Semester I **600 marks** **Duration: 6 months**

Course-01 **Theo-100 Marks** **Credit-4**

Group A

Mulberry Production **50 marks**

1. Cultivated varieties of different parts of India and World
2. Factors affecting soil fertility – integrated nutrient management
3. Crop physiology in relation to crop production – transpiration – photosynthesis – phytohormones related to growth
4. Water stress and physiological consequences : role of essential elements
5. Manures – green manures and bio fertilizers role of organic matter and soil moisture in relation to growth of mulberry
6. Propagation and cultivation of mulberry
7. Dry farming technology and weed management

Group B

Mulberry Crop Protection **50 marks**

8. Classification of diseases of mulberry
9. Influence of biotic and abiotic factors on the incidence of mulberry diseases
10. Fungal diseases of mulberry, occurrences, symptoms, epidemiology and control
11. Bacterial, Viral and mycoplasmal diseases of mulberry, control measures
12. Root knot diseases of mulberry-its occurrence, symptoms and controls
13. Integrated Disease Management
14. 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, Leaf Weber, Termites, Mites-Integrated Pest Management
15. Plant quarantine and application of fungicides and Insecticides

Course-02 **Theo-100 Marks** **Credit-4**

Group A

Principles of Soil Science **50 marks**

1. Soil forming factors : classification of soil , physical and chemical properties of soil; Soil pollution
2. Soil water – soil moisture, water requirement of mulberry, factors affecting water holding capacity, movement of water in soil including capillary rise and leaching, soil water management.
3. Soil ion exchange , soil organic matter – chemistry and importance
4. Mulberry growth and nutrition including deficiency and toxicity
5. Soil micro-organism
6. Soil types of India related to mulberry cultivation-Alluvial soils, Black soils, Red soils, Laterites and Lateritic soils

Group B

Ecosystem Dynamics **50 marks**

7. Limiting factors
8. Niche theory – niche concept , niche dynamics
9. Ecological energetics : Entropy law , concept of productivity and energy subsidy ; energy flow model
10. Bio geochemical cycles-Nitrogen Cycle, Oxygen Cycle and Carbon cycle
11. Biotic community – concept structure, dominance, fluctuation and succession – principle of population ecology
12. Environmental assessment , sustainable development

Course-03 Theo-100 Marks Credit-4

Group A 50 marks

Animal taxonomy, cocoon crop production & management

1. Basic principles of Animal taxonomy with reference to sericulture.
2. Silkworm breeds / races of tropical and temperate regions and their characteristics
3. Rearing houses : cost effective rearing houses
4. Rearing methods : nutritional requirements of young and late age silkworms different aspects
5. Managements of silkworms rearing in different seasons and regions
6. Mountages – mounting methods , cocoon harvesting , cocoon marketing , cocoon assessment and preparation of harvest report

Group B

Cocoon Crop Protection 50 marks

7. Introduction and classification of different types of silkworm diseases-Influence of environment and nutrition on the incidence of diseases, disinfecting methods and hygiene different aspects
8. Viral Diseases: Introduction-Viral diseases of Silkworms-control-
9. Bacterial Diseases: Introduction- Diseases caused by bacteria-control
10. Mycoses-Introduction- Fungi causing silkworm diseases-Life cycle and mode of infection-Physical &biological environment-control
11. Protozoan infections: Pebrine- symptomology, structure and life history of *Nosema bombycis* –sources and mode of infection-prevention and control
12. Major Silkworm Pests and their management- Uzifly and Dermested beetles- Biology, Nature of damage, Prevention and control-IPM against Uzi fly

Course-04 Theo-100 Marks Credit-4
Group A 50 marks
Biochemistry and Biophysical Phenomenon

1. Carbohydrate – classification, structure and properties.
2. Metabolism of carbohydrates – Glycolysis, TCA, Glycogenesis.
3. Protein – classification, structure, properties and metabolism.
4. Metabolism of lipid-β Oxidation of fatty acids
5. Idea about diffusion, pH, buffer, osmosis & absorption
6. Enzymes-Models of enzyme catalysis, specificity of enzymes, factors influencing enzyme activity, Michaelis constant

Group-B Physiology, Histology and Endocrinology 50 marks

7. Haemoglobin and its role in relation to O_2 and CO_2 transport
8. Physiology of urine formation-glomerular filtration, tubular function, plasma clearance and counter current mechanism.
9. Endocrine glands in insects: Secretion and function, Endocrine organs of nervous origin, endocrine organs of epithelial origin, neurohormones of the brain, hormones of corpora allata, hormones of ecdysal gland , functions of endocrine organs in insects.
10. General Characteristics of hormones and general mechanism of hormone action.
11. Application of insect hormones (juvenile hormone and moulting hormone) in Sericulture Management

Practical (200 marks)

Experiments on mulberry production, mulberry crop protection management, soil science and ecosystem study, experiments on silkworm cocoon production, protection, biochemistry, Physiology and Endocrinology

Course-1 Prac-50 Credit-2

Experiments on mulberry production, mulberry crop protection

1. Morphological studies of mulberry plant – identification of popular mulberry varieties
2. Breeding techniques and evaluation
3. Pruning, thinning, training and nursery preparation
4. Calculation and application of dose of manures and fertilizers
5. Weed identification
6. Identification of mulberry disease and pests
7. Fungicides – formulation and their application , types of sprayers
8. Farm implements / machinery for establishment / cultural operation in mulberry cultivation
9. Field survey and data collection to work out economics in mulberry cultivation
10. Study of different meteorological equipments observation , recording and maintenance
11. Soil testing and recommendation

Course-2 **Prac-50** **Credit-2**

Soil science and Ecosystem Study

1. Study of soil profile
2. Study of different types of soil – visit to different fields
3. Soil sampling
4. Preparation of soil sample in the laboratory for analysis
5. Determination of saturation capacity of soil
6. Soil analyzing for pH and electrical conductivity
7. Determination of organic carbon by walky black method
8. Determination of available nitrogen by alkaline permanganate method
9. Visit to a soil testing laboratory
10. Visit to a water shed
11. Mechanical separation of soil sample to study the percentage of gravel sand and clay
12. Assessment of soil texture
13. Determination of humus contents of different soils
14. Determination of soil moisture
15. Study of vegetation / community structure by quadrant method
16. Study of a community by quadrant method and study of frequency density and abundance of different species
17. Determination of Biological oxygen demand (BOD) of water (raw/treated sewage)
18. Determination of chemical oxygen demand (COD) of water (raw/treated sewage)
19. Determination of total alkalinity of water
20. Experiments to record temperature, relative humidity, light intensity and rainfall of a given place

Course-3 Prac-50 Credit-2

Experiments on silkworm cocoon production and protection

1. Morphology of silkworm egg, larva, pupa and moth
2. Digestive and reproductive system in larva and moth dissection
3. Silk gland in larva – dissection
4. Moth dissection – mounting of mouth parts and spiracles
5. Cocoon of different breed and hybrids
6. Disinfecting – estimation area of surface area, disinfectants, preparation of disinfectants
7. Incubation and black boxing
8. Different brushing methods
9. Assessment of leaves –selection of leaves for different instars, chopping of leaves
10. Bed cleaning
11. Identification of different silkworm diseases
12. Identification of different pest of silkworm
13. Cocoon harvesting- assessment and preparation of harvest report
14. Grainage building plan and equipments
15. Visit to sericulture institute and farms
16. One assignment on related topic to be submitted

Course-4 **Prac-50** **Credit-2**

Biochemistry, Physiology and Endocrinology

1. Protein estimation by kjeldhal and colorimetric method
2. Biochemical estimation of nutrients in mulberry leaf-Moisture percentage of mulberry leaf-chlorophyll (a, b and total) content, soluble proteins, sugars etc.
3. Study of electrophoretic profiles of DNA and protein with reference to standard markers-demonstration
4. Amylase activity studies in haemolymph of silkworm
5. Qualitative experiments on protein and carbohydrates
6. Biochemical estimation of N.P.K percentage in mulberry leaf
7. Micro technique-Fixation, Embedding, Block making and section cutting of animal tissue
8. Identification : TS of Mammalian tissues- Liver, Kidney, Testis, ovary, Thyroid, Pancreas and small intestine
9. Visit to different laboratories for a general conception about modern technologies

Semester II **600 marks** **Duration: 6 months**

Course-05 **Theo-100 Marks** **Credit-4**

Post cocoon technology

Group-A **50 marks**

Introduction to Textile fibres with special reference to silk

1. Textile fibres- Definition-Different types of textile fibres-Cotton industry-Development of fibre in cotton-Uses of cotton-Cotton textile industry- soft or bast fibres- jute industry- Hard fibre- coir industry-wool industry-surface Fibres- natural and man made fibres-Difference between Natural Fibre and Man made fibre-World output of Textile Fibres-Characteristics of different types of textile fibres- A brief idea about synthetic fibres- Concept of blending
2. Silk- Definition-origin and history of silk Industry – Silk Industry in China, Japan, India, Korea, Vietnam, Thailand, Brazil and European Countries- Different varieties of commercial silk- uses of Silk
3. Properties of Silk- Physical properties of silk-Tenacity in wet condition and dry condition-Elongation of silk fibre-Moisture regain capacity-specific gravity of silk- Effect of Temperature, Electricity and Light on silk-Chemical Properties of silk-Effect of water, acid, dilute alkali , strong alkali, metallic salt and bleaching
4. Types of Silk- Chiffon, China Silk, Crepe de Chine, Charmeuse, Jacquard, Douppioni, Noil and raw silk.
5. Reeling Industry- Importance of reeling industries for the development of sericulture -problems of reeling industry- Suitable remedial measures.

Group-B **50 marks**

Processing and Finishing of Silk

6. Assessment of cocoon shell ratio percentage , filament length, filament size, reelability percentage, estimation of renditta, raw silk percentage, different types of defective cocoon, cocoon sorting method, effect of defective cocoon in reeling, physical and commercial characters of mulberry on reeling and raw silk quality cocoon testing and grading, cocoon marketing
7. Cocoon stifling- objectives and different stifling methods, sun drying system stifling, hot air drying, batch type, conveyor type, ushna koti, advantages and disadvantages of various methods
8. Storage and preservation of cocoons
9. Cocoon cooking including brushing
10. Reeling and re-reeling
11. Seriplan board, degumming, Bleaching, Dyeing& pupal oil extraction
12. Silk testing, printing, doubling, winding, twisting, weaving and import and export of silk.

Course-06 **Theo-100 Marks** **Credit-4**
Group A **50 marks**
Non mulberry silk production

1. Production – details, comparative production efficiencies, prospects and problems in developing countries
2. Organizational set up – administrative research training employment potential relevant to social forestry potential
3. Cocoon production and marketing – reeling and weaving sectors
4. Rearing practice, ecological conditions that influence rearing of non mulberry silkworm – improved ream methods for young and late age tasar , muga and eri silkworms, mounting methods, different kinds of mountages, rearing of seed and commercial crops, indoor rearing of tasar and muga silkworms, disinfection and disinfectants
5. Seed cocoons- procurement, cocoon of different eco types, cocoon preservation, synchronization of moth emergence, production of disease free eggs, seed organisation in tasar and muga silkworm, problem of seed supply, role of BSMTC.
6. Reeling- basic difference between mulberry and non mulberry silk reeling, problems, traditional and modern method of reeling, spinning principles, different methods and different types of spun silk

Group B **50 marks**

Non mulberry Crop Management

7. Host plants of non-mulberry silkworm.
8. Diseases of non -mulberry Silkworms- Protozoan Disease, Viral disease, Bacterial disease and fungal disease-causal organism, pathogenesis and control measures.
9. Pests and predators of Tasar silkworms-their bionomics, seasonal abundance, nature and extent of damage of their varios pests and their control.
10. Pests and predators of Eri silkworms-their bionomics, seasonal abundance, nature and extent of damage of their varios pests and their control.
11. Pests and predators of Muga silkworms-their bionomics, seasonal abundance, nature and extent of damage of their various pests and their control.

Course-07 **Theo-100 Marks** **Credit-4**

Group A **50 marks**

Organization management

1. Planning and decision making nature process, types, principles, significance and limitation of planning and forecasting, decision making, meaning, importance and process
2. Historical perspective of administration and management- scientific and burocratic management
3. Functions of management, concept, process, structure, scope and factors affecting in organizing authority, power and responsibility. Delegation of authority reporting and budgeting, Job analysis, manpower, planning, recruitment and selection
4. Organizational behaviour and management- basic concepts
5. Application of management principles in cocoon production – silkworm seed production and reeling

6. Managerial problems in cocoon production – silkworm seed production and reeling

Group B **50 marks**

Entrepreneurship development

7. Entrepreneurship- Importance-Psychological, sociological factors and distinctive competence-Entrepreneurship process –Identification of opportunities-Choice of Technology-Make or Buy Decision;Need, Scope and Characteristics of Entrepreneurship
8. Human resource management –definition, objectives, scope and functions
9. Direction, motivation and leadership- meaning principles and techniques
10. Technology Management in respect to Silk Production-Choice of Technology, Plant and equipment , Resource Management-Men, Machine and materials
11. Project Formulation- Needs, Scopes and approaches-Stages and methodology in Project Identification-Preparation of various Sericultural Projects
12. Concept of marketing management and sales management – market research and information system, market organization and control-Cocoon market and silk exchange.

Course-08 **Theo-100 Marks** **Credit-4**

Group A **50 marks**

Sericulture extension management

1. Extension programme management concept and principles, steps in programming planning role of extension personnel and farmers in programme planning
2. Communication, definition, planning, types and evaluation of different teaching aids
3. Diffusion of innovation- elements and process, innovation types, adopter categories decision process.
4. Importance of sericulture in development plan, five year plans, sericulture in employment generation , sericulture in rural development

5. Resource system analysis, micro planning for sericulture socio-economic status, human resource status, financial resources, technological and other resources

6. Cases of sericulture development in other countries-Japan, China , Korea and Brazil
7. Sericulture and society, sociological approach, role of women in sericulture

Group B **50 marks**

Basic computer application

8. Basic idea of computer parts computer, concept of software and hardware, concept of operating system
9. Introduction to windows XP, familiarities with work pad, note pad, paint, calculator etc
10. Introduction to Microsoft-office-word-excel-power point
11. Introduction to RDBMS(Relational Data Base Management System), Access and VB(Visual Basic 6)
12. Concept of internet, E-mail
13. Role of Computer in Sericulture

Practical (200 marks)

Basic experiments on post cocoon technology and non mulberry sericulture (wild silk) Organization management & entrepreneurship development including preparation of project work, sericulture extension Management and computer application

Course-5 Prac-50 Credit-2

Basic experiments on post cocoon technology

1. Assessment of cocoon sorting of different types of defective cocoon
2. Determination of shell ratio percentage of provided cocoon lot
3. Determination of degree of cooking, grouping and dropping percentage
4. Single cocoon and reeling analysis- determination of average filament length , non breakable filament length
5. Determination of average size, size deviation and maximum size deviation of denier of provided silk lot
6. Estimation of degumming loss percentage
7. Bleaching and dyeing of silk
8. Visit to filature

Course-6 **Prac-50** **Credit-2**

Basic experiments on Non Mulberry Sericulture

1. Identification of food plants of Tasar silkworm with reference to taxonomic traits
2. Identification of food plants of Eri silkworm with reference to taxonomic traits
3. Identification of food plants of Muga silkworm with reference to taxonomic traits
4. Identification of egg, larva, pupa, cocoon and moths of Tasar silkworm
5. Identification of egg, larva, pupa, cocoon and moths of Eri silkworm
6. Identification of egg, larva, pupa, cocoon and moths of Muga silkworm
7. Identification of different types of diseases and Pest of Non- mulberry Silkworm
8. Generation of seeds of T.arjuna
9. Evaluation of different ecotypes of mulberry silkworms
10. visit to place to non mulberry cultivation institutes

Course-7 Prac-50 Credit-2

Management & entrepreneurship development including preparation of project work

1. Preparation of project for mulberry cultivation of one acre of land
2. Preparation of project for Silkworm rearing of one acre of land
3. Preparation of project for Silk reeling with Charka
4. Preparation of project for Silk reeling with Multiend reeling machine
5. Preparation of project for Silkworm seed production (10 Lakh capacity /annum)

Course-8 Prac-50 Credit-2

Sericulture Extension Management and computer application

6. Preparation of model, flip chart, flash card and striptease chart to depict the various topics related to sericulture
7. Preparation of questionnaire to know socio- economy status of sericulture
8. Survey at various sericultural villages to conduct socio- economic profits of various farmers
9. Result demonstration
10. Method demonstration
11. Disc Operation- Copy, Format, Directory making and removal
12. Spread Sheet (MS Excel)- Command menu, Statistical and Mathematical functions, preparation of graphs from 2 sets of data (X and Y axis)

13. Word processing (MS Word): Document preparation, character specification (bold, italics, underline, Fonts Colour) Sizing cut and Pest.

Semester III **600 marks** **Duration: 6 months**
Course-09 **Theo-100 Marks** **Credit-4**
Group A
Mulberry Breeding **50 marks**

1. Selection techniques Basic ideas on – Mass selection – Pure line selection and Clonal selection.
2. Hybridization techniques – Single cross – Double cross- Back cross- Poly cross- Reciprocal cross- GCA – SCA. Production of grafts & layers – stem and root grafting – Whip and tongue grafting techniques budding & T budding techniques – layering- Ground and Air layering techniques.
3. Polyploidy breeding – Induction, Identification and evaluation of triploids. Varieties evolved by polyploidy breeding.
4. Breeding techniques for stress condition – drought – salinity – alkalinity.
5. Breeding for disease and pest resistance.
6. Maintenance of improved varieties and release. - Multiplication – Naming of a variety and distribution of farmers.

Group B
Development, reproduction, Genetics and Tissue Culture in Mulberry
50 marks

7. Development of Mulberry- Morphology of Mulberry- Anatomy of leaf, primary stem and primary root of mulberry
8.Reproduction and Embryology- Microsporogenesis and Megasporogenesis- Structure and ovule –pollination contrivances
9. Fertilization-Embryogenesis in capsella- Embryosac development (polygonum type)-Fruits &seeds-types with examples
10 Genetic variability in mulberry-sources of variability-wild species-hybrids, popular varieties of India-Chromosomal variations
11 Cytological techniques- Mitosis, Meiosis, and Kariotype studies.
12. Tissue culture techniques in mulberry – culture media, micro propagation – Soma clonal variation. - Haploid induction – Somatic hybridization – In vitro screening and preservation- meristem, callus , anther, pollen , endosperm, encapsulation of shoot buds and cry preservation of germ cell.

Course-10 Theo-100 Marks Credit-4

Group-A Marks- 50

APPLIED STATISTICS AND SERICULTURAL ECONOMICS.

1. Role of statistics in biological science (Sericulture) – Application of descriptive and inferential statistics.
2. Data collection – method – Classification (frequency and cumulative) and tabulation – Application of graphical representation of data.
3. Measures of central tendency (mean, median mode) – definition – uses and application – measures of dispersion (standard deviation) – definition – uses and applications.
4. Co relation and regression – definition – methods of measurement of simple co relation (Karl person and rank co relation efficient) linear regression – methods of computing regression line (method of least square) uses of co relation and regression.
5. Probability – def – Basic concepts – the critical distribution (binomial – Poisson – normal) – def – Characteristic application.
6. Tests for significance – basic concept - (student t test , F test and Chi square test) large sample tests – testing of sample means (single of two means) application of F test. (only simple means) Chi square application (testing and goodness of fit and test of independence.)
7. Analysis of field experiments – data aim and basic concepts – CRD – with equal and unequal replicates. – RBD and split plot application. The concept of LSD and DMRT application.

Group-B **Marks- 50**

SERICULTURE ECONOMICS….

8. .Role of economic in sericulture. – Nature and scope of economic theory.
9. Production economics – meaning, nature and scope production function – basic production relationship.
10. Theory of cost – basic concept – cost function – different cost and their relation ship – cost of production in mulberry and cocoon.
11. Theory of market – concept of demand and supply determinates of demand and supply of silk production – marketing of cocoon and raw silk – role of price in supply of production – marketing of cocoon and raw silk.
12. Economics of mulberry cultivation – silk worm rearing, seed production and silk reeling – cost and returns cost benefit ratio. Employment generation – value addition – Yield gap analysis.
13. International trade – comparative advantages of production and trade in silk in India. Export and import of silk and products .

Course-11 **Theo-100 Marks** **Credit-4**

GROUP A **50 marks**

BREEDING OF SILKWORM

1. Parameters relevant to silk production-qualitative and quantitative characters and its used in breed selection
2. Selection methods-individual and family selection-indirect, stabilizing and directional selection
3. Inbreeding and out breeding-advantages and disadvantages-effects of inbreeding-consequence of homozygosity.
4. Heterosis – Exploitation of heterosis – Cross breeding techniques of hybridization – Combining ability.
5. Evaluation of hybrids for different location – identification of Seri cultural zones – availability of hybrids – local adoptability test of hybrids.
6. Maintenance and multiplication of basic stocks – purity of breeds – national and regional level.

GROUP B **50 marks**

GENETICS OF SILKWORM

7. Hereditary traits – Linkage map in silkworm.
8. Gene interaction – quantitative inheritance – polygenic characters.
9. Inheritance of cocoon colour, larval markings, E-alleles, multiple alleles
10. Sex linkage – sex determination – breeding of sex limited breeds- Sex linked and sex limited traits and their special significance in sericulture
11. Inheritance of voltinism, maternal inheritance, inheritance of moultinism, environmental influence and hormonal control.
12. Chromosome number and nature of chromosomes in different types of silkworm
13. Mutation-use of induction mutation in Sericulture.

Course-12 Theo-100 Marks Credit-4

Silk worm seed technology.

GROUP A 50 marks

Seed Organization

1. Introduction – types of seeds – reproductive seed – industrial seed.
2. Morphology of Silkworm Egg: Size, shape, weight and colour of eggs, structures of eggs-its constituents
3. Embryology of silkworm egg:
   Characteristics of different stages-critical stages of development
4. Seed organization

a) Breeders stock - basic stock maintenance – characteristics of pure races – multiplication.

b) Seed areas: identification-concept of selected seed reares and villages

c) Seed legislation: acts, rules and regulation

d) Parental seed cocoon production-Mulberry Cultivation at Seed Zone – Silkworm rearing at Seed Zone- Mounting and harvesting of seed crop

e) Monitoring of seed crop: Screening of egg shells, larva, faecal matters for disease. Disinfection and maintenance of hygiene during rearing

f) Seed cocoon markets-Pupal examination-certification of seed cocoon lots-Price fixation for seed cocoons-concept of Pure races

GROUP B 50 marks

Handling, Preservation and Production of Commercial Eggs

5.Different Steps of Commercial Egg Production-Disinfection of grainage-Procurement, transportation, sorting of seed cocoons-Early test for detection of Pebrine Disease- Sex separation, Synchronization and emergence of moth-Coupling, decoupling and oviposition-Mother moth examination-Surface sterilization of silkworm eggs

6. Acid treatment- Hot acid treatment, Cold acid treatment and acid treatment for chilled eggs

7. Preservation of eggs – short term and long term chilling-4 months, 6 months and 10 months hibernation schedule

8. Loose egg preparation – its advantages and disadvantages...

9. Transportation of eggs...

10. Economics of egg production – cost control.

11. Quality control in commercial grainage.

12. Incubation and its role, effect of temperature, humidity, photoperiod...

Practical (200 marks)

Basic Experiments on Breeding and Genetics, Development, reproduction, Tissue Culture on Mulberry, Applied Statistics and Sericultural Economics, Breeding and Genetics of Silkworm and Silkworm Seed Technology.

Course-9 Prac-50 Credit-2

Basic Experiments on Breeding and Genetics, Development, reproduction, Tissue Culture on Mulberry

1. Study the hybridization technique of mulberry.
2. Morphological Studies of mulberry plant.
3. Anatomical Studies of mulberry leaf.
4. Anatomical Studies of Primary root of mulberry.
5. Anatomical Studies of Primary stem of mulberry.
6. Cytological techniques-preparation of pretreatment, solutions-fixatives and stains-Procedure
7. Somatic chromosomes-mitosis in root/shoot meristem
8. Meiosis during microsporogenesis-smear preparation of pollen mother cells
9. Biochemical estimation of nutrients in mulberry leaf-Moisture percentage of mulberry leaf-chlorophyll (a, b and total) content, soluble proteins, sugars etc.

Course-10 Prac-50 Credit-2

Applied Statistics and Sericultural Economics

1. Frequency distribution of continuous and discreet data.
2. Representation of frequency distribution through Histogram, Column diafram and frequency polygon
2. Calculation of Mean, Mode, Standard deviation and CV%.
3. Co-relation, regression analysis
4. Student‘t’ test.
5. Chisquare test
5. Calculation of (i) Total Variable Cost, (ii) Total Cost,(iii) Average Variable Cost,(iv) Average fixed cost, (V) Average Total Cost and (Vi) Marginal cost.
6. Economics of mulberry cultivation – silk worm rearing, seed production and silk reeling – cost and returns cost benefit ratio.

Course-11 Prac-50 Credit-2

Breeding and Genetics of Silkworm

1. Characters of silkworm race
2. Evaluation of Heterosis.
3. Selection Methods
4. Inbreeding Depression
5. Chisquare Test
6. Identification of mutants
7. Breeding Plans
8. Parthenogenesis
9. Biochemical Genetics
10. Genetics of Cocoon Colour
11. Mutation
12. Maternal inheritence

Course-12 Prac-50 Credit-2

Silkworm Seed Technology

1. Planning of Grainage Building.
2. Grainge Equipments.
3. Processing of seed cocoons
4. Cutting of Seed Cocoons
5. Sex separation
6. Emergence of moths-selection of moths-Pairing and Depairing- oviposition-Maintenance of required environmental conditions
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 paper-washing of loose eggs-Drying-Treatment of eggs with acid-weighting and packing
9. Acid treatment of bivoltine eggs-Hot acid treatment and Cold acid treatment.
10. Visit to Silkworm Seed Production Centre.

Semester IV **600 marks** **Duration: 6 months**

Course-13 **Theo-100 Marks** **Credit-4**

Group A

Cellular Physiology **50 marks**

1. Membrane structure and functions; intracellular compartments, protein sorting, secretory and endocytic pathways.
2. Cytoskeleton.
3. Structure and function of nucleous-Ultra structure of nuclear membrane: Nucleolus
4. Mitochondria and chloroplasts-their genetic organization
5. Cell cycle: Definition and different phases-Mitosis and Meiosis –Different stages and significance- Differences between mitosis and meiosis
6. Chromosome organization and morphology: centromere and telomere: chromosome alterations-deletions, translocations, duplications and inversions: variations in chromosome number-aneuploidy and polyploidy:

Group B

Biotechnology **50 marks**

7. Biotechnology-Scope and importance , Basis of Biotechnology , Global impact , Health care , Agriculture , Achievements , Prevention of misuse of Biotechnology , Gene bank and Plant conservation.
8. Biotechnological application :
    a. Invitro establishment of microrhiza...
    b. CAT gene, npIIgene, lac z gene
9. Biofertilizer -- general idea
10. Biological control of plant pathogen pests and weeds – basic idea.
11. General idea on:
    - Cell and tissue culture of plant and animals.
    - Cell lines and cell clones
    - Callus structure.
    - Somatoclonal variation.
    - Micro propagation.
    - Gene transfer in plant and animals
    - .Transgenic biology
    - Artificial seed.
    - Hybridoma technology
    - Allopheny
12. Role of Biotechnology in Sericulture

Course-14 Theo-100 Marks Credit-4
Group A

Genetic Engineering and Molecular Biology 50 marks

1. Recombinant DNA Technology, basic principles and application, plasmids, vectors and restriction enzymes techniques. Misuse of recombinant DNA Technology.
2. Theoretical aspects of the techniques of genetic engineering:
i. Isolation of DNA to be cloned
ii. Use of restriction linker.
iii. Colony hybridization technique.
iv. Invitro translation technique
v. DNA finger printing.
vi. Blotting technique.
vii. c DNA clone bank.
3. DNA Library-Genomic DNA Library, Chromosome specific library, cDNA library
4. Application of genetic engineering –application in medicine, agricultural application, industrial application, application in environment management.
5. Eucaryotic genome organization: DNA damage and repair; DNA replication, amplification and rearrangement.
6. Transcription of DNA, Genetic code and protein synthesis.
7. Molecular markers: SNPs, STRs, VNTRs, RFLP, Single nucleotide polymorphism, restriction fragment length polymorphism, Ramdomly amplified polymorphic DNA

Group B
Immunology and Biological Techniques

50 marks

8. Immunity and immune responses- innate immunity, adaptive immunity, collaboration between innate and adaptive immunity-T cell and cell mediated immunity, B – cell and humoral immunity, other forms of adaptive immunity
9. Antigens and Adjuvant: General concepts and types
10. Structure and classification of immunoglobulin
11. Antigen-Antibody interaction
12. Primary and secondary immno responses, genetic control of immno responses
13. Elementary ideas of vaccination and vaccines
14. Principles and uses of instruments: Microscopy (Light, Florescent, Phase Contrast, Electron), Ph meter, colorimeter, spectrophotometer, centrifuge and gel electrophoresis (PAGE)

Special Paper A (Course15+ Course16)
Sericulture Management (Theo-200 marks) Credit-8

Group A Mulberry Production (Course-15 Theo-100 Marks Credit-4)

1. Factors affecting crop productivity and role of different agroclimatic condition in crop production, importance of seed materials, planting techniques, crop geometry and establishment of mulberry garden. Mulberry cultivation under irrigated and rainfed condition. Management of chawki garden. Scope and Principles of intercropping.
2. Weed management-Major weeds of mulberry garden-Crop Weed interaction-Damage caused by weeds-Integrated weed management
3. Water management in mulberry-Major systems of irrigation-Water management in dry land condition.
4. Nutrient management-Use of manures and fertilizers- Use of biofertilizers-Concept of Integrated Plant Nutrient Management.
5. Inter-Cultivation Practices: Purpose, methods, time and frequency
6. Different Methods of Pruning and Harvesting of Mulberry.
7. Mechanization of Mulberry Cultivation.
8. Mulberry Management: Maintenance of mulberry plots in relation to rearing schedules- Maintenance of farm records and their relevance- Farm implements and machinery- Significance of leaf cocoon ratio
9. Major Mulberry Diseases and their management-Major foliar Diseases, Soil borne diseases and nursery diseases of mulberry and their management. Concept of biocontrol agents/antagonistic microbes for the utilization in foliar and soil borne diseases. Integrated disease management in mulberry.
10.Major Mulberry Pests and their management-Sucking, Piercing and biting type of mulberry Pests and their management. Concept and Principles of Pest management strategies.

Group B Cocoon Production (Course-16 Theo-100 Marks Credit-4)

11. Concept of model rearing house-Criteria for selection of a model rearing house-Orientation- Size-Condition inside the model rearing house-Merits and Demerits of Model rearing house.
12. Rearing appliances-Design of rearing appliances-Requirements and cost of rearing housed for 100 DFLs.
13. Disinfection of rearing room-Major room and bed disinfectants- Preparation of various disinfectants-Maintenance of hygiene in the rearing room.
14. Incubation of eggs- Methods of incubation- Physical factors affect incubation- Incubation devices-Black boxing.
15. Brushing of silkworm larvae- Estimation of brushing capacity-Different methods of brushing with merit and demerits-Cellular brushing and mass brushing.
16. Rearing of silkworm larvae-Young age silkworm rearing-Characteristics of Young age silkworms-Ecological and nutritional condition of Chawki silkworms-Different methods of Chawki rearing- Late age silkworm rearing-Characteristics of Late age silkworms-Ecological and nutritional condition of Late age silkworms-Different methods of Late age rearing rearing.
17.Management of silkworm larvae – Moulting care-Methods and frequency of bed cleaning- Planning of spacing-Management of silkworm rearing during dry summer and wet summer.
18.Mounting and harvesting of cocoon-Different methods of mounting- Different types of mountages- Cocoon harvesting- Care during mounting and harvesting-Assessment of cocoon-Cocoon market.
19. Major Silkworm Diseases and their management- Protozoan Disease, Viral disease, Bacterial disease and fungal disease-causal organism, pathogenesis and prophylaxis measures
20. Major Silkworm Pests and their management- Uzifly and Dermested beetles-Biology, Nature of damage, Prevention and control-IPM against Uzi fly

Special paper B (Course15+ Course16)

SERICULTURE EXTENSION, RURAL SOCIOLOGY, AND RURAL DEVELOPMENT (Theo-200 marks) Credit-8

Group A Sericulture Extension ((Course-15 Theo-100 Marks Credit-4)

1. Extension-Definition, Concept, Principle and scope-Formal, informal and non formal education
2. Extension Communication-Models of communication- Elements of Extension Communication-Communication gap
3. Communication Methods in Extension- Individual Method, Group Method and Mass Method—Merits and Limitations of all the methods
4. Extension Teaching Method- Trainer dominated method, Trainee dominated method and cooperative method
5. Aduio-visual aids in Extension – Projected and Non Projected Aids-Merits and Demerits of all the methods
6. Adoption and diffusion of Innovations-Attributes of innovation-Adoption Process- Adopter categories
7. Systems in extension in India.
8. Planing Extension Programmes- Definitions, Objectives- Principle of extension programme planning- Steps in extension programme planning-Role of Extension workers and farmers in Extension Programme planing
9. Special features of extension :
    a. Features of progressive farmers.
    b. Labour composition in sericulture.
    c. New commercial products from sericulture.
    d. Education and development of sericulture.
    e. Rearer's classification, Technology, adoption and extension

Group B Rural Sociology and Rural Development (Course-16 Theo-100 Marks Credit-4)

10. Meaning and definition and rural sociology, characterization of Indian rural community..
11. Principle of rural sociology and psychology..
12. Study of rural family – social group including casts, religion, occupation...
13. Social interaction, social control and social problems in India..
14. Study of rural culture – explicit and implicit implements...
15. Social changes – factors responsible for rural social changes, Sericulture as a tool for social change…
16. Community development – meaning and concept, process and phases, community development a planned social change, community development program.
17. Community development and extension education.
18. Integrated rural development project – concept and organization...
19. Concepts of... IRDP, IAAP, IADP, ICDP, HYVP, GMF, DPAD, DWACRA, CDP, CAD, NATD, KVK, MFAL, NGO, NREP, NSS, NYK, SFDA, TTC, TRYCEM..
20. Rural youth: Youth group, social profile of youth, based needs, National youth council, youth service schemes, Training of rural youths for self employment, rural youth clubs – their objects and organization…
21. Rural women – classification of farm women's, Role of women in agriculture, technology to rural women, Employment opportunities, National research center for women in sericulture, Gender analysis, [Extension needs related to farm women, Nutrition, education and employment of women, the economics preservatives Attributes leading to employment, Role of panchayets, in developing rural women, Improvement of capabilities of women farmers…]

Special Paper-C (Course15+ Course16)

Insect Diseases and Pathobiology (Theo-200 marks) Credit-8

Group A Insect Diseases (Course-15 Theo-100 Marks Credit-4)

1. Microscopy:

Light Microscopy-Phase contrast, Phase Fluroescent, X-ray diffraction, Dark Field-SEM-TEM

2. Diagonistic Techniques: Introduction-General laboratory procedures-Examination & processing of specimens for diagnosid.

3. Virus & Rikettsial Diseases: Introduction-Viral diseases of Silkworms-control-Rickettsial diseases in insects a general account.

4. Bacterial Diseases: Introduction- Diseases caused by bacteria-control-Insect control by bacteria, a general account

5. Mycoses-Introduction- Fungi causing silkworm diseases-Life cycle and mode of infection-Physical &biological environment-control

6. Protozoan infections: A general characteristics of entomophilic protozoan infections-Mastogophora, Sarcodina, Sporozoa, Microsporida &Ciliophora-Control

7.Nematode infection: Taxonomy, Biology, Life cycle &mode of infection-Pathological &economic significance of nematode parasitism of insects.

8. UZifly as Pest-extent of damage-extent of economic injury level-methods to monitor. Economics of mass multiplication of parasitoids of Uzifly.

Group-B (Pathobiology) (Course-16 Theo-100 Marks Credit-4)

9. Symbiology: Mutualism between arthropods &microrganisms-association between insects &microorganism-adaption of microorganisms to insects-Intra &extra cellular symbiotic-host-parasitoid-pathogen interaction-implication in insect control.
10. Hormonal induced Pathogenesis: Endocrine & Neurosecretory glands, bio-assays for hormonal compounds-hormonal compounds and compounds which induce hormonal pathologies-normal hormonal regulation and pathologies on embryogenesis, moulting, metamorphosis and reproduction.
11. Radiation, Neoplasms, carcinogenic chemicals and insects
12. Genetic Diseases: Basic Principles of genetics, lethal mutants, Sterile mutants, Tumors and behavioral mutants-gynandromorphs
13. Genetic Methods for insect Pest Control- Release of sterile males, introduction of deleterious chromosomes, factors which modify chromosome segregation
14. Immunobiology: Insect immunity and resistance

Practical (200 marks)
In each special Paper 50% of total practical marks will be allotted for the preparation of Dissertations / Projects/ Assignments/Seminar etc

Special Paper A
Sericulture Management

a. Mulberry Production (Course 15 Prac100 Credit-4)

1. Preparation of nurseries.
2. Propagation of mulberry-Propagation of cuttings and grafts and planting them in nursery- Maintenance of nurseries.
3. Different methods of planting mulberry under rainfed and irrigated conditions.
4. Irrigation methods-Numerical problems related to irrigation and water requirement of mulberry.
5. Manures and fertilizers-their identification-calculation of dosages to be applied to a given of mulberry plantation- Methods of application
6. Identification of common weeds and their control.
7. Pruning, different methods of pruning of mulberry followed in India.
8. Identification of major crop management related problem
9. Isolation of VAM spores from soil
10. Isolation of Azotobacter from garden soil
11. Identification of different types of diseases and Pest of mulberry
12. Preparation of Project/Assignment/ Presentation of Seminar

b. Cocoon Production (Course 16 Prac100 Credit-4)

1. Incubation devices for different scale of rearing.
2. Measurement of leaf moisture
3. Assessment of leaf yield and brusing capacity
4. Assessment of rearing appliances
5. Estimation of surface area- Preparation and application of disinfectants
6. Brushing of silkworm larvae
7. Different types of young age rearing
8. Moulting test
9. Different methods of leaf preservation.
10. Different methods of bed cleaning
11. Different types of late age rearing
12. Identification of moulting and spinning larvae
13. Different types of mounting methods and mountages
14. Assessment of commercial cocoon
15. Selection and assessment of seed cocoon
16. Synchronization of multivoltine and bivoltine seeds.
17. Identification of different types of diseases and Pest of Silkworm
18. Preparation of slide of Pebrine (*Nosema bombycis*) and Grasserie (Bombyx mori Nuclear Polyhedrosis Virus (BmNPV)
19. A complete rearing for individual student
20. Preparation of Project/Assignment/ Presentation of Seminar

Special paper B

SERICULTURE EXTENSION, RURAL SOCIOLOGY, AND RURAL DEVELOPMENT

a. Sericulture Extension (Course 15 Prac100 Credit-4)

a) Study of corporative approach in sericulture institution.

b) Study of features of a progressive farmer.

c) Rearer's classification.

d) New commercial product from Sericulture

e) Evaluation of different teaching aids-Audio Aids, Audio-visual aids and visual aids

f) Result Demonstration and Method Demonstration

g) Farm & Home Visit

h) Questionnaire

i) Preparation of Project/Assignment/ Presentation of Seminar

b. Rural Sociology and Rural Development (Course 16 Prac100 Credit-4)

1) Visit to villages to study the class of rural community.

2) Visit the villages to study DWACRA / TRYSEM etc. to operation

3) Role of community development in a sericulture village...

4) Preparation of interview schedule.../ Questionnaire...

5) Socio economic survey of a sericulture village…selection of respondents – collection of data – compilation and analysis of data --- preparation of draft reports.

6) Construction of knowledge test – rating and ranking scale...

7) Practical use of socio metric techniques

8) Participatory Research Method

9) Preparation of Project/Assignment/ Presentation of Seminar

Special Paper-C
Insect Diseases and Pathobiology

a. Insect Disease (Course 15 Prac100 Credit-4)

1. Developing awareness to Light microscopy, Phase contrast, Phase Fluorescent, Dark Field, X-ray diffraction, SEM and TEM

2. Collection of diseased insects and determination of microbial etiology: infectivity tests with the pathogens following Koch's postulates to determine that the suspected microorganisms are truly a pathogen. Isolate in pure culture bacteria from the gut of any available insect or silkworm.

3. Virus and Bacteria: Methods of examination-Isolation and cultivation-identification-Testing of Pathogenicity-Storage

4. Fungi: Life cycle-Characteristics of infected insects- Methods of examination-Isolation-Cultivation of entomogenous fungi-Identification-Testing of pathogenecity-Storage

5. Protozoa: Methods of examination-Isolation and cultivation (Microsporidia)-Identification-Testing of Pathogenicity-Storage

6. Laboratory Exercise on Nematode

7. Preparation of Project/Assignment/ Presentation of Seminar

b. Pathobiology (Course 16 Prac100 Credit-4)

8. Histological tissue preparation-Tissue fixation and processing for microtome section of midgut, silkgland, malpighian tubules, testis and other organs, staining techniques

9. Immunobiological techniques.

10. Microorganisms Associated with Normal Insects- Intracellular Associations-Extracellular Associations

11. Radiosterilization and Chemosterilization

12. Preparation of Project/Assignment/ Presentation of Seminar