management , Deep & Deep Publication, D-1/24, Rajouri Garden, New Delhi -110027, 1984.
2. Mc Clelland DC : The Achieving Society, Princeton, NJD, Van Nostrand Co. N.Y. 1961.
3. Meredith GG, Nelson : Practice of Entrepreneurship, ILO, Geneva, 1982. Be. et. al.
4. Pareek U & Rao TV : Personal Efficacy in Developing Entrepreneurship, Learning Systems, New Delhi, 1978.
5. Rao TV & Pareek U. : Developing Entrepreneurship - A Handbook, Learning Systems, New Delhi, 1982.
6. Vyas JN : Planning an Industrial Unit 1, Neelkunj Neelkanth Park Opp. Navrangpura, Ahmedabad.
7. Welsh JA & Jerry FW : Entrepreneurs Master Planning Guide – How to Launch a successful Business. Prentice Hall, Englewood Cliffs, 1983
8. Department of Industrial: Incentives & Concessions for Setting up Industries in Development. Backward Areas, Deptt. of Industrial Development, Govt. of India, New Delhi.
9. India Investment : Guide for Entrepreneurs, India Investment Centre, Industrial Centre. Jeevan Vihar Building, Sansad Marg, New Delhi.
10. Entrepreneurship : A handbook for New Entrepreneurs (with special reference to S & T group), Entrepreneurship Institute of India. Development Institute of India.
11. Philip Kotler Publisher: Marketing Management, Prentice Hall of India.
12. James C. Van Horne : Fundamentals of Financial Management, Publisher : Prentice Hall of India.
13. Edgar H. Schein : Organisation Psychology, Publisher : Prentice Hall of India.
14. A.K. Datta : Materials Management, Publisher : Prentice Hall of India.
15. Monthly Bullentin of Reserve Bank of India.
16. Industrial Survey of India, Hindu Group.
17. Business Today, Indian Express Group.
18. Economic Times.