ANDHRA PRADESH

RECRUITMENT OF ASSISTANT PROFESSORS IN THE UNIVERSITY SYLLABUS FOR THE SCREENING TEST

SERICULTURE

SUBJECT CODE – 59

Unit - I

MULBERRY PRODUCTION TECHNOLGY

Principles and practices of plant propagation techniques with special reference to mulberry

Seedlings: Collection of seeds, growing seedlings in field nurseries Techniques of propagation by cuttings and saplings their merits and demerits.

Grafting: Selection of stock and scion materials. Stem root and bud grafting techniques. Ground, air and Trench layering methods.

Preparation of nursery bed. Layout, size, composition, maintenance and care. Mulberry cultivation practices (Under irrigated and dry land conditions)

Selection and preparation of land, implements and machinery employed in mulberry cultivation. Selection of elite varieties for cultivation.

Planting materials (cuttings, saplings, grafts, layers) and their practical utility.

Planting systems: Row system, pit system and paired row system, leaf yield estimation and their importance in leaf productivity under different field conditions.

Inter-cultivation, weeds and weeding. Its types, objectives, methods and periodicity.

Organic manure (FYM, compost, tank silt, night-soil, sewage sludge, oil cakes, vermicompost,)

Green manure, Biofertilizers, Chemical fertilizers – Types, application methods and schedules for irrigated and rainfed mulberry gardens.

Irrigation: Water requirement of mulberry, water resources, water quality, irrigation systems.

Pruning types, objectives, methods, advantages and practical relevance.

Leaf harvesting methods in relation to cultivation and rearing practices. Storage, transportation andpreservation methods.

Mulching, Intercropping and their uses.

Foliar nutrition, formulations – Mode of application merits and demerits.

Package of practices of mulberry cultivation under rain-fed and irrigated conditions. Watershed area concept and water management practices in dry land and mulberry cultivation. Influence of gro-climatic factors on growth and development of mulberry.

Edaphic factors: Soils formation- weathering, types of weathering, factors influencing the weathering. types, profile,structure, topography, porosity, aeration, soil water, organic matter, soil micro-organisms.

Soil chemical characters, Soil reaction, Salinity, acidity and alkalinity. Soil amendments, soil and waterconservation.Soils of mulberry.

Climatic factors:

Role of light, temperature, wind velocity, attitude, rainfall and relative humidity in mulberry growth anddevelopment.

Mineral deficiency, diagnostic techniques, correction measures and mineral toxicity.

Unit – II

SILKWORM BIOLOGY, PHYSIOLOGY AND ENDOCRINOLOGY THEORY

1. Origin and distribution of silkworm
2. Taxonomic classification of silkworm and Kinds of silkworms
3. Moultinism and voltinism of silkworm- temperature, Photoperiod and humidity
4. Morphology of Silkworm larva, pupa, moth and metamorphosis.

1. Body wall and its derivatives- structure and function of integument- Larval integument- Pupal and Adult
2. Structure and Physiology of

a. Digestive system – Larval digestive system, Digestive organs of adult, Food ingestion and digestion and Feces and fecal elimination

b. Respiratory system- Micro structure of trachea, Mechanism of the respiration- gaseous diffusion, Tracheal ventilation, Excretory system, Circulatory system, Silkgland,

Muscular system and Reproductive system

c. Artificial diets for the silkworm

DEVELOPMENTAL PHYSIOLOGY OF SILKWORM

1. Growth and development of silkworm
2. Physiology and biochemistry of moulting and metamorphosis
3. Physiology and biochemistry of diapauses
4. Hormone regulation of growth and development

APPLICATION OF INSECT HORMONES IN SERICULTURE

1. Application of juvenile hormone in sericulture
2. Application of moulting hormone in sericulture

Unit - III

DISEASES OF SILKWORM AND THEIR CONTROL

1. Viral diseases: Nuclear polyhedrosis, Cytoplasmic polyhedrosis, Infectious flacherie and Densonucleosis

2. Bacterial diseases: Septecemia, Bacterial disease of digestive tract and Sotto(Bacterial Taxicosis)

3. Fungal diseases: Muscarding and Aspergillosis

4. Protozoan disease: Pebrine

PESTS OF SILKWORM AND THEIR CONTROL

1. Major pest: Uzi fly

2. Minor pests: Dermestid beetles and other pests of silkworm

3. Forms and formulations and applications of pesticides.

4. Integrated Disease and Pest Management (IDPM) in Silkworm.

Unit - IV

BIOLOGY OF MULBERRY

TAXONAMY AND ANOTOMY

Distribution, morphology and taxonomic status of the genus Morus.

Popular mulberry cultivars of tropical and temperate regions and their yield potentiality. Anatomy of mulberry leaf, stem and root

PHYSIOLOGY

Photosynthesis, photosynthetic pigments their characteristic, carbon fixation mechanism (C3, C4 andCAM) photorespiration and productivity.

Evapo-transpiration, stomatal frequency and dynamics, anti-transparents. Water stress and its effect on growth and development of mulberry:

(a) Biochemical and physiological adaptations, drought resistance

(b) Response of mulberry to salt stress and water logging

(c) Symptoms of water logging injury in plants, physiological and biochemical response of plants to water logging. Photoperiodism, Mulberry growth regulators, flowering and fruit development, senescence and abscission. Biological nitrogen fixation: Symbiotic and A symbiotic biological nitrogen fixation mechanism.

Unit - V

PATHOLOGY OF MULBERRY AND SILKWORM THEORYDISEASES OF MULBERRY AND THEIR CONTROL

1. Fungal diseases: Leaf spot, Powdery mildew, Rust disease, Root rot, and Twig blight
2. Bacterial disease: Bacterial blight
3. Mycoplasma diseases: Dwarf diseases
4. Viral diseases: Mosaic diseases
5. Nematode diseases: Root knot disease
6. Deficiency diseases: Mineral deficiency and its control.

PESTS OF MULBERRY AND THEIR CONTROL

1. Lepidoptera: Behar hairy caterpillar, Cutworm, Moringa hairy caterpillar, Tussock hairy caterpillar, Leaf –roller

2. Hemiptera: Mulberry mealy bug, Jassid, Scale insects,
3. Coleoptera: Stem girdler beetle and Stem borer
4. Orthoptera: Grass hopper
5. Thysanoptera: Thrips
6. Isoptera: Termites
7. Acarina: Mites

Unit - VI

COCOON PRODUCTION TECHNOLOGY

Different races in mulberry silkworm-classification based on voltinism, moultinism and geographic origin. Popular silkworm breeds and hybrids for commercial rearing, their adaptability, productivity etc.

Silkworm rearing technology: prerequisite planning for rearing and programme of mulberry leaf production. Importance of Types of rearing, seed crop rearing and commercial rearing, pre-requisites for rearing. Rearing house, model rearing house, construction of different types of rearing houses, modification to control Uzi fly infestation, sanitation, disinfectants and their effects, and their role in disease management, importance of disinfection-physical, chemical, and gaseous types-formalin requirements for effective disinfection. Rearing equipment for shelf rearing and shoot rearing methods. Methods and importance of incubation, black boxing techniques, brushing of silkworm.

Mulberry leaf quality: Various factors affecting leaf quality (tender, medium and coarse leaves) nutritional requirements, harvesting and transportation- preservation of mulberry leaf, chopping of mulberry leaves, requirements at different instars-artificial diet, their advantage and limitation role of hormones and the chemicals on rearing performance. Environmental factors for rearing, measurements, and regulation of environmental factors such as photoperiods, temperature, and humidity. Effect of temperature and humidity on young and late age silkworm-control of temperature and humidity, controlling devices, effect of air and light on rearing.

Young age silkworm rearing: Characteristics of young age larvae (chawki), different methods

adopted including isolation chamber method, co-operative chawki rearing, and importance of chawki rearing centers. Method adopted in Sericulturally advanced countries.

Late age silkworm rearing: Characteristics-different methods (shoot and tray rearing), their merits, and demerits-importance in sericulture economics.

Cleaning and Spacing: Objectives and methods of cleaning. Time and frequency of cleaning for different instars, objectives of spacing, optimum spacing for different ages, molting, care during molting.

Unit - VII

Recent/Modern concepts in chawki and late age silkworm rearing (Isolation chamber, single feeding shoot, and floor rearing), merits and demerits. Improved techniques of rearing over traditional practices.

Spinning: Characteristics of spinning larvae, mechanism of silk formation, cocoon formation, mounting- different methods-merits and limitations, care during mounting, environmental conditions during spinning. Harvesting of Cocoons: Time of harvesting of Cocoons, defective cocoons- double, flimsy, deformed, stained and melted cocoons-characteristics and their impact on cocoon quality, remedial measures to avoid defective cocoons. cocoon assessment-transportation and marketing of cocoons-leaf cocoon ratio. Rearing technology for non-mulberry silkworms Tasar, Oak tasar Muga, Eri and silkworm varietiesties.

SEED TECHNOLOGY

1. Management of Basic seed Farms **(P3)**
2. Seed multiplication farms **(P2)**.
3. Parent seed cocoon production **(P1)**

MANAGEMENT OF GRAINAGE

1. Location of the Grainage, capacity of a Grainage, Grainage building, Grainage Equipment .
2. Programme of Production

3. P1 Seed Cocoon Production and supply
4. Synchronization of moths
5. Transportation of Seed Cocoons
6. Staff of the Grainage, Day duty batch, Night duty batch and Moth examination batch
7. Transportation of Silkworm eggs
8. Cordial relation with Farmers.

PROCESS OF EGG PRODUCTION

1. Disinfection of Grainage equipment and building
2. Hybrid Disease Free Layings
3. P1 Seed Cocoons**:** Cocoon arrangements, Sorting of Cocoons, Arrangement of Cocoons, Sex separation, Emergence of moths, Pairing, Fertilization, Moth Examination, Sample testing, Individual and Mass moth examination, Washing of Eggs, Preparation of Sheet eggs and looseeggs and disposal of Dfls.

PRESERVATION AND HANDLING OF EGGS

1. Embryology and hibernation of Silkworm eggs
2. Preservation of multivoltine eggs.
3. Preservation of Bivoltine eggs.
4. Acid treatment of Bivoltine eggs
5. Hot acid and Room temperature acid treatment of silkworm eggs
6. Acid treatment after a long duration of chilling – Chilling for a shorter duration and acidtreatment and cold storage of Acid treated eggs.

Unit - VIII

MOLECULAR BIOLOGY AND IMMUNOLOGY

Introduction to nucleic acids – Chemistry and Physics of DNA and RNA – Watson and Crick model of DNA. Structure of RNA - Different types of RNA – tRNA, mRNA and rRNA – DNA organization in chromosomes.

Mechanism of DNA replication – semiconservative synthesis of DNA – DNA replication in prokaryotesand eukaryotes – DNA polymerase – Inhibitors of DNA synthesis.

Transcription: Biosynthesis of RNA and DNA – RNA Polymerase – Initiation, elongation and termination of transcription – RNA.

Translation: Factors and enzymes involved in protein synthesis – initiation, elongation and termination of translation. Wobble hypothesis – a special note on amino acylation of t-RNA – inhibitors of protein synthesis.

Types of immunity: Passive, active and acquired immunological action.

Classes and structure of antibodies – Functions of antibodies and generation of antibody diversity – antigen-antibody reaction – blood group antigens – monoclonal antibodies.

Cellular basis of immunity – Immune system – Primary and secondary response – T & B lymphocyte antigen processing and presentation – Immunoglobulin gene

Unit - IX

POST-COCOON TECHNOLOGY

Textile Fibres : Brief introduction to natural and man-made fibres – Cotton – Wool – Silk and Nylons –Polyester – Acrylic.

Physical and chemical properties of silk.

Identification of textile fibres – Burning, microscopic and solubility tests.

Cocoon properties – assessment – Cocoon testing – methods followed in Japan and its practicability toIndian conditions – Cocoon shape, colour, wrinkles or grain

Defective cocoons – Types defective cocoons and percentage.

Commercial characters: Assessment of Cocoon by Size, Filament length – Filament denier, average Denier– Estimated Renditta Shell ratio its percentage and Raw Silk percentage.

Cocoon stifling /drying – Objectives – different methods – Suitable stifling methods according to

cocoonvarieties and reeling devices. Merits and demerits of each method.

Cocoon storage and preservation of cocoons in silk reeling units – Factors to be considered for ideal storage – Faulty storage – Fungus and insect attack.

Cocoon boiling / cooking – objectives – different methods – open pan, three pan, pressurized cocoon boiling systems – Floating and sunken systems – Merits and Demerits of each method – Appropriate cocoon cooking systems to be followed according to cocoon variety and reeling devices.

Silk reeling: System of reeling – Direct and indirect type – Floating and sunken type.
Reeling method on country Charkha – Improved Charkha – Cottage basin – Multiend and automaticreeling machines.
Passage of thread in various reeling machines.

Functions in reeling machines components – Reeling basin – Jettebout – Porcelain button – Croissure –Chambon and tavellette type – Guide pulleys – Tension pulley Traverse mechanisms – Reel or swift – Reel stop motion – Denier control device Production Calculations.

Non- mulberry silk reeling – Tasar – Muga and Eri Reeling appliances. Cooking methods – Reeling process for non-mulberry cocoons.

Re-reeling – Objectives – Standard sized hank – Grant reeling – Lacing – Skeining – Book making –Standard weight of skein, Book, Bale.

SERICULTURE ORGANIZATION EXTENSION AND ECONOMICS

Present Status of Sericulture in the world: India's position: Distribution of Sericulture in India. Organizational setup in Sericulture. Central Silk Board and its role in promoting Sericulture. Role of State

VANYA SERICULTURE

1. Insect and non-insect fauna producing silk and their distribution in world and India.
2. Status of vanya silks in India – characteristic features, advantages, income and employment,production and demand.
3. Host plants of vanya silkworms: Sate-wise distribution in India, area and economic importance.
4. Botanical description of primary host plants of vanya silkworms.
5. Establishment of primary host plants of vanya silkworms and package of practices for their cultivation.
6. Pests and diseases of primary host plants of vanya silkworms and their management.
7. Planning for vanya silkworm egg production and rearing; grainage and rearing equipments.
8. Disinfection and hygiene practices in grainages and silkworm rearing houses / premises.

1. Breeding, eco-races / races, morphology and life cycle of vanya silkworms.
2. Egg production technology of vanya silkworms.
3. Rearing technology of young and late-age vanya silkworms.
4. Pests and diseases of vanya silkworms and their management

1. Tasar and muga cocoon reeling: Selection, cooking and reeling; eri cocoon spinning.
2. Economics of tasar, eri and mugaculture.
3. Byproducts of vanya sericulture and their utilization.
4. Constraints (inherent and man-made) in vanya silk production; strategies for improvement ofvanya sericulture (host plants and vanya silkworms) in India.

Unit - IX

MULBERRY GENETICS AND BREEDING

Chromosome number karyotypes meiotic behavior in Morus species/varieties -Brief account of micro andmega sprogenesis - development of male and female gametophytes - pollen structure – pollination – fertilization – endosperm – embryo – polyembryony - parthenocarpy with reference to mulberry.

General introduction to plant breeding: History - scope and objectives - Method of evaluation of mulberry genotypes - Agro-botanical parameters (Sprouting, rooting survivability, yield) - Chemoassay and Bioassay.
Stress parameters: Plant exploration - collection and establishment of mulberry germplasm bank - Field maintenance - Significance of mulberry germplasm conservations - Mulberry germplasm systems.

Plant introduction and acclimatization – Scope, objectives and limitations – Plant quarantine – Plant introduction agencies - National and International agencies.

Selection: Mass Selection - pure-line selection and clonal selection – definition - methods procedures followed - Applications and significance in mulberry breeding – Achievements made.
Hybridization: History – definition - objectives and application - Hybridization strategies in mulberry breeding (single cross - double cross - back cross - three-way cross - reciprocal cross) - advantages and constraints - Bulk and pedigree methods of segregating population - Heterosis and crop improvement.

Polyploidy: Definition – types - induction on polyploidy - Polyploidy in mulberry species/varieties - Characters associated with polyploids - Significance of polyploidy in evolving popular mulberry varieties.
Mutation breeding: Definition – types - Artificial induction of mutations – Mutagens -Mulberry mutants -Role of physical and chemical mutants in inducing beneficial mulberry genotypes.

Breeding for drought resistance: Definition - Mechanism of drought escape - Tolerance - endurance andresistance - Characteristic features of drought resistance in crop plants - Methods of breeding for drought resistance.

Breeding for disease resistance: Definition – scope - and limitations - Nature and causes of disease resistance - Methods of breeding for disease resistance in mulberry.
Distribution morphology and cultivation strategies of non-mulberry silkworm food plants. (Tropical temperate Tasar - Muga and Eri food plants).

Unit - X

BIOTECHNOLOGY

Scope – Importance – Different branches of Biotechnology.

GENETIC ENGINEERING: Molecular vectors – Cloning – shuttle – expression - binary vectors – plasmids – virus - Enzymes – Restriction endonucleases - types and utility in gene cloning and mapping.

MOLECULAR CLONNING TECHNIQUES

cDNA synthesis - Joining of DNA fragments to vectors - Introducing of recombinant molecules into selected host cells (transformation) - Screening techniques – Western – Northern - Southern Blotting

- Genomic and c DNA Libraries.

RECOMBINANT DNA TECHNOLOGY

Polymer chain reaction technology - PCR techniques in biotechnology and genetic engineering -Gene tagging and DNA finger printing.

RESTRICTION ENZYMES ANALYSIS – RFLP and RAPD profiles for identification of DNA geneticmaterial.

IMMUNITY – Mechanism of antigen – antibody reactions – defense mechanisms.

Cell mediated immunity in silkworms – phagocytosis - Anti bacterial – anti viral factors and inducedresistance.

SEROLOGICAL TECHNIQUES – Principles and application of serological tests used in identification of Pathogenic agents - Precipitation tests – Ring test – Single and double diffusion test – Agglutination tests – Immuno fluorescence test - Enzyme linked Immunosorbent Assay (ELISA) – Western blotting method - Bio-insecticides – Engineered Baculaviruses – Molecular tools of lepidopteron development biology and physiology - Potential agents for insect control - bacillus thurengiensis gene.

BIOFERTILIZERS – Nitrogen fixation and Mass production of bio fertilizers - diazotrophic microorganisms blue green algae and Azolla - Micorhizae.

TISSUE CULTURE – Tissue culture techniques in mulberry anther/ pollen culture - callus culture -somoclonal variants – somatic - hybrid in *vitro* screening - cryopreservation.

Unit - XI

SILK FIBRE TECHNOLOGY

Raw silk testing and Grading: - Visual and mechanical tests – Winding test – Size test Tenacity and elongation test – Evenness – Cleanness – Neatness tests – Cohesion test – Condition weight test- Testing and grading on the basis of BIS and ISI Standards.

Spun silk yarn technology: Difference between reeling and spinning – Types of silk wastes– Cocoon waste – reeling waste – Cookers waste – Reeler's waste – Basin Thrower's waste – Various processes involved in spun silk processing – Degumming – Combing – Drawing and Drafting – Rowing –Spinning- Doubling – Twisting – Gassing – Re-reeling.

Utilization of pupae – Oil extraction – Protein extraction

Silk exchange – Functions – Factors influencing price of raw silk stabilization – Role of governmentagencies in price stabilization.

Reeling water: Consumption of water in silk industry water quality – Suitable water for cocoon cooking and reeling – Influence of water quality on raw silk - Treatment of water for reeling purpose.

Silk weaving: Silk Throwing / Preparatory processes – Winding – Doubling – Twisting – Rewinding - Warping – Pirn winding – Weaving – Handloom weaving - Types of power looms - Fabric defects - Silk knitting.

Wet processing: Degumming – Bleaching – Dyeing – Eco-friendly dyes - Printing – Hand blockprinting- screen printing – Fabric finishing

Principles of silk industry: Basic principles – Uses in silk industry - Silk care- stain and its removal- Tips on handling and storage of silk cloths – zari - Textile designing – computer aided textile designing (CATD).

Unit - XII

SILK TECHNOLOGY AND ENTREPRENEURSHIP DEVELOPMENT

Physical and commercial characteristics of multivoltine and bivoltine cocoons: Cocoon markets – organization and functions - cocoon sorting – objectives and procedure - defective cocoons.

Cocoon stifling: Objectives and methods – sun drying, steam stifling, hot air drying, - advantages and disadvantages - Preservation of cocoons.

Cocoon cooking: Objectives and methods - open pan - three-pan – pressurized - floating and sunken systems - merits and demerits.

Reeling water: Sources and quality, importance in cocoon cooking and raw silk quality; factors influencing water quality; corrective measures.

Silk reeling: Evolution of silk reeling. Reeling units – charaka - cottage basin - multi-end and automatic reeling devices - Comparative account on the performance of different reeling units - components and their functions in silk reeling devices.

Re-reeling and packing: Objectives - grant reeling - hank preparation – lacing – skeining – booking - bale making and bundling.

Raw silk properties – physical - chemical and microscopic - Factors influencing the properties of rawsilk - Silk exchanges – structure and function.

Raw silk testing and grading – objectives: Raw silk testing – conditioned weight - visual and mechanical tests - Raw silk grading - international standards (ISA) and Bureau of Indian Standards (BIS).

Degumming - bleaching and silk dyeing – objectives and methods.

Silk throwing: silk weaving - hand and power loom; fabric examination.Byproducts of silk reeling industry and their utilization.

Entrepreneurship development programme (EDP): Emergence and objectives of EDP - essentialqualities to become an entrepreneur - selection of a potential entrepreneur.

Planning for EDP: Objectives, selection of a centre, purpose of pre-training promotional work. EDP in raising mulberry saplings (Kisan nursery) and vermicomposting.

EDP in organization of chawki rearing centres.EDP in silkworm egg production and rearing.

EDP in silk reeling – charaka, cottage basin and multi-end reeling units.EDP in mass production of parasitoids and predators.