

CURRICULUM FOR B.Sc. V AND VI SEMESTERS - SERICULTURE

Sem. No.	Course Category	Course Code	Course Title	Credits Assigned	Instructional hours per week		Duration of Exam (Hrs.)	Exam/ Evaluation Pattern (Marks)		
					Theory	Practical		IA	Exam	Total
V	DSC	SER-C9-T	SILKWORM SEED TECHNOLOGY	4	4	-	2	40	60	100
		SER-C10-P	SILKWORM SEED TECHNOLOGY	2	-	4	3	25	25	50
		SER-C11-T	MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY	3	3	-	2	40	60	100
		SER-C12-P	MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY	2	-	4	3	25	25	50
		SER-C13-T	SILKWORM CYTOGENETICS, BREEDING AND PHYSIOLOGY	3	3	-	2	40	60	100
		SER-C14-P	SILKWORM CYTOGENETICS, BREEDING AND PHYSIOLOGY	2	-	4	3	25	25	50
	DSE	SER-E1-T (Anyone to be chosen)	A. BIOCHEMICAL TECHNIQUES	3	3	-	2	40	60	100
			B. CELL BIOLOGY AND GENETICS	3	3	-	2	40	60	100
	Vocational	SER-V1-T	VALUE ADDITION IN SERICULTURE	3	3	-	2	40	60	100
VI	DSC	SER-C15-T	SILK TECHNOLOGY	4	4	-	2	40	60	100
		SER-C16-P	SILK TECHNOLOGY	2	-	4	3	25	25	50
		SER-C17-T	VANYA SERICULTURE	3	3	-	2	40	60	100
		SER-C18-P	VANYA SERICULTURE	2	-	4	3	25	25	50
		SER-C19-T	SERICULTURE ECONOMICS, MARKETING AND EXTENSION	3	3	-	2	40	60	100
		SER-C20-P	SERICULTURE ECONOMICS, MARKETING AND EXTENSION	2	-	4	3	25	25	50
	DSE	SER-E2-T (Anyone to be chosen)	A. AGRICULTURE BIOTECHNOLOGY	3	3	-	2	40	60	100
			B. BIOSTATISTICS	3	3	-	2	40	60	100
	Vocational	SER-V2-T	SERICULTURE ENTERPRENERSHIP DEVELOPMENT	3	3	-	2	40	60	100

V - SEMESTER

DSC : SER-C9-T (Credits - 4)

SILKWORM SEED TECHNOLOGY		
Theory		4 hrs/week : 60 hrs.
Unit-1		
1.	Developmental biology: Morphology and structure of silkworm egg, fertilization, cleavage, blastoderm and germ band formation, blastokinesis, eye spot and blue egg. Dispause development. Embryonic stage for refrigeration.	6Hrs.
2.	General account of silkworm egg production, grainages, production and demand trends.	2Hrs.
3.	Silkworm seed organization: Concept and significance of seed organization. Basic seed forms and multiplication centers - P4, P3, P2 and P1 stations. Norms and procedure followed in P3, P2 and P1 multiplication centers.	7Hrs.
Unit-2		
4.	Silkworm Seed Legislation Act. CSB Silkworm seed regulations 2010. Concept of seed areas, selected/adopted seed rearers/villages. Maintenance of seed crops.	4Hrs.
5.	Seed cocoon markets. Norms for purchase of bivoltine and multivoltine seed cocoons, Certification of seed cocoon lots, price fixation and transaction of seed cocoons.	5Hrs
6.	Disinfection and hygiene in seed production units.	2Hrs.
7.	Grainages - types of grainages, location and capacity, model grainage, grainage equipments and their uses.	4Hrs.
Unit-3		
8.	Environmental requirements during silkworm egg production.	2Hrs.
9.	Procurement and transportation of seed cocoons. Cocoon sorting, selection and preservation of seed cocoons. Sex separation – signification and methods.	4Hrs.
10.	Moth emergence and synchronisation; sex separation in moth; effect of improper synchronisation on egg hatching and quality-safe duration.	4Hrs.
11.	Coupling and decoupling, oviposition, refrigeration of male moths, preparation of loose and sheet eggs. Mother moth examinations - individual and mass methods, dry moth examination.	5Hrs.
Unit-4		
12.	Handling of multivoltine eggs - preservation of eggs to postpone hatching, ideal embryonic stages for cold storage and maximum duration of cold storage. Handling of bivoltine eggs - physical and chemical methods - hot and cold acid treatment.	4Hrs
13.	Postponement of hatching - hibernation schedule for 3, 4, 6 and 10 month's duration.	4Hrs
14.	Incubation of eggs - methods, environmental conditions required for incubation, postponement of hatching of eggs by temporary consignment.	4Hrs.
15.	Grainage management.- Role of LSPs. Bye products of grainage and their utilization.	3Hrs.

DSC : SER-C10-P (Credits - 2)

SILKWORM SEED TECHNOLOGY		
Practical		15 Practicals - 4 hrs each
1.	Morphology of silkworm egg. Mounting of 5 th , 6 th , 7 th , 8 th and 9 th day old embryos.	3 Prac.
2.	Model grainage building plan and Grainage equipments.	2 Prac.
3.	Seed cocoon processing/handling - deflossing, sorting and preservation- pupal examination and Sex separation of pupa and moth. Synchronization of emergence.	2 Prac.
4.	Moth emergence- selection of moths- pairing and de-pairing- oviposition- preservation of male moths- preparation of disease free layings- sheet egg and loose egg preparation-Preparation of starch coated paper, washing of loose eggs, Drying-Treatment of eggs with acid-Weighing and packing.	2 Prac.
5.	Pupa and Mother moth examination for Pebrine spores- Individual and Mass moth examination- surface disinfection of silkworm eggs. Preservation and handling of hibernated eggs for 3, 4, 6 and 10 month hibernation schedules.	2 Prac.
6.	Acid treatment of bivoltine eggs- hot acid and cold acid treatment. Incubation of acid treated eggs-Calculation of hatching percentage.	2 Prac.
7.	Visit to Seed cocoon markets, commercial Grainage and cold storage center to know activities of cocoon markets, preparation of layings and cold storage of eggs.	2 Prac.
Note: Visit to Grainage and submission of report shall be considered for IA.		

DSC : SER-C11-T (Credits - 3)

MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY		
Theory		3 hrs/week : 45 hrs.
Unit-1		
1.	Ultra-structure of eukaryotic cell and chromosomes.	2 Hrs.
2.	Chromosomes in mulberry: Number and Karyomorph, mitosis and meiosis and meiotic irregularities.	3 Hrs.
3.	Genetic resources of mulberry: Germplasm – Importance, collection, conservation, evaluation, cataloging, multiplication and distribution.	3 Hrs.
4.	Plant introduction and acclimatization. Quarantine – norms, procedure, merits and demerits.	2 Hr.
5.	Mulberry breeding: Objectives, parameters associated with yield and quality of leaf. Methods - hybridization, polyploidy and mutation breeding.	4 Hrs.
Unit -2		
6.	Selection techniques: mass, pure line and clonal selection.	3 Hrs.
7.	Hybridisation: Objectives, types and procedure.	3 Hrs
8.	Mutation breeding in Mulberry: Types, mutagens - physical and chemical mutagenesis. Merits and demerits.	3 Hrs.
9.	Polyploidy breeding in mulberry: Induction, types, and their importance. Evolution of triploids in mulberry and their importance.	2 Hrs.
10.	Breeding for disease and drought resistance.	2 hrs.
11.	Evaluation of selected genotypes and release of improved varieties.	2 Hrs.
Unit -3		
12.	Plant and water: Water potential, absorption of water and solutes - active and passive absorption, absorption of minerals, translocation of salutes. Source and sink relationship,	2 Hrs.
13.	Mineral nutrition - macro and micro nutrients and their physiological role. Foliar nutrition in mulberry and its significance.	3 Hrs.
14.	Transpiration: Significance, mechanism of stomata opening and closing, regulation of water loss by stomata and factors affecting the rate of transpiration.	3 Hrs.
15.	Biological nitrogen fixation; types and importance in mulberry cultivation.	2 Hrs.
16.	Photosynthesis: Outline of the process, photosynthetic pigments and their characteristics, factors affecting photosynthesis, carbon fixation (C3 and C4 plants). Photorespiration and its significance.	3 Hrs.
17.	Plant growth regulators: Importance, physiological role and application in mulberry.	3 Hrs.

DSC : SER-C12-P (Credits – 2)

MULBERRY CYTOGENETICS, BREEDING AND PHYSIOLOGY		
Practical		15 Practicals of 4 hrs each
1.	Study of mitosis in onion and mulberry.	2 Pract.
2.	Mulberry germplasm and Mulberry multi-locational trials	1 Pract.
3.	Evaluation of breeding parameters in different mulberry varieties.	1 Pract.
4.	Induction of tetraploidy in mulberry by using colchicin (Demonstration)	1 Pract.
5.	Mulberry breeding equipments.	1 Pract.
6.	Hybridization technique in mulberry.	1 Pract.
7.	Determination of stomatal index	1 Pract.
8.	Kranz Anatomy in relation to photosynthesis	1 Pract.
9.	Estimation of leaf protein and carbohydrates	2 Pract.
10.	Separation of leaf photosynthetic pigments of mulberry through paper chromatography.	1 Pract.
11.	Extraction of photosynthetic pigments by solvent wash method.	1 Pract.
12.	Estimation of moisture percentage and retention capacity of mulberry leaf.	1 Pract.
13.	Determination of water potential by potato tuber method.	1 Pract.
	Visit to research institutes and germplasm, report shall be consider for IA	

DSC : SER-C13-T (Credits – 3)

SILKWORM CYTOGENETICS, BREEDING AND PHYSIOLOGY		
Theory		3 hrs/week : 45 hrs.
Unit-1		
1.	Structure and chromosome numbers in mulberry and non-mulberry silkworms. Evolutionary significance of chromosomes in <i>Bombyx mori</i> .	2 Hrs.
2.	Sex determination mechanism in silkworm. Importance of ZZ and ZW chromosomes.	2 Hrs.
3.	Gametogenesis- Oogenesis and Spermatogenesis	2 Hrs.
4.	Genetic basis of voltinism and moultinism in the silkworm, <i>Bombyx mori</i> .	2 Hrs.
5.	Hereditary traits of silkworm egg, larva, pupa and adult of <i>Bombyx mori</i> .	3 Hrs.
6.	Genetics of cocoon colours - inheritance of cocoon colours of <i>Bombyx mori</i> .	1 Hrs.
7.	Parthenogenesis in silkworm- types and induction of parthenogenesis.	2 Hrs.
Unit -2		
8.	Silkworm germplasm bank.	1 Hrs.
9.	Silkworm breeding: scope and objectives; methods – inbreeding, line breeding, out breeding and mutation breeding.	3 Hrs.
10.	Selection: individual and mass selection, fixation of characters, evolution of new breeds and race authorization.	3 Hrs.
11.	Heterosis/hybrid vigour, theories of heterosis, combining ability - general and specific, line to tester and dialyl analysis, exploitation of heterosis in improvement of silkworm breeds. Concept and importance of single, double and polyhybrids.	3 Hrs.
12.	Breeding of Sex-limited breeds and sex-limited breeds in India	3 Hrs.
Unit -3		
13.	Digestion: Structure and function of digestive system. Phagostimulants and feeding deterrents. Process of digestion, midgut pH - potassium secretion, digestive enzyme. Nutritive requirements of the silkworm. Artificial diets.	3 Hrs.
14.	Respiration: tracheal system, spiracles, mechanism of respiration, factors affecting respiration.	2 Hrs.
15.	Excretion: structure and function of excretory system and cryptonephrial arrangement and its significance in water regulation.	2 Hrs.
16.	Neuro - endocrine system: Structure and function of endocrine glands.	3 Hrs.
17.	Circulation: heartbeat, role of alary muscles, accessory hearts, blood pressure in open circulatory system. Haemolymph.	2 Hrs.
18.	Muscle Physiology: Histology of insect muscles, flight muscles in insects, ultra structure of skeletal muscle, mechanism of muscle contraction.	2 Hrs.
19.	Integument: Structure, formation and function.	2 Hrs.
20.	Metamorphosis- types of insect metamorphosis, theories of metamorphosis.	2 Hrs.

DSC : SER-C14-P (Credits-2)

SILKWORM CYTOGENETICS, BREEDING AND PHYSIOLOGY		
Practical		15 Practicals of 4 hrs each
1.	Study of chromosomes in testis and ovaries of silkworm, <i>Bombyx mori</i> .	2 Pract.
2.	Identification of different silkworm breeds cocoons - NB ₄ D ₂ , KA, PM, C.Nichi, Nistari, CSR ₂ and CSR ₄ , FC1 and FC2.	1 Pract.
3.	Identification of mutants of silkworm larva- zebra, ursa, knobbed and sex-limited Races.	1 Pract.
4.	Comparative assessment of the hybrids and pure race cocoons.	1 Pract.
5.	Estimation of heterosis.	1 Pract.
6.	Estimation of inbreeding depression.	1 Pract.
7.	Estimation of proteins in silkworm egg and haemolymph.	2 Pract.
8.	Estimation of haemolymph glucose level.	1 Pract.
9.	Morphology of haemocytes in silkworm.	1 Pract.
10.	Estimation of amylase activity in haemolymph of bivoltine and multivoltine races.	2 Pract.
11.	Estimation of SDH activity in the eggs/tissue.	2 Pract.

DSE : SER-E1-T (Credits – 3) (Anyone to be chosen)

BIOCHEMICAL TECHNIQUES		
Theory		3 hrs/week : 45 hrs.
Unit -1		
1.	SI units, molarity, moles, pH and buffer solutions	3 Hrs
2.	Cell fractionation techniques: Cell lysis, homogenization, extraction, salting in, salting out, dialysis and ultra filtration.	5 Hrs
3.	Spectrophotometry	
4.	Chromatographic techniques: Principles and applications of paper, TLC, adsorption, ion exchange, gel filtration, affinity, GLC, chromatofocusing, HPLC and FPLC.	7 Hrs
Unit-2		
5.	Centrifugation: Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Ultra centrifugation: Differential and density gradient centrifugation, centrifugal elutriation.	5 Hrs
6.	Electrophoretic techniques: Polyacrylamide gel electrophoresis, SDS-PAGE, 2D-electrophoresis, diagonal, agarose gel electrophoresis, isoelectric focusing, pulsed field electrophoresis, high voltage electrophoresis, capillary electrophoresis.	6 Hrs
7.	Visualizing proteins, glycoproteins, lipoproteins, and nucleic acids. Zymogram and reverse zymogram.	4 Hrs
Unit-3		
8.	Blotting techniques: Dot blot, Southern, Northern, Western blot, DNA footprint assay.	5 Hrs
9.	DNA fingerprint assay, gel retardation assay, nuclease protection assay.	5 Hrs
10.	RFLP, RAPD. PCR, RT-PCR, q-PCR, Microarrays.	5 Hrs

DSE : SER-E1-T (Credits – 3) (Anyone to be chosen)

CELL BIOLOGY AND GENETICS		
Theory		3 hrs/week : 45 hrs.
Unit-I		
1	General Introduction: Historical perspective, The Cell Theory, Ultra structure of plant and animal cell, different types of cells.	3 Hrs.
2	Cell organelles: Structure and functions of - cell wall, plasma membrane, membrane proteins, cytoplasm, nucleus, mitochondria, chloroplast, golgi bodies, endoplasmic reticulum, ribosomes, lysosomes, peroxisomes.	6 Hrs.
3	Cell Division: Cell cycle, phases and regulation of cell cycle, cell division, Mitosis and Meiosis, Interphase nucleus, Achromatic apparatus, Synaptonemal complex.	6 Hrs.
Unit-2		
4	Cell interaction and motility: Cell junctions- septate, tight and gap junctions, cell motility, flagellar and ciliary motion, structure and functions of muscle cells, muscle contraction, nerve cell structure and functions.	4 Hrs.
5	History of genetics: Introduction and brief history of genetics.	1 Hrs.
6	Mendelian theory: Laws of inheritance- dominance, segregation, and independent assortment, test cross, back cross. Deviations to Mendelian inheritance- interaction of genes (13:3 ratio), incomplete dominance, codominance, epistasis. Sex-linked inheritance, Chromosome theory of inheritance, linkage and crossing over.	6 Hrs.
7	Mutation: Natural and induced mutations, mutagenesis- Chemical, physical and biological mutagens, Molecular mechanisms.	4 Hrs.
Unit-3		
8	Eukaryotic chromosomes: Types, chromatin structure, nucleosomes, higher order chromatin organization. Special chromosomes- lampbrush, polytene and B - chromosome.	5 Hrs.
9	Chromosomal aberrations: Deletion, duplication, inversion, translocation and ploidy. Chromosomal disorders in humans.	5 Hrs.
10	Genetic recombination in bacteria: Transformation, transduction and conjugation.	5 Hrs.

Vocational: SER-E1-T (Credits - 3)

VALUE ADDITION IN SERICULTURE INDUSTRY		
Theory		3 hrs/week : 45 hrs.
	Unit-1	
1.	Introduction to value addition in Sericulture industry: Definition, Importance, and its benefits for small-scale farmers and entrepreneurs in the sericulture industry. The scope and significance of value-added products Value added products for better economics and sustainability of sericulture industry.	3 Hrs.
2.	Overview of the mulberry plant and its by-products. Scope, importance and benefits of value addition.	3 Hrs.
3.	Medicinal and therapeutic values of different parts of the mulberry: mulberry leaves, stem, root, and fruits.	3 Hrs.
4.	Mulberry leaf value added products - Mulberry tea and syrups. Mulberry fruit products –wine, jams, syrups, and juice. Mulberry stem utilization for art, adhesive, fodder, and fuels.	3 Hrs.
5.	Companies/Industries, market opportunities and prospects of mulberry-based products for value-addition.	3 Hrs.
	Unit-2	
6.	Overview of the silkworm and its by-products. Scope, importance and benefits of value addition.	3 Hrs.
7.	Value addition in silkworm and its byproducts:Production of compost,vermin-compost and biogas. Cordyceps and Mushroom production. Copper chlorophyll acid extraction andpreparation of skin whitening composition from silkworm larval litter,	4 Hrs.
8.	Nutritional value addition: Nutritional aspects and dietary benefits of different stages mulberry and non-mulberry silkworms. Utilization of silkworm larvae and pupae as an alternate food source. Production of pupal Oil paints, varnishes, and medicine, animal feed - poultry and fishery industries..	5 Hrs.
9.	Companies/Industries, market opportunities and prospects of silkworm-based products for value-addition.	3 Hrs.
	Unit-3	
10.	Overview of the post-cocoon sector and its by-products. Scope, importance and benefits of value addition.	2 Hrs.
11.	Development and diversification of handy crafts from cocoons and silk. Its market value and economic assessments.	3 Hrs.
12.	Creation of value-added products from silk wastes and spun silk. Its market value and economic assessments.	2 Hrs.
13.	Medicinal and therapeutic values of silk proteins. Biomedical application of silk protein-based products and their economic values.	3 Hrs.
14.	Exploring non-mulberry sericulture: Value added products and its market opportunities and economic assessments.	2 Hrs.
15.	Companies/Industries, market opportunities and prospects of mulberry-based products for value-addition.	3 Hrs

VI - SEMESTER

DSC : SER-C15-T (Credits – 4)

SILK TECHNOLOGY		
Theory		4 hrs/week ; 60 hrs.
Unit-1		
1.	Introduction to different textile fibres. Physical and commercial characteristics of cocoons: cocoon colour, shape size, hardness, grain/wrinkle, weight of cocoon, weight of cocoon shell, shell ratio.	3 Hrs.
2.	Cocoon marketing- Procedure for procurement of raw material- purchase of cocoon in open auction; grading of cocoons- visual inspection and selection.	3 Hrs.
3.	Cocoon stifling: Definition, objectives, different methods-conventional and modern techniques- steam stifling. Hot air drying- Batch type and conveyer type; advantages and disadvantages.	3 Hrs.
4.	Cocoon cooking/boiling: Definition and objectives, different methods of cocoon boiling-Mono pan, three pan and pressurized cocoon boiling methods.	3 Hrs.
5.	Cocoon brushing: Definition, objectives and methods.	3 Hrs.
Unit-2		
6.	Reeling water: quality required for silk reeling, total and permanent hardness, optimal pH; corrective measures	3 Hrs.
7.	Reeling: Objective and cocoon reeling from various devices-country charaka, cottage basin, multi end reeling machine, auto and semi-automatic, improved CSTR reeling devices; advantages and disadvantages	3 Hrs.
8.	Re-reeling and packing: Objectives, process; lacing, skeining, booking and baling.	3 Hrs.
9.	Raw silk properties- physical, chemical and biological. Uses of raw silk- Textile and other commercial uses.	2 Hrs.
10.	Raw silk testing and grading; Visual inspection. Mechanical tests- winding test, size deviation test, seriplane test, serigraph test and cohesion test. Supplementary tests- conditioning weight, scouring loss, exfoliation tests.	4 Hrs.
Unit-3		
11.	Silk throwing: Introduction, objectives of silk throwing, preparation for twisting, soaking, winding, doubling, twisting (high & low), heat/steam setting, rewinding.	3Hrs.
12.	Silk weaving: Warp preparation- warp, beaming, drawing and denting. Weft preparation-different pirn winding methods. Powerloom and handloom weaving. Flow chart of weaving; weaving defects.	3 Hrs.
13.	Chemical processing of silk yarns and fabric: Introduction and objectives of degumming-Methods. Silk bleaching- Importance and processing. Silk dyeing-Acidic and basic dyeing processing. Introduction of different classes of dyes and chemicals used for silk dyeing.	4 Hrs.
14.	Detailed study of spun silk industry- various steps involved, flow chart, spun silk yarn and noil yarn.	3 Hrs.
15.	Introduction to by-products of sericulture industry; by- product utilization in mulberry; types of silk waste and pupal waste-oil extraction and cake preparation.	2 Hrs.

DSC : SER-C16-P (Credits -2)

SILK TECHNOLOGY		
Practicals		15 Practicals of 4 hrs. each
1.	Categorization of different types of cocoons, good and defective cocoons, calculation of percentage of each type.	1 Prac.
2.	Identification of silk, cotton, wool and synthetic fibre (viscose/nylon/polyester) by physical methods - flame and microscopic test, chemical and confirmatory tests.	2 Prac.
3	Cocoon stifling- Determination of degree of drying.	1 Prac.
4.	Reeling water: Determination of total and permanent hardness, alkalinity and pH.	1 Prac.
5.	Demonstration of cooking methods - Mono pan and three Pan	1 Prac.
6.	Determination of commercial characters of cocoon (Pure breed, cross breed, single and double hybrid) : average cocoon weight, shell weight, shell percentage or shell ratio.	2 Prac.
7.	Reeling on epprouvette for determination of average filament length, reelability, raw silk recovery, renditta and denier of Pure breed, cross breed, single and double hybrid ..	2 Prac
8.	Degumming of raw silk by soap & soda wash method and estimation of sericin and fibroin percentage.	1 Prac.
9.	Bleaching of silk fibers.	1 Prac.
10.	Silk dyeing to obtain different shades using acid and basic dyes.	2 Prac.
11.	Identification of different types of silk waste; floss, cooker, reeler, basin refuse and re-reeling waste, dupion silk.	1 Prac.
12.	Study of charaka, cottage basin, multi-end silk reeling machine, automatic and semi- automatic reeling machine-practical demonstration. (Visit to private reeling unit and filature). Study of silk fabric manufacturing unit- Power & handloom. Identification of weaving defects (Visit only)	2 Prac.
NOTE: Visit to reeling units/filatures/TSC/CRC/institutes-Report submission for IA.		

DSC : SER-C17-T (Credits – 3)

VANYA SERICULTURE		
Theory		3 hrs/week ; 45 hrs.
Unit-1		
1.	Insect and non-insect fauna producing silk and their distribution in world and India.	2 Hrs.
2.	Status of vanya silks in India – characteristic features, advantages, income and employment, production and demand.	3 Hrs.
3.	Host plants of vanya silkworms: State-wise distribution in India, area and economic importance.	3 Hrs.
4.	Botanical description of primary host plants of vanya silkworms.	4 Hrs.
5.	Establishment of primary host plants of vanya silkworms and package of practices for their cultivation.	3 Hrs.
Unit-2		
6.	Pests and diseases of primary host plants of vanya silkworms and their management.	4 Hrs.
7.	Planning for vanya silkworm egg production and rearing; grainage and rearing equipments.	3 Hrs.
8.	Disinfection and hygiene practices in grainages and silkworm rearing houses / premises.	3 Hrs.
9.	Breeding, eco-races / races, morphology and life cycle of vanya silkworms.	3 Hrs.
10.	Egg production technology of vanya silkworms.	2 Hrs.
Unit-3		
11.	Rearing technology of young and late-age vanya silkworms.	3 Hrs.
12.	Pests and diseases of vanya silkworms and their management	3 Hrs.
13.	Tasar and muga cocoon reeling: Selection, cooking and reeling; eri cocoon spinning.	3 Hrs.
14.	Economics of tasar, eri and muga culture.	2 Hrs.
15.	Byproducts of vanya sericulture and their utilization.	2 Hrs.
16.	Constraints (inherent and man-made) in vanya silk production; strategies for improvement of vanya sericulture (host plants and vanya silkworms) in India.	2 Hrs.

DSC : SER-C18-P (Credits - 2)

VANYA SERICULTURE		
Practical		15 Practicals of 4 hrs each
1.	Distribution of vanya silkworms in India- Map preparation.	1 Pract.
2.	Distribution of food plants for vanya silkworms in India – Map Preparation.	1 Pract.
3.	Taxonomic and botanical description of primary food plants of vanya silkworms.	1 Pract.
4.	Establishment of food plants.	2 Pract.
5.	Diseases and pests of food plants.	2 Pract.
6.	Life cycle and morphology of vanya silkworms.	2 Pract.
7.	Preparation for vanya silkworm rearing.	1 Pract.
8.	Rearing of non mulberry silkworms.	1 Pract.
9.	Diseases and pests of vanya silkworms.	1 Pract.
10.	Reeling of tasar and muga; spinning of eri cocoons.	2 Pract.
11.	Bye-products of vanya sericulture industry.	1 Pract.
12.	Economics of vanya silkworm rearing.	1 Pract.

-

DSC : SER-C19-T (Credits – 3)

SERICULTURE ECONOMICS, MARKETING AND EXTENSION		
Theory		3 hrs/week ; 45 hrs
	Unit-1	
1.	Importance of sericulture in rural, national and world economics – nature and scope of economic theory. Special features of sericulture vis-à-vis other agricultural enterprises – income and employment generation.	3 Hrs.
2.	Production economics: meaning, nature and scope, production function, basic production relationships.	2 Hrs.
3.	Economics of mulberry leaf production under rainfed and irrigated systems with reference to popular cultivars.	2 Hrs.
4.	Economics of silkworm egg production in government and private grainages with reference to cross breed, single hybrid and double hybrid.	3 Hrs.
5.	Economics of cocoon production with reference to cross breed, single hybrid and double hybrid for seed and commercial purpose.	3 Hrs.
6.	Economics of raw silk production in charaka, cottage basin and multi-end reeling units.	3 Hrs.
	Unit-2	
7.	Theory of market, concept of demand and supply, determinants of demand and supply of silk production.	2 Hrs.
8.	Sericulture markets: Importance of cocoon markets –Types, functions and functionalities. Marketing problems of silk industry.	3 Hrs.
9.	Marketing of cocoons and by-products. Regulated cocoon market. Non-regulated cocoon market.	3 Hrs.
10.	Silk exchanges: Role and procedure involved in marketing of silk.	3 Hrs.
11.	International trade – comparative advantages of production and trade in silk in India – export and import of silk and silk products – trends in export of silk in India.	3 Hrs.
	Unit – 3	
12.	Extension education: Philosophy, characteristics, principles and functions. Teaching and learning process.	3 Hrs.
13.	Extension programme management: Concept and principles and steps in programme planning. Role of extension personnel and farmers in programme planning.	3 Hrs.
14.	Extension communication: Basic functions, models, elements and concepts. Extension teaching aids: According to use and form, factors for selection of extension teaching methods.	3 Hrs.
15.	Training: meaning, principles, methods and training programmes in sericulture. Adoption and diffusion of innovations. TOT: meaning and systems; role of extension in TOT.	3 Hrs.
16.	Sericulture extension system: Extension systems of CSB, state governments, voluntary organizations and Universities. Extension services in sericulture.	3 Hrs.

DSC : SER-C20-P (Credits – 2)

SERICULTURE ECONOMICS, MARKETING AND EXTENSION		
Practical	15 Practicals of 4 hrs each	
1.	Preparation of audio visual aids-charts.	1 Pract.
2.	Preparation of handouts, pamphlets and preparations for film shows.	1 Pract.
3.	Visit to nearby farmers field and interaction with the farmers, research institutes and TSCs.	2 Pract.
4.	Arranging and conducting panel discussion with farmers and scientists.	1 Pract.
5.	Arranging sericultural extension programme for village.	1 Pract.
6.	Marketing of cocoons – functions and procedure	1 Pract.
7.	Marketing of silk – functions and procedure	1 Pract.
8.	Visit to cocoon markets and silk exchanges. Interaction with the buyers and sellers and market officers	1 Pract.
9.	Estimation of economics for mulberry cultivation under rainfed and irrigated conditions.	1 Pract.
10.	Estimation of economics for silkworm seed production under private and government grainages.	1 Pract.
11.	Estimation of economics for silkworm rearing in shelf and shoot method of rearing with respect to cross breed, single hybrid and double hybrid silkworm breeds.	1 Pract.
12.	Estimation of economics for silk reeling under charaka, cottage basin, multi-end and filature units with respect to silk obtained from cross breed, single hybrid and double hybrid cocoons.	1 Pract.
13.	Estimation of employment generation in mulberry cultivation, silkworm seed production, silkworm rearing, silk reeling, twisting and weaving units.	2 Pract.
Note: All the visits reports shall be considered for IA		

DSE : SER-E2-T (Credits – 3) (Anyone to be chosen)

AGRICULTURE BIOTECHNOLOGY		
Theory		3 hrs/week ; 45 hrs.
Unit -1		
1	Introduction: Conventional crop improvement techniques - Introduction and acclimatization, mass, pure line and clonal selection and their limitations.	3 Hrs.
2	Biotechnology for crop improvement, future prospects of biotechnology for agriculture.	3 Hrs.
3	Biological nitrogen fixation: Nitrogen fixing microorganisms, role of nitrogenase, genetics of nitrogen fixation, Mechanism of nitrogen fixation in free living and symbiotic microorganisms, regulation of <i>nif</i> gene expression.	5 Hrs.
4	Biofertilizers and phyto-stimulants: Mechanism of growth promotion by microbial inoculants - <i>Bradyrhizobium</i> and <i>Rhizobium</i> , <i>Azospirillum</i> , <i>Azatobacter</i> , <i>Mycorhizae</i> . Mass production, methods of application.	4 Hrs.
Unit- 2		
5	Genetic engineering of crop plants: Basics of gene transfer techniques, Gene transfer techniques for desirable traits in crop plants – <i>Agrobacterium</i> mediated gene transfer.	5 Hrs.
6	Direct gene transfer to protoplasts - Biolistic gene transfer, electrophoretic gene transfer, liposome mediated gene transfer.	5 Hrs.
7	Transgenic plants obtained through gene transfer techniques- Bt-cotton, herbicide tolerant soybean, virus resistance (Papaya ringspot).	5 Hrs.
Unit-3		
8	Genome – Nuclear and cytoplasmic; Significance of organelle genomes; Genome size and sequence components.	5 Hrs.
9	Molecular markers: Definition, properties, kinds of molecular markers: – Restriction based and PCR based; RFLP: methodology and applications, RAPD & AFLP: Principles, methodology and applications, Development of SCAR and SSR markers. Other markers: CAPS, SNP, Comparison of different marker systems.	6 Hrs.
10	Modern gene concept - Gene structure, structural and functional genes.	4 Hrs.

DSE : SER-E2-T (Credits – 3) (Anyone to be chosen)

BIOSTATISTICS		
Theory		3 hrs/week ; 45 hrs.
Unit -1		
1.	Definition and scope of statistical methods in scientific studies.	3 Hrs.
2.	Descriptive statistics: Population and sample-collection of data, tabular and graphical representation of data, attribute and variable, discrete and continuous variable.	6 Hrs.
3.	Frequency distribution: Preparation of frequency table, relative and cumulative frequencies, diagrammatic representation of frequency distribution, histogram, frequency polygon, frequency curves and ogives.	6 Hrs.
Unit-2		
4.	Measures of central tendency and dispersion / scale and skewness.	5 Hrs.
5.	Linear correlation and regression - Spearman's rank correlation.	4 Hrs.
6.	Elementary idea of probability: introduction, definition, concepts of probability, classical and empirical-relative frequency of probability, addition and multiplication theories.	6 Hrs.
Unit-3		
7.	Binomial, poisson and normal distribution properties.	3 Hrs.
8.	Elementary sampling theory: sampling theory, random samples, random numbers, sampling distribution of standard errors.	4 Hrs.
9.	Tests of significance - normal students 't', chi-square and F-tests, tests of hypotheses about population mean and variance of a normal population, levels of significance.	4 Hrs.
10.	Analysis of variance: Assumption, one way classification, two way classification with equal numbers of observation per cell, multiple comparison, tests for normality and homogeneity of variances, CRD and RBD.	4 Hrs.

Vocational: SER-E2-T (Credits - 3)

SERICULTURE ENTERPRENERSHIP DEVELOPMENT		
Theory		3 hrs/week ; 45 hrs.
Unit -1		
1.	Entrepreneurship: Meaning, importance and evolution. Factors influencing entrepreneurship – Psychological, Social, Economic and Environmental factors.	3 Hrs.
2.	Characteristics of an entrepreneur and selection of a potential entrepreneur. Types of entrepreneur: According to Type of Business, Use of Technology, Motivation, Growth and Stage. Role and importance of entrepreneurs in economic growth.	4 Hrs
3.	New generations of entrepreneurship viz., social, Health, Tourism and Women. Barriers to entrepreneurship. Economic Development and entrepreneurship Concept.	4 Hrs.
4.	Entrepreneurship development programme (EDP): Emergence and objectives of EDP. Planning for EDP: Objectives, selection of a centre, purpose of pre-training promotional work.	4 Hrs.
Unit-2		
5.	Follow-up for EDP: Need, extent and mechanism; facilitating follow-up; approach to competence development. Evaluation of entrepreneurial development programmes.	4 Hrs.
6.	Project formulation: Meaning and purpose, personnel / agencies involved in project appraisal, market and technical feasibility of the project, source of finance, profitability, risk analysis and liquidity management	3 Hrs.
7.	Marketing: Approach and essence; market assessment – demand; steps involved in market study; agencies supporting sericulture projects.	4 Hrs.
8.	EDP in production of mulberry saplings (Kisan nursery). EDP in production of compost and vermicompost through sericulture byproducts.	4 Hrs.
Unit-3		
9.	EDP in organization of chawki rearing centres.	4 Hrs.
10.	EDP in silkworm egg production and silkworm rearing.	4 Hrs.
11.	EDP in silk reeling – charaka, cottage basin and multi-end reeling units.	4 Hrs.
12.	EDP in mass production of parasitoids and predators.	3 Hrs.