

# Murshidabad University



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Date:13/09/2021

## NOTIFICATION

It is notified for information of all concerned that Murshidabad University in its meeting, held on 09/09/2021 approved the ad-hoc syllabus, M.A/M.Sc. course of study in Sericulture under CBCS in the Postgraduate dept. of the University.

The above shall be effective from academic session 2021-2022.

**POST-GRADUATE SERICULTURE CBCS SYLLABUS 2021**

**Draft of Detailed Syllabus**

**Note:** Duration of two hours per week for each Core Course will be allocated towards Field Work in addition to the credits (hours) assigned.

<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>MARKS</b>	<b>CONTACT HOURS</b>	<b>CREDIT</b>
<b>FIRST SEMESTER</b>				
<b>CORE COURSE PG-SERI-CC-101</b>	<b>Biology of Mulberry, Soil Science and Mulberry Crop Production</b>	MARKS	CONTACT HOURS	CREDIT
<b>Objective</b>	<ul style="list-style-type: none"> <li>➤ To study the influence of different agro-climatic factors on growth and development of mulberry.</li> <li>➤ To study the impact of soil on quality mulberry production.</li> <li>➤ To acquaint with the know-how of establishment of mulberry garden and maintenance of it under different agro-climatic conditions.</li> <li>➤ To know various new technologies of mulberry production.</li> </ul>			
Unit 1	<p><b>Biology of Mulberry</b></p> <p>Popular mulberry cultivars of India and World, salient features, economic importance, systematic of the Morus species. Anatomy of mulberry leaf, stem and root. Reproductive biology of mulberry. Crop physiology in relation to crop production, transpiration, photosynthesis and phytohormones related to growth. Water stress and physiological consequences</p> <p><b>Soil Science</b></p> <p>Soil forming factors, soil profile, classification of soil, Soil types of India related to mulberry cultivation-Alluvial soils, Black soils, Red soils, Lateritic soils. Physical and chemical properties of soil. Soil water, factors affecting water holding capacity, movement of water in soil including capillary rise and leaching, water requirement of mulberry, soil water management.</p> <p>Ion exchange in soil, soil organic matter – chemistry and importance.</p> <p>Role of essential elements in relation to mulberry growth and nutrition including deficiency and toxicity symptoms.</p> <p>Soil sampling and testing, problematic soils and their reclamation.</p> <p>Soil micro-organism</p> <p>Soil pollution</p>	25	35	
Unit 2	<p><b>Agronomical Practices</b></p> <p>Basic principles of mulberry crop production, methods, farming systems; planting seasons.</p> <p>Propagation and cultivation of mulberry plants, sexual and asexual methods and their significance.</p> <p>Grafting and layering practices in mulberry -</p>	25	35	

	<p>types and techniques.  Influence of climatic factors on growth and productivity of mulberry, agro-climatic zones.  Organic manures including green manuring, inorganic fertilizers and bio fertilizers.  Irrigation in mulberry including dry farming technology.  Inter-cultivation practices in mulberry.  Harvesting, transportation and preservation of mulberry</p> <p><b>Mulberry Crop Management</b>  Nursery management for production of seedlings and saplings.  Irrigation management: Sources, methods and schedules.  Integrated nutrient management in mulberry: methods and schedules.  Weed management.  Establishment and maintenance of mulberry gardens; package of practices for mulberry gardens.  Assessment of mulberry leaf yield and quality.  By-products of mulberry and their utilization.  Mechanization in mulberry production.  Farm management: Scope and concept, basic farm management decisions, cost computation procedures and maintenance of farm records.</p>			
<b>References</b>	<ul style="list-style-type: none"> <li>➤ Bongale, U.D (1995) Fertilizers in mulberry cultivation. Pushpa Sree Publications, Thalaghattapura, Bangalore.</li> <li>➤ Dokuhon, Z.S (1998). Illustrated Textbook on Sericulture. Oxford &amp; IBH publishing Co, Pvt. Ltd, New Delhi, Calcutta.</li> <li>➤ Gupta, R.K &amp; Mittal, R.K (1983) Bibliography of Indian Weeds. Associated Pub. Co. New Dehli.</li> <li>➤ Hasao Aruga (1994) Principles of Sericulture (Translated from Japanese) Oxford &amp; IBH publishing Co, Pvt. Ltd, New Delhi.</li> <li>➤ Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.</li> <li>➤ Krishnamurthy, N. (1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.</li> <li>➤ Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.</li> <li>➤ Subba Rao, N.S (1998) Biofertilisers in Agriculture. Oxford &amp; IBH Pub. Co, Pvt. Ltd, New Delhi.</li> <li>➤ A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central Silk Board, Bangalore-68, India. 2005.</li> <li>➤ Rajanna L, Das P.K, Ravindra S, Bhogesha K, Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology by Central Silk Board, Bangalore, Dec.2005.</li> </ul>			
<b>TOTAL</b>		50	70	04
<b>CORE COURSE PG-SERI-CC- 102</b>	<b>Silkworm Physiology, Rearing Technology and Cocoon Production</b>	MARKS	CONTACT HOURS	CREDIT
<b>Objective</b>	<ul style="list-style-type: none"> <li>➤ To study the influence of environmental factors on growth and development of mulberry silkworm.</li> </ul>			

	<ul style="list-style-type: none"> <li>➤ To study the key factors for successful cocoon crop production.</li> <li>➤ To acquaint with the know-how of rearing technologies.</li> <li>➤ To know various new technologies of rearing.</li> </ul>			
Unit 1	<p><b>Silkworm Taxonomy &amp; Morphology</b>  Basic principles of Animal taxonomy with reference to sericulture.  Silkworm breeds / races of tropical and temperate regions and their characteristics.  Classification of silkworms: Geographical distribution, moultnism, voltinism, cocoon colour and shape.  Morphology and life cycle of the silkworm, <i>Bombyx mori</i>: Egg, larva, pupa and adult  Embryonic development in <i>Bombyx mori</i>.</p> <p><b>Silkworm Physiology</b>  Metamorphosis in insects: Importance, types and hormonal influence.  Endocrinology: General Characteristics of insect hormones and general mechanism of hormonal action. Organisation of neuroendocrine system in insects, structure of endocrine glands, neurosecretion - chemistry and function of insect hormones in relation to <i>Bombyx mori</i>.  Application of insect hormones (juvenile hormone and moulting hormone) in Sericulture Management  Anatomical features of silkworm: Digestive, circulatory, excretory, nervous, and respiratory systems; silk gland of silkworm.  Sex differences in silkworm.  Reproductive systems of silk moths.</p>	25	35	
Unit 2	<p><b>Rearing Technology</b>  Planning for silkworm rearing- brushing capacity; selection of silkworm races / breeds.  Environmental requirements for silkworm.  Rearing houses: Types, location and orientation, cost effective rearing houses.  Rearing methods: nutritional requirements of young and late age silkworms.  Disinfection and hygiene in rearing.  Egg transportation, incubation methods and methods of brushing  Qualitative and quantitative requirements of mulberry for young and late-age silkworms. Harvesting, transportation and preservation of mulberry leaves.  Chawki silkworm rearing and Late age silkworm rearing methods and operations  Mountages and mounting methods, cocoon harvesting.</p> <p><b>Cocoon Crop Production &amp; Management</b>  Managements of silkworms rearing in different seasons and regions.  Cocoon sorting, packing, transportation.  Cocoon assessment and preparation of crop</p>	25	35	

	harvest report. By-products of silkworm rearing and their utilization.			
<b>TOTAL</b>		50	70	04
<b>CORE COURSE PG-SERI-CC- 103</b>	<b>Mulberry and Silkworm Crop Protection</b>	<b>MARKS</b>	<b>CONTACT HOURS</b>	<b>CREDIT</b>
Unit 1	<p><b>Mulberry Diseases</b> Classification of diseases of mulberry. Influence of biotic and abiotic factors on the incidence of mulberry diseases. Fungal diseases of mulberry, occurrences, symptoms, epidemiology and control. Bacterial, Viral and mycoplasmal diseases of mulberry, symptoms, seasonal occurrence, disease cycle and control measures. Root knot diseases of mulberry-its occurrence, symptoms and controls. Integrated Disease Management. Plant quarantine and application of fungicides.</p> <p><b>Mulberry Pests</b> Mulberry Pests- Classification, life cycle, symptoms of attack, period of occurrence and types of damage caused by major and minor mulberry pests like Whitefly, Bihar hairy caterpillar, Leaf Roller, Cut Worm, Wingless Grasshopper, Mealy bug and Stem Gridler, Stem Borer, Scale Insect, Thrips, Jassid, Leaf Weber, Termites, Snails and Mites etc. Pest Forecasting and Integrated Pest Management Application of Insecticides.</p>	25	35	
Unit 2	<p><b>Silkworm Diseases</b> Introduction and classification of different types of silkworm diseases. Influence of environment and nutrition on the incidence of diseases, impact of disinfection and maintenance of hygiene. Diseases of <i>Bombyx mori</i> : Causal organism, mode of infection and transmission, symptomatology, incidence, extent of crop loss, cross infectivity and management of microsporidiosis (pebrine), virosis (NPV, CPV, IFV and DNV), bacteriosis (bacterial flacherie) and mycoses (muscardine and aspergillosis).</p> <p><b>Silkworm Pests</b> Insect and non-insect pests of mulberry silkworm and their status. Major Silkworm Pests: classification, distribution, incidence, extent of damage and Prevention and control - Uzifly and Dermested beetles. Integrated Pest Management against Uzi fly.</p>	25	35	
<b>TOTAL</b>		50	70	04
<b>CORE COURSE</b>	<b>Silk Production Technology and Textile</b>	<b>MARKS</b>	<b>CONTACT</b>	<b>CREDIT</b>

PG-SERI-CC-104	Industry		HOURS	
Unit 1	<p><b>Post Cocoon Technology</b> Textile fibres: Definition, types, Characteristics of different types of textile fibres, soft or bast fibres, hard fibre, natural and manmade fibres and their difference, concept of blending. World output of Textile Fibres, Brief idea on cotton, jute, wool and coir industries in India. Silk: Definition, Different varieties of commercial silk, uses of silk, physical and chemical properties of silk. Tenacity, Elongation, Moisture regain capacity-specific gravity of silk. Effect of Temperature, Electricity and Light on silk. Effect of water, acid, alkali, metallic salt and bleaching on silk. Procurement of cocoon, stifling, storage and preservation of cocoons, sorting, cooking, reeling, re-reeling, twisting, doubling, packaging of silk yarn, degumming, bleaching, weaving, dyeing, printing and value addition in silk fabric.</p> <p><b>By-products Utilisation</b> Classification of by-products and their bio-medical and economic importance. Usage of by-products of sericulture industry, spun silk industry, pupal oil extraction, preparation of handicrafts from seriwastages, innovative ideas to use seriwastages. Importance of reeling industries for the development of sericulture, problems and prospects of reeling industry.</p>	25	35	
Unit 2	<p><b>Reeling Machines, Looms and Chemicals</b> Different types of reeling machines in sericulture industry. Looms- handloom and powerlooms Machine used in silk and cocoon assessment processes- epprouvette, seriplane board etc. Dyes: Classification and uses in silk.</p> <p><b>Marketing of Cocoon &amp; Silk</b> Assessment of cocoon and silk quality, grading and testing, price fixation, cocoon market and silk exchange. Marketing strategy, Silk Industry in India, export and import of silk.</p>	25	35	
TOTAL		50	70	04
		MARKS	CONTACT HOURS	CREDIT
<b>CORE COURSE</b> PG-SERI-CC-105	<p><b>Mulberry Crop Production and Cocoon Crop Production</b></p> <p><b>Mulberry Crop Production</b></p> <p>Morphology of mulberry. Salient features of popular mulberry cultivars</p>	25	60	02

	<p>in India.  Anatomy of stem, root and leaf blade of mulberry.  Raising of saplings, preparation of cuttings, planting and maintenance of nursery.  Grafting (bud, stem and root) and layering in mulberry.  Planting methods for mulberry.  Characteristic features of important weeds of mulberry garden.  Preparation of compost and vermicompost.  Application of organic manures and chemical fertilizers for mulberry.  Irrigation methods (surface, sprinkler and drip irrigation) for mulberry.  Estimation of leaf yield, leaf-shoot ratio and leaf area in mulberry.  Methods of pruning and harvesting of mulberry.</p> <p>Study of soil profile  Soil sampling for soil testing and analysis.  Study of different types of soil – visit to different fields  Determination of saturation capacity of soil  Soil analysis for pH and electrical conductivity  Determination of organic carbon by Walky-Black method  Determination of available nitrogen by alkaline permanganate method  Visit to a soil testing laboratory  Visit to a water shed  Mechanical separation of soil sample to study the percentage of gravel, sand and clay  Assessment of soil texture  Determination of humus contents of different soils  Determination of soil moisture  Determination of Biological oxygen demand (BOD) of water (raw/treated sewage)  Determination of chemical oxygen demand (COD) of water (raw/treated sewage)  Determination of total alkalinity of water  Experiments to record temperature, relative humidity, light intensity and rainfall of a given place</p> <p><b>Cocoon Crop Production</b>  Morphology of the silkworm, <i>Bombyx mori</i>  Life cycle of the mulberry silkworm.  Sex difference in mulberry silkworm.  Characteristic features of popular bivoltine and multivoltine races of silkworm.  Dissect and display the digestive and excretory systems in silkworm.  Dissect and display of nervous system and silk glands in silkworm.  Dissect and display of male and female reproductive systems of silk moths.</p>			
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	<p>Mounting of embryo – pin head and blue egg stages.</p> <p>Disinfection and hygiene practices for rearing houses and equipments.</p> <p>Silkworm rearing houses - model and plan.</p> <p>Silkworm rearing equipments and their uses.</p> <p>Incubation and black boxing of silkworm eggs.</p> <p>Brushing of silkworms – methods.</p> <p>Selection of mulberry for feeding young and late-age silkworms.</p> <p>Preservation of mulberry for feeding young and late-age silkworms.</p> <p>Young – age and late – age silkworm rearing methods and operations.</p> <p>Moulting – identification of moulting larvae and care.</p> <p>Mounting – mountages, identification and mounting of spinning larvae.</p> <p>Harvesting and sorting of cocoons.</p> <p>Preparation of crop report and other records in the rearing house.</p> <p><b>A consolidated report and one assignment on given topic shall be submitted at the end of the course for evaluation.</b></p>			
<p><b>CORE COURSE PG-SERI-CC- 106</b></p>	<p><b>Mulberry and Silkworm Crop Protection and Silk Production Technology</b></p> <p><b>Mulberry Crop Protection</b> Identification of different mulberry diseases. Identification of different mulberry pests. Preparation of slides. Calculations related to fungicide and insecticide preparation. Visit to sericulture institute and farms.</p> <p><b>Silkworm Crop Protection</b> Identification of different silkworm diseases. Identification of different silkworm pests. Preparation of slides. Calculations related to fungicide and insecticide preparation. Visit to sericulture institute and farms.</p> <p><b>Silk Production Technology</b> Assessment of cocoon Sorting of different types of defective cocoon Determination of shell ratio percentage of given cocoon lot. Determination of degree of cooking, grouping and dropping percentage. Single cocoon reeling analysis for determination of average filament length, non breakable filament length. Determination of average size, size deviation and maximum size deviation of denier of provided silk lot. Estimation of degumming loss percentage. Bleaching and dyeing of silk.</p>	<p>25</p>	<p>60</p>	<p>02</p>



	Visit to a filature / weavers area.  <b>A consolidated report and one assignment on given topic shall be submitted at the end of the course for evaluation.</b>			
<b>GRAND TOTAL</b>		<b>200 (Theoretical) + 50 (Practical)= 250</b>	<b>400</b>	<b>20</b>

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**SECOND SEMESTER**

<b>CORE COURSE PG-SERI-CC- 201</b>	<b>Seed Organisation, Silkworm Seed Production &amp; Management and Laboratory Tools &amp; Techniques</b>	MARKS	CONTACT HOURS	CREDIT
Unit 1	<p><b>Seed Organisation</b> Introduction – types of seeds – reproductive seed – industrial seed. Morphology and structure of silkworm egg and its constituents. Embryology of silkworm egg. Characteristics of different stages including critical stages of development. Seed organization: Breeders stock - basic stock maintenance – characteristics of pure races and its multiplication. Seed areas: identification and concept of selection of seed rearers. Seed legislation acts, rules and regulation. Parental seed cocoon production and silkworm rearing at Seed Zone. Mounting and harvesting of seed cocoon crop. Monitoring of seed crop: Screening of egg shells, larva, faecal matters for disease. Disinfection and maintenance of hygiene during rearing. Seed cocoon markets-Pupal examination-certification of seed cocoon lots-Price fixation for seed cocoons.</p> <p><b>Silkworm Seed Production &amp; Management</b> 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. Acid treatment- Hot acid treatment, Cold acid treatment. Preservation of eggs: short term and long</p>	25	35	

	<p>term chilling - 4 months, 6 months and 10 months hibernation schedule.</p> <p>Loose egg and sheet egg preparation and their advantages and limitations.</p> <p>Transportation of eggs.</p> <p>Economics of egg production.</p> <p>Quality control and management in commercial grainage.</p>			
Unit 2	<p><b>Laboratory Tools &amp; Techniques</b></p> <p>Microscopy: Introduction, principle and technique.</p> <p>Chromatography: Introduction - Principle and applications of –</p> <p>Partition chromatography (paper chromatography),</p> <p>Adsorption chromatography (Thin Layer Chromatography),</p> <p>Gas Liquid Chromatography (GLC),</p> <p>Ion-exchange Chromatography,</p> <p>Molecular Sieve Chromatography and Affinity Chromatography and High Performance Liquid Chromatography (HPLC).</p> <p>Centrifugation: Principle, Types of centrifuges. Differential and density gradient centrifugation.</p> <p>Electrophoresis: Principle, procedure and applications of –</p> <p>Polyacrylamide gel electrophoresis (PAGE), Sodium dodecyl sulfate- Polyacrylamide gel electrophoresis (SDS-PAGE) and Isoelectric focusing (IEF).</p> <p>Spectrophotometry: Principle and biochemical applications of UV – Vis spectrophotometry, fluorimetry and spectrophotometry.</p>	25	35	
TOTAL		50	70	04
<b>CORE COURSE PG-SERI-CC- 202</b>	<b>Genetics and Breeding of Mulberry and Silkworm</b>	MARKS	CONTACT HOURS	CREDIT
Unit 1	<p><b>Genetics of Mulberry</b></p> <p>Reproductive biology of mulberry: Sexual polymorphism, development of anther, pollen and male gametophyte, development of ovary, Microsporogenesis and Megasporogenesis, female gametophyte, pollination, fertilization, embryo and seed development; polyembryony, parthenocarpy and apomixis.</p> <p>Fertilization-Embryogenesis in capsella-Embryosac development (polygonum type) - fruits &amp; seeds – types.</p> <p>Genetic variability in mulberry-sources of variability-wild species - hybrids, popular varieties in India.</p> <p>Chromosomal variations.</p> <p>Cytological techniques- Mitosis, Meiosis, and Karyotype studies.</p> <p>Tissue culture techniques in mulberry – culture media, micro propagation, Soma</p>	25	35	

	<p>clonal variation. Haploid induction – Somatic hybridization, In vitro screening and preservation - meristem, callus , anther, pollen , endosperm, encapsulation of shoot buds and cryopreservation of germ cells.</p> <p><b>Breeding of Mulberry</b> Selection techniques: Basic ideas on – Mass selection – Pure line selection and Clonal selection. Hybridization techniques – Single cross – Double cross- Back cross- Poly cross- Reciprocal cross- GCA – SCA. Grafting, budding and layering techniques. Polyploidy breeding – Induction, identification and evaluation of triploids. Varieties evolved by polyploidy breeding. Breeding techniques for stress condition – drought – salinity – alkalinity. Breeding for disease and pest resistance. Maintenance of improved varieties and release. - Multiplication – Naming of a variety and distribution of farmers.</p>			
Unit 2	<p><b>Genetics of Silkworm</b> Hereditary traits – Linkage map in silkworm. Gene interaction – quantitative inheritance – polygenic characters. Inheritance of cocoon colour, larval markings, E-alleles, multiple alleles Sex linkage – sex determination – breeding of sex limited breeds- Sex linked and sex limited traits and their special significance in sericulture. Inheritance of voltinism, maternal inheritance, inheritance of moultnism, environmental influence and hormonal control. Chromosome number and nature of chromosomes in different types of silkworm. Mutation-use of induction mutation in Sericulture.</p> <p><b>Breeding of Silkworm</b> Parameters relevant to silk production- qualitative and quantitative characters and its used in breed selection. Selection methods-individual and family selection-indirect, stabilizing and directional selection. Inbreeding and out breeding-advantages and disadvantages-effects of inbreeding, consequence of homozygosity. Heterosis – Exploitation of heterosis – Cross breeding techniques of hybridization, Combining ability. Evaluation of hybrids for different location – identification of Seri cultural zones – availability of hybrids – local adoptability</p>	25	35	

	test of hybrids. Maintenance and multiplication of basic stocks.			
<b>TOTAL</b>		50	70	04
<b>CORE COURSE PG-SERI-CC- 203</b>	<b>Vanya Silk (Non-Mulberry)</b>	<b>MARKS</b>	<b>CONTACT HOURS</b>	<b>CREDIT</b>
Unit 1	<p><b>Non-mulberry Sericulture</b> Insect and non-insect fauna producing silk and their distribution in world and India. Status of vanya silks in India, characteristic features, economic importance and demand. Concept of social forestry. Problems and prospects non-mulberry sericulture. Strategies for improvement of vanya sericulture. State-wise distribution of vanya silk production in India. Economics of tasar, eri and muga culture. By-products of vanya sericulture and their utilization.</p> <p><b>Cultivation of host plants, disease and pests of host plants</b> Primary and secondary host plants of vanya silkworms: Establishment of primary host plants of vanya silkworms and package of practices for their cultivation. Pests and diseases of primary host plants of vanya silkworms and their management.</p>	25	35	
Unit 2	<p><b>Seed Organisation, rearing and disease and pests of vanya silkworm</b> Eco-races / races, morphology and life cycle of vanya silkworms. Planning for vanya silkworm egg production and rearing; grainage and rearing equipments. Disinfection and hygiene practices in grainages and vanya silkworm rearing houses/premises. Egg production technology of vanya silkworms. Rearing technology of young and late-age vanya silkworms. Pests and diseases of vanya silkworms and their management.</p> <p><b>Post Cocoon Technology for Vanya Silk</b> Tasar and muga cocoon cooking and reeling. Eri cocoon spinning. Marketing of vanya silk.</p>	25	35	
<b>TOTAL</b>		50	70	04
<b>CORE COURSE PG-SERI-CC- 204</b>	<b>Immunology, Bio-chemistry, Molecular Biology, Seri-biotechnology</b>	<b>MARKS</b>	<b>CONTACT HOURS</b>	<b>CREDIT</b>
Unit 1	<p><b>Immunology and Bio-chemistry</b> Immunity and immune responses- innate immunity, adaptive immunity, collaboration between innate and adaptive immunity-T cell and cell mediated immunity, B – cell and</p>	25	35	

	<p>humoral immunity, other forms of adaptive immunity  Antigens and Adjuvant: General concepts and types  Structure and classification of immunoglobulin  Antigen-Antibody interaction  Primary and secondary immune-responses, genetic control of immune-responses  Elementary ideas of vaccination and vaccines</p> <p>Carbohydrate – classification, structure and properties.  Metabolism of carbohydrates – Glycolysis, TCA, Glycogenesis.  Protein – classification, structure, properties and metabolism.  Metabolism of lipid-<math>\beta</math> Oxidation of fatty acids  Idea about diffusion, pH, buffer, osmosis &amp; absorption  Enzymes-Models of enzyme catalysis, specificity of enzymes, factors influencing enzyme activity, Michaelis constant</p>			
Unit 2	<p><b>Molecular Biology, Seri-biotechnology</b>  Membrane structure and functions; intracellular compartments, protein sorting, secretory and endocytic pathways.  Cytoskeleton.  Structure and function of nucleous-Ultra structure of nuclear membrane: Nucleolus.  Mitochondria and chloroplasts-their genetic organization.  Cell cycle: Definition and different phases-Mitosis and Meiosis –significance.  Differences between mitosis and meiosis  Chromosome organization and morphology: centromere and telomere: chromosome alterations-deletions, translocations, duplications and inversions: variations in chromosome number - aneuploidy and polyploidy.  Recombinant DNA Technology, basic principles and application, plasmids, vectors and restriction enzymes techniques.  Misuse of recombinant DNA Technology.</p> <p>Theoretical aspects of the techniques of genetic engineering:  Isolation of DNA to be cloned  Use of restriction linker.  Colony hybridization technique.  Invitro translation technique  DNA finger printing.  Blotting technique.  c DNA clone bank.  DNA Library-Genomic DNA Library,</p>	25	35	

	<p>Chromosome specific library, cDNA library</p> <p>Application of genetic engineering – application in medicine, agricultural application, industrial application, application in environment management.</p> <p>Eucaryotic genome organization: DNA damage and repair; DNA replication, amplification and rearrangement.</p> <p>Transcription of DNA, Genetic code and protein synthesis.</p> <p>Molecular markers: SNPs, STRs, VNTRs, RFLP, Single nucleotide polymorphism, restriction fragment length polymorphism, Randomly amplified polymorphic DNA.</p> <p>Biotechnology-Scope and importance , Basis of Biotechnology , Global impact , Health care , Agriculture , Achievements , Prevention of misuse of Biotechnology , Gene bank and Plant conservation.</p> <p>Biotechnological application :</p> <p>In-vitro establishment of microrhiza</p> <p>CAT gene, nptII gene, lac z gene</p> <p>Biofertilizer -- general idea</p> <p>Biological control of plant pathogen pests and weeds – basic idea.</p> <p>General idea on:</p> <p>Cell and tissue culture of plant and animals.</p> <p>Cell lines and cell clones</p> <p>Callus structure.</p> <p>Somatoclonal variation.</p> <p>Micro propagation.</p> <p>Gene transfer in plant and animals</p> <p>Transgenic biology</p> <p>Artificial seed.</p> <p>Hybridoma technology</p> <p>Allopheny</p> <p>Role of Biotechnology in Sericulture</p>			
TOTAL		50	70	04
		MARKS	CONTACT HOURS	CREDIT
<b>CORE COURSE PG-SERI-CC- 205</b>	<p><b>Silkworm Seed Production, Genetics and Breeding of Mulberry and Silkworm</b></p> <p>Planning of Grainage Building.</p> <p>Grainage Equipments.</p> <p>Processing of seed cocoons</p> <p>Cutting of Seed Cocoons</p> <p>Sex separation</p> <p>Emergence of moths-selection of moths</p> <p>Pairing and Depairing oviposition</p> <p>Maintenance of required environmental conditions</p> <p>Mother moth Examination-individual and mass-whole and sampling, methods of surface sterilization of silkworm eggs</p> <p>Sheet eggs and loose egg preparation-preparation of starch paper-washing of loose eggs-Drying-Treatment of eggs with acid-weighting and packing</p>	25	60	02

	<p>Acid treatment of bivoltine eggs-Hot acid treatment and Cold acid treatment. Visit to Silkworm Seed Production Centre.</p> <p>Study the hybridization technique of mulberry. Morphological Studies of mulberry plant. Anatomical Studies of mulberry leaf. Anatomical Studies of Primary root of mulberry. Anatomical Studies of Primary stem of mulberry. Cytological techniques-preparation of pre-treatment, solutions-fixatives and stains procedure Somatic chromosomes-mitosis in root/shoot meristem Meiosis during microsporogenesis - smear preparation of pollen mother cells Biochemical estimation of nutrients in mulberry leaf-Moisture percentage of mulberry leaf-chlorophyll (a, b and total) content, soluble proteins, sugars etc.</p> <p>Characters of silkworm race Evaluation of Heterosis. Selection Methods Inbreeding Depression Chi-square Test Identification of mutants Breeding Plans Parthenogenesis Biochemical Genetics Genetics of Cocoon Colour Mutation Maternal inheritance</p>			
<p><b>CORE COURSE</b> <b>PG-SERI-CC-</b> <b>206</b></p>	<p><b>Non-Mulberry Sericulture, Molecular Biology, Immunology, Biochemistry and Seri-biotechnology</b></p> <p>Identification of food plants of Tasar, Eri and Muga silkworm with reference to taxonomic traits Identification of egg, larva, pupa, cocoon and moths of Tasar, Eri and Muga silkworm. Identification of different types of diseases and Pest of Non- mulberry Silkworm Visit to a non mulberry cultivation institutes</p> <p>Protein estimation by kjeldhal and colorimetric method Biochemical estimation of nutrients in mulberry leaf Moisture percentage of mulberry leaf Chlorophyll (a, b and total) content, soluble proteins, sugars etc. Study of electrophoretic profiles of DNA and protein with reference to standard markers-demonstration Amylase activity studies in haemolymph of</p>	25	60	02

	silkworm Qualitative experiments on protein and carbohydrates Biochemical estimation of N.P.K percentage in mulberry leaf Micro technique-Fixation, Embedding, Block making and section cutting of animal tissue			
		MARKS	CONTACT HOURS	CREDIT
<b>GRAND TOTAL</b>		<b>200 (Theoretical) + 50 (Practical) =250</b>	<b>400</b>	<b>20</b>
<b>THIRD SEMESTER</b>				
<b>CORE COURSE PG-SERI-CC-301</b>	<b>Ecology, Conservation, Biodiversity of Sericigenous fauna and Applied Entomology</b>	MARKS	CONTACT HOURS	CREDIT
Unit 1	Environmental Dynamics Ecology & Conservation	25	35	
Unit 2	Biodiversity of Sericigenous Fauna Applied Entomology	25	35	
TOTAL		50	70	04
<b>CORE COURSE PG-SERI-CC-302</b>	<b>Basic Computer Application, Biostatistics and Research Techniques</b>	MARKS	CONTACT HOURS	CREDIT
Unit 1	Basic Computer Application	25	35	
Unit 2	Bio-Statistics Research Methodology	25	35	
TOTAL		50	70	04
<b>PG-SERI-CBCS-A</b>	<b>Choice Based Credit System (C.B.C.S-A) – “Sericulture Practices in India” will be offered by the Departments of Sericulture for Students of Other Departments. Students of Department of Sericulture will opt for C.B.C.S.-A course offered by other Department.</b>	50	70	04
<b>PG-SERI-DSEC-01</b>	<b>Discipline Specific Elective Course (Theory)* Students will opt DSEC offered by Department of Sericulture</b>	50	70	04
<b>CORE COURSE PG-SERI-CC-303</b>	<b>Ecology, Conservation, Biodiversity of Sericigenous fauna and Applied Entomology Basic Computer Application, Biostatistics and Research Techniques</b>	25	60	02



<b>SERI-DSEC- 403</b>	<b>Discipline Specific Elective Course (Practical)* Students will opt DSEC offered by Department of Sericulture</b>	25	60	02
	<b>Allotment of Dissertation Topic (To be contd. In Sem IV)</b>			
<b>GRAND TOTAL</b>		<b>200 (Theoretical) + 50 (Practical) =250</b>	<b>300</b>	<b>20</b>
<b>FOURTH SEMESTER</b>				
<b>COURSE</b>	<b>TOPIC</b>	<b>MARKS</b>	<b>CONTACT HRS</b>	<b>CREDIT</b>
<b>CORE COURSE PG-SERI-CC-401</b>	<b>Extension, Economics, Sociology and Rural Development, Entrepreneurship Development,</b>	<b>MARKS</b>	<b>CONTACT HOURS</b>	<b>CREDIT</b>
Unit 1	Sericulture Extension and Economics Sociology and Rural Development	25	35	
Unit 2	Entrepreneurship Development Sustainable Sericultural Management	25	35	
<b>TOTAL</b>		<b>50</b>	<b>70</b>	<b>04</b>
<b>PG-SERI-CBCS-B</b>	<b>Choice Based Credit System (C.B.C.S-B) – “Agricultural Entomology” -C.B.C.S Sericulture Students will opt C.B.C.S course offered by Parent Department</b>	<b>50</b>	<b>70</b>	<b>04</b>
<b>PG-SERI-DSEC-402</b>	<b>Discipline Specific Elective Course (Theory)* Students will opt DSEC offered by Department of Sericulture</b>	<b>50</b>	<b>70</b>	<b>04</b>
<b>CORE COURSE PG-SERI-CC-403</b>	<b>Sericulture Extension and Economics Seminar / Project on EDP/Management,</b>	<b>25</b>	<b>60</b>	<b>02</b>
<b>PG-SERI-DSEC-404</b>	<b>Discipline Specific Elective Course (Practical)* Students will opt DSEC offered by Department of Sericulture</b>	<b>25</b>	<b>60</b>	<b>02</b>
<b>Dissertation</b>	<b>Dissertation submission, Seminar Presentation Dissertation Contd. From Sem III</b>	<b>50</b>	<b>70</b>	
<b>GRAND TOTAL</b>		<b>150 (Theoretical) + 50 (Practical) + 50 (Dissertation) = 250</b>	<b>400</b>	<b>20</b>
	<b>Post Graduation Grand Total Marks</b>	<b>1000</b>	<b>1600</b>	<b>80</b>
<b>List of Discipline Specific Elective Course (DSEC):</b>				

<ul style="list-style-type: none"><li>• <b>Mulberry Production</b></li><li>• <b>Cocoon Production</b></li><li>• <b>Silk Production</b></li><li>• <b>Extension and Management</b></li></ul>			