



UNIVERSITY OF CALCUTTA

Notification No. CSR/72/2024

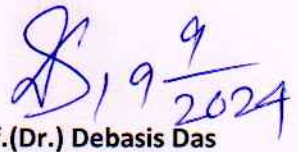
It is notified for information of all concerned that in terms of the provisions of Section 54 of the Calcutta University Act, 1979, (as amended), and, in the exercise of her powers under 9(6) of the said Act, the Vice-Chancellor has, by an order dated 11.09.2024 approved the syllabus of Sericulture (SRTV)-Core- Vocational under CCF, under this University, as laid down in the accompanying pamphlet.

The above shall take effect for Sericulture (SRTV) – Core Vocational courses of studies under CCF, which was introduced from the academic Session 2023-2024.

SENATE HOUSE

Kolkata-700073

19.09.2024


Prof.(Dr.) Debasis Das

Registrar

PART II; SEM III

CC 3	SERICULTURE CROP IMPROVEMENT	75	25
CC 4	SILK PRODUCT SCIENCE	75	25
SEC-3	APPLIED AND ECONOMIC ZOOLOGY	100	
IDC	Anyone to be selected from other Subjects [Except Major and Minor Subject] as provided by the College	50	25

CC 3.TH	SERICULTURE CROP IMPROVEMENT	50 HOURS
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Unit 1: Botany and Cytology of Host Plants of Silkworms 12 Hours

Taxonomy and systematics of mulberry and non mulberry silkworm host plants, botanical description of mulberry and primary host plants of tasar, eri and muga silkworms viz., mulberry, terminalia, quarcus, Som and Soalu and castor, tapioca and kessaru. Floral biology of host plants of silkworms viz., mulberry, terminalia, quarcus, Som, Soalu, castor, tapioca and kessaru. Mitosis and karyomorphological studies in host plants of silkworms. Micro and megasporogenesis and fertilization in mulberry. Fruit seed development and parthenocarpy in mulberry.

Unit 2 : Genetics and Breeding of Host Plants of Silkworms 12 Hours

Germplasm sources, geographical distribution and exploration. Centre involved in crop improvement program of host plants of silkworms. Conservation and role of germplasm in crop improvement. Inheritance of economic characters (quantitative and qualitative characters). Objectives and pre-requisites of breeding. Methods of breeding, viz., introduction and acclimatization, methods of selection in mulberry. Hybridization, heterosis breeding, breeding methods for self and cross pollinated crops, backcross, population improvement, mutation breeding, polyploid breeding.

Unit 3 : Cytology and Genetics of Silkworms 12 Hours

Concepts and principles of genetics. Cell division, Oogenesis, spermatogenesis and fertilization. Structure and chemical composition of chromosome and nucleic acids. Genotype and phenotype, qualitative and quantitative traits. Laws of inheritance. Crossing over, categories of crossing over, mechanism of crossing over. Chromosomal maps, pleiotropy, penetrance and expressivity. Concept of Linkage. Genetic basis for hormonal control. Genetics of cocoon colour. Sex determination in mulberry silkworm.

Unit 4 : Silkworm Breeding

14 Hours

History of silkworm breeding in Japan, China and India, Principles and objectives of silkworm breeding. Establishing / activities of silkworm breeding programme. Maintenance of silkworm germplasm bank. Maintenance of breeds / stocks, 3- tier multiplication of parental stock with silk yield attributes. Genetic basis for silkworm breeding programme. Hybridization-objectives, types, Hybridization procedure, problems in hybridization like inbreeding depression, lethal genes, etc. Heterosis, genetic basis for heterosis, manifestation of heterosis, commercial exploitation of heterosis. Heterosis in different crossing systems. Silkworm improvement through mass selection, pure line selection, bulk method, back cross method and line breeding. Parthenogenesis – definition, history, natural and artificial parthenogenesis, methods of induction of parthenogenesis. Mutation Breeding –historical account, types of mutations. Mutagens- classification of mutagens, effect of mutagens, mechanism of action of mutagens. Procedure for mutation breeding. Applications, limitation and achievements of mutation breeding. Chromosomal aberrations. Poly-Ploidy breeding – heteroploidy, auto-polyploidy, significance of polyploids. Concepts of breeding auto-sexing silkworm breeds (*B. mori*). Authorization of silkworm breeds and their hybrids. Breeding of non-mulberry silkworms.

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 3 short notes)

- Students will write 3 short notes (each of 5 marks) out of 5 short notes.

3 x 5 = 15 marks

Section C (Broad question, 4 questions)

Students will write four questions (each of 10 marks) out of seven questions.

10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

1. Botanical description of mulberry, terminalia, quarcus, Som and Soalu and castor, tapioca and kessuru. Anatomy of root, stem, leaf, fruit and seed in mulberry. Micro and megasporogenesis and fertilization in mulberry, squashing and smearing techniques in mulberry. Karyo-morphology and idiogram in some host plants of silkworms. **5 hours**
2. Procedure for mass and pedigree selection, techniques of hybridization, appliances necessary for breeding. Procedure for collection of pollen and artificial pollination in mulberry, details of recording data, Procedure for induction of polyploidy in mulberry-treatment with colchicine, techniques of induction of mutation. **5 hours**
3. Procedure for mass and pedigree selection, techniques of hybridization, appliances necessary for breeding. Procedure for collection of pollen and artificial pollination in mulberry, details of recording data, Procedure for induction of polyploidy in mulberry-treatment with colchicine, techniques of induction of mutation. **5 hours**
4. Study of breed characteristics of *Bombyx mori*, *Antheraea* sp., and *Samia cynthia ricini*. Procedure and maintenance of silkworm germplasm bank. Procedure for hybridization in silkworms, Procedure for selection pedigree and mass method. Assessment of variability (ANOVA). Genetic analysis of qualitative and quantitative traits. Estimation of heterosis. Diallel (partial and complete) and three way cross analysis. Analysis of double cross hybrids. Line X Tester analysis. Path analysis. Induction of mutation in silkworms. Measurement of mutation frequency. Induction of polyploidy in silkworms. Breeding procedure for non-mulberry silkworms. Visit to germplasm bank and silkworm breeding stations. Study of performance of silkworm hybrids. **5 hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Determination of BPV and MPV.
2. Comparative assessment of the hybrids and pure race cocoon
3. Silkworm germplasm and multi-locational trials (field visit)
4. Any one Quantitative trait calculation on fecundity/ ERR by no. / ERR by weight/Defective cocoon and floss%
5. calculation on heterosis/Inbreeding depression calculation.
6. Chi-square test.
7. Identification of different races of silkworm, specimen A, B, C, D and E
8. Laboratory Note Book
9. Internal Assessment

One external and one internal examiners will conduct the examination

REFERANCES

1. GOLDSMITH, M AND WILKINSON, A.S. (1996) MOLECULAR MODEL SYSTEM IN LEPIDOPTERANS. CAMBRIDGE PRESS, LONDON.
2. HIRATSUKA. (1999) SILKWORM BREEDING OXFORD & IBH PUBLISHING CO, PVT. LTD. NEW DELHI. CALCUTTA.
3. MOROHOSHI, S (2000) DEVELOPMENT, AND PHYSIOLOGY OF SILKWORM. OXFORD & IBH PUBLISHING CO, PVT. LTD., NEW DELHI.
4. SREERAMREDDY (ED), G. (1998). SILKWORM BREEDING. IBM PUBLISHERS, NEW DELHI.
5. STRICKBERGER, M.W. (1996). GENETICS. PRENTICE-HALL OF INDIA, NEW DELHI
- BASAVARAJA, H.K., ASWATH, S.K., SURESH KUMAR, N., MAL REDDY, N. AND KALPANA, G.V. (2005) SILKWORM BREEDING AND GENETICS. CENTRAL SILK BOARD, BANGALORE.
- DILIP DE SARKAR (1998) THE SILKWORM – BIOLOGY, GENETICS AND BREEDING. VIKAS PUBLISHING HOUSE PVT. LTD., NEW DELHI.
- NATARAJU, B., SATHYAPRASAD, K., MANJUNATH, D. AND ASWANI KUMAR, C. (2005) SILKWORM CROP PROTECTION. CENTRAL SILK BOARD, BANGALORE
- TAZIMA, Y. (1964) GENETICS OF SILKWORM. ACADEMIC PRESS, LONDON.
- ATHER H. SIDDIQI (1982) EXPERIMENTAL PHYSIOLOGY. OXFORD & IBH PUBLISHING CO. PVT. LTD., NEW DELHI AND CALCUTTA.
- EIKICHI HIRATSUKA (2000) SILKWORM BREEDING. OXFORD & IBH PUBLICATIONS, NEW DELHI.
- ELCIO P. GUIMARAES, JOHN RUANE, BEATE D. SCHERF, ANDREA SONNINO AND JAMES D. DARGIE (2007) MARKER-ASSISTED SELECTION, FAO, ROME
- WIGGLESWORTH, V.B. (1956) INSECT PHYSIOLOGY. 5TH EDN. REV. METHUEN, LONDON.
- AMITABHA SARKAR (2009). MULBERRY BREEDING.

KALYANI PUBLISHERS • B.D. SINGH (2015). PLANT BREEDING PRINCIPLES & METHODS. • N. NADARAJAN & LT. M. GUNASEKARAN (2012). QUANTITATIVE GENETICS AND BIOMETRICAL TECHNIQUES IN PLANT BREEDING. • PHUNDAN SINGH (2015) ESSENTIALS OF PLANT BREEDING. KALYANI PUBLISHERS; 5TH EDITION • PHUNDAN SINGH (2013). PRACTICAL AND NUMERICAL PROBLEMS IN PLANT BREEDING. • ROBERT W. ALLARD (2010). PRINCIPLES OF PLANT BREEDING. • S. ROY CHOWDHURI, B.B. BINDROO S.P. CHAKRABORTI (2013). A TEXTBOOK ON MULBERRY BREEDING AND GENETICS. KALYANI PUBLISHER

CC 4.TH

TECHNOLOGY OF SILK PRODUCTION

50 HOURS

Unit 1 : Physics and Chemistry of Fiber

16 Hours

History and classification of fibers and yarns, Synthetic and natural fibers-linen, cotton, wool and silk. Physical properties of fibers –tenacity, elongation, cohesion, heat resistance, electrical properties, flamability, ageing resistance, abrasion resistance, density and specific gravity, physical structure, length, width of fibers. Polymer chemistry – macromolecules - cellulose, sericin, fibroin, synthetic fibers. Cellulose based and petrochemical based fibers. Chemical properties of fibers - reaction with acids, alkalies, metallic salts, dyes, halogens etc. Mineral fiber : asbestos. Application of physical and chemical properties for inducing special effects in fabrics.

Unit 2 : Mulberry Raw Silk Technology

18 Hours

Introduction- world raw silk production and present silk production in India, Cocoon formation, Physical characteristics of mulberry cocoon- colour, shape, wrinkles etc. Cocoon markets-its functions, method of transaction, method of fixing the cocoon price, Transportation of cocoons-care and handling, Cocoon testing and grading, Cocoon sorting-manual and mechanical method Different types of defective cocoons, Mulberry silk reeling process-steps involved in silk reeling, Cocoon stifling and methods, storage of stifled cocoons-sun drying, steam stifling, hot air drying, Cocoon cooking and its systems, - open pan, two pan, three pan, pressurized cooking method/circular cocoon boiling machine, mechanical cooking, brushing methods, Evolution of reeling machines. General principles in reeling, different reeling machines-charakha, improved charakha, cottage basin/domestic basin, multi-end reeling machine, semi automatic and automatic

reeling machine. Re-reeling and lacing, Silk examination, skeining, book and bale making, Storage and selling raw silk, silk exchange.

Unit 3 : Non mulberry Raw Silk Technology

16 Hours

Physical properties of Tasar, Muga, eri cocoon, Tasar cocoon reeling- stifling, cooking, reeling machines, Muga cocoon reeling- stifling, cooking, reeling machines, Eri cocoon cooking, spinning methods, Filature water engineering. Marketing of silk, silk exchanges and price stabilization of silk. Objectives and advantages of raw silk testing and grading. Qualities of silk, major and minor characters of quality silk, silk testing and conditioning houses, BIS and ISA specifications of testing and grading of silk, condition test, winding test, size test, strength test, evenness, cleanness and neatness tests, cohesion test, standard tables for grading of silk.

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 3 short notes)

- Students will write 3 short notes (each of 5 marks) out of 5 short notes.

3 x 5 = 15 marks

Section C (Broad question, 4 questions)

Students will write four questions (each of 10 marks) out of seven questions.

10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

1. Physical and commercial properties of cocoons. Physical and chemical properties of silk-, effect of heat, electricity, radiation, x-ray etc.. Sorting of cocoons-defective cocoons, storage of cocoons, different systems of cocoon cooking, brushing, reeling of cocoons, study of parts of reeling machines, re-reeling of silk, silk examination and package. Crossbreed / Bivoltine silk reeling. Equipments and facilities required for silk testing. Visit to filature, Automatic reeling machine. **5 Hours**

2. Spun Silk – Characters. Manufacturing of Spun silk. Systems of spun silk processing, silk wastes, pierced cocoons and Eri cocoons as raw material for spinning industry. Flow chart of spinning, spinning operations, procurement and storing of silk waste. Degumming, opening, Dressing, Drawing, Roving, Spinning, Gasing. Re-reeling and packaging of Spun silk. Hand spinning of cocoon wastes, Katia, Matka, Geecha silk. Equipments used in cottage spinning units - Takli, Natwa, Medleri charka, amber charaka, Das, Trivedi and Chowdary spinning wheels. Motorized cum pedal operated spinning wheel. Study of different types of silk wastes, different types of spun silks- Katia, Matka, Geecha, Noil, Machine spun silk, Machines used in spun silk industry. Study of different silk wastes. Raw silk waste, opened waste, combed / Dressed waste, sliver, Rovings. Processing of silk waste / Eri cocoons / pierced cocoons. Visit to Silk testing and grading units / spun silk industry. **5 Hours**

3. Silk throwing-winding, doubling, twisting-types of twisting. Steam setting of twisted yarn. Warping and yarn winding. Degumming of silk; Methods of degumming, water quality for wet processing. Bleaching and dyeing, classification of dyes, factors influencing dyeing, preparation of dye and methods of dyeing. Printing and methods of printing –block and screen printing. Weaving-loom and its structure, different types of looms, arrangement of yarn for simple weaving and design weaving. Textile Designing, Motifs for weaving and textile printing, silk / fabric finishing, silk knitting. Disposal of effluents. Study of different dyes, preparation of dyes, bleaching and dyeing of silk. Soap and soda method and enzymatic method, Visit to cottage-weaving sectors. Study of different types of looms and their characteristics. **5 Hours**

4. Study of different types of yarns and fabrics and their classifications. Designs in fabrics, various blended fabrics. Caring of fabric, value addition in fabrics, Knitting, embroidery, embossing, dyeing, printing, self designing. Designing, Blending, Chiffon, Satin, Creping, Mercerisation. Induction of tentering, Special effects in fabric by different levels of twisting, combination of twisted yarns, blending of silk with other yarns. Designing of silk fabrics. Weaving- plain designs, zari designs. Loading/ weightening of silk/fabric. Silk in upholstery and interior decorations. Zari making from silk. Silk fabrics – traditional kacheevaram, dharmavaram, arni, illakal, molkalmur, pochampalli, venkatagiri, banarasi, rajasthani, paithani etc. apparels from various silks, Caring of silk fabrics. Fashion design from silk-tie, blouse, cap, vanity bags etc. **5 Hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Identification of textile fibers by physical and chemical tests: tests- microscopic examination, flame test and solubility test for silk, cotton, wool and synthetic fiber (nylon/polyester/)
2. Determination of average filament length, non-breakable filament length and filament denier/ Determination of silk ratio percentage
3. estimation of Rendita/ Determination of average size, Size deviation and maximum deviation of the given sample of silk.
4. Determination of good cocoon and defective cocoon percentage and SR% from good cocoon lot.
5. Identification of specimen A, B, C, D and E.
6. Laboratory Note Book
7. Internal Assessment

One external and one internal examiners will conduct the examination

REFERANCES

1. ANON. 1972 MANUAL ON SERICULTURE, VOL.3 SILK REELING FAO,

AGRICULTURE SERVICE BULLETIN NO. 72/3. 2. BYONG HO KIM. 1989. FILATURE WATER ENGINEERING, SEOUL NATIONAL UNIVERSITY PRESS, REPUBLIC OF KOREA. 3. HUANG GUO RUI. 1988. SILK REELING, OXFORD AND IBH PUBLISHING CO. PVT. NEW DELHI. 4. MAHADEVAPPA, D., HALLIYAL, V.G., SHANKAR, A.G. AND BHANDIWAD, R. 2000 MULBERRY SILK REELING TECHNOLOGY, OXFORD AND IBH PUBLISHING CO. PVT. LTD. NEW DELHI. 5. SONG, K.E AND LEE, Y.W. 1973. MODERN SILK REELING TECHNOLOGY. SERICULTURE EXPT. STATION, REPUBLIC OF KOREA 6. SONWALKER, T.N. HANDBOOK OF SILK TECHNOLOGY, NEW AGE INTERNATIONAL PVT., LTD. 7. YONG WOO LEE. 1999. SILK REELING AND TESTING MANUAL, FAO AGRICULTURAL SERVICES BULLETIN NO. 136, ROME, ITALY.

2. ANON. 1972 MANUAL ON SERICULTURE, VOL.3 SILK REELING FAO, AGRICULTURE SERVICE BULLETIN NO. 2/3. 2. BYONG HO KIM. 1989. FILATURE WATER ENGINEERING, SEOUL NATIONAL UNIVERSITY PRESS, REPUBLIC OF KOREA. 3. HUANG GUO RUI. 1988. SILK REELING, OXFORD AND IBH PUBLISHING CO. PVT. NEW DELHI. 4. MAHADEVAPPA, D., HALLIYAL, V.G., SHANKAR, A.G. AND BHANDIWAD, R. 2000 MULBERRY SILK REELING TECHNOLOGY, OXFORD AND IBH PUBLISHING CO. PVT. LTD. NEW DELHI. 5. SONG, K.E AND LEE, Y.W. 1973. MODERN SILK REELING TECHNOLOGY. SERICULTURE EXPT. STATION, REPUBLIC OF KOREA 6. SONWALKER, T.N. HANDBOOK OF SILK TECHNOLOGY, NEW AGE INTERNATIONAL PVT., LTD. 7. YONG WOO LEE. 1999. SILK REELING AND TESTING MANUAL, FAO AGRICULTURAL SERVICES BULLETIN NO. 136, ROME, ITALY. 8. Akira Nakamura (2000) Fiber Science and Technology. Oxford & IBH Publications, New Delhi

SEC-3.TH	APPLIED AND ECONOMIC ZOOLOGY	50 HOURS
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Unit 1: Agricultural Pests- The module deals with Pests which are harmful insects that decreases the agricultural yield. There are several kinds of pests, such as potential pests, key pests, occasional pests, regular pests, seasonal pests, persistent pests, sporadic pests etc, these terms are explained. **08 Hours**

Unit 2: Beneficial Insects- The module deals with Useful Insects . Many insects are beneficial for mankind. They are of two major categories, namely helpers and producers the categories with examples are explained. **08 Hours**

Unit 3: Pisciculture - Pisciculture is the rearing of fishes under controlled conditions. The module deals with importance of Pisciculture, construction & Management of pond, **08 Hours**
 - Culturing of Common culturable food fish- The module deals with Common culturable species etroplus, milk fish, murrels, common carps- grass carp, silver

carp, common carp, mrigal, tilapia , it deals with seed collection, breeding and types of culture.

Unit 4: Pearl Culture- Pearl is the gem produced from a living animal. Both marine and fresh water pearls are produced in india, The module deals in detail the process. The module deals with Pearl Culture (Preparation of nuclei, host and graft tissue, implantation, nursing). **10 Hours**

Unit 5: Poultry farming- The module deals with introduction, Importance of egg production, Nutritive value of eggs. It explains how Poultry eggs and meat provide high quality balanced proteins, vitamins and minerals. Poultry breeds- The module deals with Poultry breeds (Indigenous breeds- & Exotic breeds) **08 Hours**

Unit 6: Lac culture- The module deals with Lac culture. Lac is the resinous secretion of lac insects. Lac culture is the scientific management of lac insects to obtain a high amount of quality lac. **08 Hours**

THEORY QUESTION PATTERN

For all SEC Papers

Theory (Full Marks 100)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 4 short notes)

- Students will write 4 short notes (each of 5 marks) out of seven short notes.

4 x 5 = 20 marks

Section C (Broad question, 4 questions)

Students will write six questions (each of 10 marks) out of nine questions.

6 x 10 = 60 marks

REFERANCES

APPLIED AND ECONOMIC ZOOLOGY
BY DR. V. B. UPADHYAY DR. G. S. SHUKLA

KNRN APPLIED AND ECONOMIC ZOOLOGY
BY PARUL YADAV

APPLIED AND ECONOMIC ZOOLOGY
BY TRIPURARI MISHRA

TEXT BOOK OF APPLIED ZOOLOGY: VERMICULTURE, APICULTURE, SERICULTURE,
LAC CULTURE, AGRICULTURAL PESTS AND THEIR CONTROLS
BY PRADIP JABDE

APPLIED AND ECONOMIC ZOOLOGY
BY ASHOK KUMAR ET AL RATHOURE

PART II; SEM IV

CC 5	SOIL SCIENCE & AGRICULTURAL CHEMISTRY	75	25
CC 6	NON- MULBERRY SERICULTURE	75	25
CC 7	COCOON CROP PRODUCTION	75	25
CC 8	ORGANIC FARMING	75	25

CC 5.TH	SOIL SCIENCE & AGRICULTURAL CHEMISTRY	50 HOURS
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Unit 1: Fundamentals of Soil Science

12 Hours

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, soil organisms: macro and micro organisms, their beneficial and harmful effects.

Unit 2: Problematic Soils and their Management, Geoinformatics

12 Hours

Soil quality and health, Distribution of waste land and problem soils in India. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; Their categorization based on properties. Reclamation and management of saline and sodic soils, acidic soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils-Soil pollution-behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water – quality and standards, utilization of saline water in agriculture.

Unit 3: Geo-informatics

12 Hours

Definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping: fertilizer recommendation using geospatial technologies: Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of

Agricultural Inputs. Remote sensing and GIS in diagnosis and management of problem soils.

Unit 4: Manures, Fertilizers and Soil Fertility Management 14 Hours

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients., Soil testing. Forms of nutrients in soil, Methods of fertilizer recommendations to mulberry crops, methods of application under rainfed and irrigated condition.

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 3 short notes)

- Students will write 3 short notes (each of 5 marks) out of 5 short notes.

3 x 5 = 15 marks

Section C (Broad question, 4 questions)

Students will write four questions (each of 10 marks) out of seven questions.

10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

1. Study of general properties of minerals, Study of silicate and non-silicate minerals, Study of igneous, sedimentary and metamorphic rocks, Study of soil sampling tools and collection of representative soil sample, Study of soil profile, Determination of soil moisture content, Determination of bulk density and particle density and porosity of soil, Study of soil texture by feel and bouyoucos Methods. Determination of soil colour, Study of capillary rise phenomenon of water in soil column and water movement in soil. Determination of heat transfer in soil, Study of soil map, Visit to NBSS&LUP. **10 Hours**

2. Determination of Soil pH, EC, ESP, CEC, LR, GR. Quantity of irrigation water – Determination of anion, cation, SAR in irrigation water. Study of topographical maps, Use of GPS, introduction to remote sensing and GIS, Visit to pesticides residue lab, visit to problematic soil site, visit to KSRSAC. **05 Hours**

3. Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants. Analysis of Manures and fertilizers, Visit to STL/FTL **05 Hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Identification of different types of soil. (any five)
 2. Determination of bulk density and particle density of soil/ Determination of organic carbon by Titration method/ Soil PH/Conductivity test/ Determination of available phosphorus.
 3. Laboratory Note Book
 4. Internal assessment.
- One external and one internal examiners will conduct the examination

REFERANCES

1. YELLAMANDA REDDY, T. AND SHANKARA REDDI, G.H. (1995) PRINCIPLES OF AGRONOMY. PUBLISHERS, NEW DELHI 2. T.D BISWAS, S.K MUKHERJEE. TEXT BOOK OF SOIL SCIENCE, 3. THE NATURE AND PROPERTIES OF SOIL, NYLC C. BRADY Page 29 | 39 4. A.K. SACHETI. SOIL AND ITS PROPERTIES, 5. GURMEL SINGH. VENKATARAMANAN, G.SASTRY, B.P JOSHI MANUAL OF SOIL AND WATER CONSERVATION PRACTICES,

CC 6.TH	NON- MULBERRY SERICULTURE	50 HOURS
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Unit 1: Scope of Non-mulberry sericulture and mulberry vs. non-mulberry sericulture. Types of non-mulberry silkworms and their distribution in India and other countries. Taxonomy of food plants of non-mulberry silkworms: Study of salient features of the families, Magnoliaceae, Caesalpiniaceae, Euphorbiaceae, Combretaceae, Apocyanaceae, giving more emphasis on the plants of Sericultural importance. Cultivation of primary food plants of tasar, muga, and eri silkworms- Terminalia arjuna,, Machilus bombycina, Ricinus communis and their systematic position.

08 Hours

Unit 2: Taxonomy of food plants of non-mulberry silkworms: Salient feature of the families of non- mulberry silkworm. Life cycle of Tasar, Eri and muga silkworms. Brief account of important diseases and pests of primary non-mulberry food plants and their management. Rearing of non-mulberry silkworms. Ecological conditions that influence rearing of non mulberry silkworms- improved rearing methods for young and late age tasar, eri and muga silkworms. Mounting methods- different kinds of mountages- rearing of seed and commercial crops- Indoor rearing of tropical tasar and muga silkworms.

08 Hours

Unit 3: Cultivation of primary food plants of Tasar, Muga and Eri silkworms: Terminalia arjuna, Machilus bombycina, Ricinus communis. Seed cocoons- Procurement- cocoon preservation-synchronization of moth emergence production of disease free eggs. Non mulberry reeling – natwa, bhir, takli spinning.

08 Hours

Unit 4: Brief account of implant disease and pest of primary non-mulberry food plants and their management. Disease of non-mulberry silkworms. Protozoan, bacterial viral and fungal diseases, symptoms, causative agent preventive and control measures. Diseases of non-mulberry silkworms- protozoan, bacterial, viral and fungal diseases. Symptoms- causative agents-preventive and control measures.

08 Hours

Unit 5: Non- mulberry Sericulture extension and economics. Extension education- meaning ,objectives and importance. Principles and concepts of extension education Extension programmes- concepts and principles, role of extension personnel and farmers in programme planning Transfer of technology. Communication- definition and planning- types of communication. Training- concepts and definition- different methods of training. TSC's and Co-Operative chawki rearing centers: Role and Importance. Farm management. **08 Hours**

Unit 6: Global production of non-mulberry silks, their scope and impact on the socio-economic conditions of tribals. Distribution of non-mulberry silk yielding insects and non-insects and their classification. Different types of voltinism and characterisation of different stages of tropical and temperate tasar, eri and muga silkwoms. Traditional and improved methods of temperate and tropical tasar, eri and muga silkworm rearing and egg production technology. Natural enemies and other problems in non-mulberry silk cocoon production. Marketing of non mulberry silk cocoons. Economics of tasar, eri and muga culture. Recent developments in non-mulberry sericulture. **10 Hours**

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 3 short notes)

- Students will write 3 short notes (each of 5 marks) out of 5 short notes.

3 x 5 = 15 marks

Section C (Broad question, 4 questions)

Students will write four questions (each of 10 marks) out of seven questions.

10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

1. Rearing appliances used in rearing and seed preparation of non-mulberry silkworms (Drawings/sketches) **4 Hours**
2. Taxonomic features of non-mulberry food plants(Terminalia arjuna, Machilus bombycina Ricinus communis) **4 Hours**
3. Identification of the morphological features of egg, larva, pupa, cocoon and moths of different non mulberry silkworms **4 Hours**
4. Identification of Tasar, Eri and Muga raw silk, silk reeling machineries, process of reeling. **4 Hours**
5. rearing method of tasar, muga and eri silkworm. **4 Hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Identification of the leaves of five food plants of non- mulberry silkworms with morphological characters and taxonomic traits.
2. Five Identifications of egg, larva, pupa, cocoon and moth and yarns of different non- mulberry silkworms.
3. Field visit.
4. Internal Assessment
5. Laboratory Note Book

One external and one internal examiners will conduct the examination

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1. CHOWDHURY, S.N. (1998) MUGA CULTURE. CENTRAL SILK BOARD, BANGALORE, INDIA
2. DOKUHON, Z.S. (1998). ILLUSTRATED TEXTBOOK ON SERICULTURE. OXFORD & IBH PUBLISHING CO., PVT. LTD. CALCUTTA.
3. JOLLY, M.S. CHOWDHUTY, S.N AND SEN. (1975). NON-MULBERRY SERICULTURE IN INDIA. CENTRAL SILK
4. BOARD, BOMBAY, INDIA.
4. JOLLY, M.S (1998). TASAR CULTURE. CENTRAL SILK BOARD, BANGALORE, INDIA.
5. SARKAR, D.C. (1998) ERI CULTURE. CENTRAL SILK BOARD, BANGALORE
6. THANGAVELU, K.; CHAKRABORTY, A.K.; BHAGAWATI, A.K. AND ISA, MD. (1998) HANDBOOK OF MUGACULTURE. CSB,

BANGALORE. 7. CHAUDHURY, S.N. (1982) ERI SILK INDUSTRY. DIRECTORATE OF SERICULTURE & WEAVING, GOVT. OF ASSAM, GOUHATI, ASSAM.

CC 7. TH	COCOON CROP PRODUCTION	50 HOURS
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Unit 1: History, Development and Organization of Sericulture Industry

Origin and history of sericulture in the World, India and Karnataka. Features and importance of sericulture in the world. National and International Silk Organizations, Organizational set up in different countries including India. Development of sericulture through plans, World Bank Projects. Sericulture organization at State Level with reference to the planning and quality control, marketing, silk exchange, export–import policy and laws. Laws relating to the production of seed, cocoon, raw silk and transport. Price stabilization. Internal consumption. R & D institutes of CSB, State Govt. & Universities. Literature in Sericulture.

16 Hours

Unit 2: Mulberry Silkworm Rearing

Biology of mulberry silkworm, popular polyvoltine & bivoltine breeds. Rearing houses and appliances. Planning for silkworm rearing suitable to different sized mulberry holdings, rearing house, equipment and labour availability. Shoot rearing and shelf rearing. Importance of disinfection, care in handling and incubation of eggs and black- boxing. Environmental conditions for rearing of young and late age silkworms. Brushing, leaf selection for different instars, frequency and quantum of feeding. Care at moulting. Spacing of worms. Bed cleaning. Rearing practices for young and late age silkworms. Mounting of worms. Effective rate of rearing. Cocoon harvesting and sorting. Transporting and marketing of cocoons. Assessment of cocoon yield and quality. Leaf cocoon ratio and consumption indices. Feed utilization and conversion efficiency. Nutritional requirement of silkworms, vis-à-vis, their availability in mulberry leaf. Different nutrients and their role in silkworm growth, development and silk production. Nutrient deficiency and its impact on silkworm biology. Nutrient supplements through mulberry leaf fortification. Maintenance of rearing records. Innovations and indigenous technology know how. Benefit cost ratio of silkworm rearing. Artificial diets and juvenile hormone analogues in practical sericulture.

18 Hours

Unit 3 : Integrated Pest Management of silkworm

16 Hours

Introduction, meaning of pest, parasite, predator and hyper-parasite, minor and major pests, confirmers and regulators. Concepts of pest management, ETL and EIL. Importance of silkworm pests including insect and non-insect pests. Tachnid fly, (*Exoristaspp*). of silkworm: classification, distribution, occurrence, nature of damage and alternate hosts, : behaviour in relation to emergence, mating, oviposition and flight, : Management practices viz., physical, mechanical, chemical, biological and Integrated Pest Management (IPM). preventive measureschemo-sterilization, biological control, genetic control and use of bio-pesticides. Importance of cocoon pests in grainages. Biology, nature of damage and other hosts of *Dermistes spp.*: its preventions through physical, mechanical and chemical means, integrated management of the pest. Occurrence, nature of damage, prevention and control of other pests of silkworm like Pantatomid bug (*Cantheconasp.*) praying mantid(*Hierodulasp*). Red ant (*Oecophyllasp.*) Braconid fly (*Apantdes sp.*). Occurrence and nature of damage caused by non-insect pests like rats, squirrels, lizards, mites, nematodes, snakes, birds etc.

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

- Students will answer ten questions (each of 2 marks) out of 15 questions.

2 x 10 =20 marks

Section B (Short Notes, 3 short notes)

- Students will write 3 short notes (each of 5 marks) out of 5 short notes.

3 x 5 = 15 marks

Section C (Broad question, 4 questions)

Students will write four questions (each of 10 marks) out of seven questions.

10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

1. Rearing houses: Model rearing house and low-cost rearing house. (Demonstration and Exercise); Rearing Appliances (Estimation of rearing appliances for 100df/s) **4 Hours**
2. Disinfection: Types of disinfectants; Concentration and dosage requirement; Preparation of spray formulation of disinfectants (For 100df/s) **4 Hours**
3. Rearing Techniques: Harvesting and preservation technique; leaf selecting for different instants; mulberry leaf estimation; Identification of moulting larva, care during moulting, mounting and mounting density, types of mountages; Harvesting of cocoons, assessment of cocoons. **4 Hours**
4. Maintenance of records for silkworm rearing/Internal Assessment/Local silkworm rearing field visit. **4 Hours**
5. Pest and Predators of silkworms **4 Hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Identification and uses of five sericulture rearing appliances.
2. Calculate the brushing capacity in accordance to leaf estimation/acre.
3. Submission of record book of silkworm rearing/ Field note book on Local silkworm rearing field visit .
4. Identification of pest and predator of silkworm based on external symptoms.
5. Laboratory Note Book.
6. Internal Assessment

One external and one internal examiners will conduct the examination

REFERANCES

- GANGA, G., AND J. SULOCHANA CHETTY. (1991) AN INTRODUCTION TO SERICULTURE. OXFORD & IBH PUBLISHING COMPANY. 2. KRISHNASWAMI, S.; NARASIMHANNA, M.N.; SURYANARAYAN, S.K AND KUMARARAJ, S. (1973) SERICULTURE MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME
1. CHARLESLEY, S.R. (1982). CULTURE AND SERICULTURE. ACADEMIC PRESS INC., NEW YORK, U.S.A
 2. GANGA, G., AND J. SULOCHANA CHETTY. (1991) AN INTRODUCTION TO SERICULTURE. OXFORD & IBH PUBLISHING

COMPANY. 3. MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME. 4. MADAN MOHAN RAO, M. (1999) COMPREHENSIVE SERICULTURE MANUAL. PS PUBLICATIONS, HYDERABAD. 5. S. MOROHOSHI (2001). DEVELOPMENT PHYSIOLOGY OF SILKWORMS. SCIENCE PUBLISHERS, U.S. 6. YATARO TAZIMA (2001). IMPROVEMENT OF BIOLOGICAL FUNCTIONS IN THE SILKWORM. SCIENCE PUBLISHERS 7. M. AMIN MASOOD AND AFIFA S. KAMILI (2000). PRINCIPLES OF TEMPERATE SERICULTURE. KALYANI PUBLISHER. 8. SILKWORM CROP PROTECTION, CENTRAL SILK BOARD, BANGALORE, INDIA. 9. GOVINDAN, R.; NARAYANASWAMY, T.K. AND DEVAIAH, M.C. (1998) PRINCIPLES OF SILKWORM PATHOLOGY. SERI SCIENTIFIC PUBLISHERS, BANGALORE. 10. GOVINDAN, R.; RAMAKRISHNA NAIKA AND SANNAPPA, B. (2004) ADVANCES IN DISEASE AND PEST MANAGEMENT IN SERICULTURE. SERI SCIENTIFIC PUBLISHERS, BANGALORE

CC 8. TH	ORGANIC FARMING	50 HOURS
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Unit 1: Organic Agriculture

10 Hours

Detrimental effects of currently chemical dependant farming. i) Reduction of crop production due to depletion of soil Health. ii) Pesticide contamination and human health hazard. iii) Contamination of food products by pesticides & chemicals. iv) Environmental (soil, water, air) pollution. v) Reduction of natural enemies of crop pests. vi) Threat to Bio diversity.

Unit 2: Types of Farming

08 Hours

(Advantage & disadvantage of each system): Pure Organic Farming – Definition, Concept & Benefits Integrated Farming system (Combination of Organic and Inorganic) Mixed Farming

Unit 3: Concept of different cropping systems in relation to Organic Farming

08 Hours

(Inter cropping etc) Organic Farming (Process) Concept of farming system , Developing organic farms , Important steps & methods Plant Nutrients: Name of plant Nutrients with gradation , Functions of Nutrients in plant growth and Development of crops

Unit 4: Nutrient uptake and Utilization by plant:

08 Hours

From Organics , From Inorganic Chemical Fertilizer. Advantage & Disadvantage of their use: Nutrient content of different fertilizers , Balanced Nutrients supply: a) For Organic Farming system using nutrients from Organic sources. b) Integrated plant nutrient Management.

Unit 5: Sources of nutrients for Organic Agriculture: 08 Hours

Organic Manure – FYM/Rural compost, City compost, Oil cakes, Animal wastes, Vermi composts, etc Characterization and Nutrients content of the above sources (Data Chart) Green Manure – Green Manure with Leguminous crops in crop rotation. In-situ incorporation of crop residues -Benefits of Other Nitrogen contributing plants. Liquid Manure

Unit 6: Importance of Bio fertilizers in soil productivity 08 Hours

Nitrogenous, Phosphatic , Potassic .Preparation of Compost, Different Methods , Enrichment of compost , Nutrient composition , Preparation of vermicompost: Pit construction , Raw materials , Availability of specific species of earth worm , Method of preparation , Quality improvement of finished vermicompost.

THEORY QUESTION PATTERN

For all Core Papers

Theory (Full Marks 75)

Section A (Short questions, ten short questions)

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3 x 5 = 15 marks

Section C (Broad question, 4 questions)

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10 x 4 = 40 marks

PRACTICAL SYLLABUS

20 HOURS

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|---|-----------------|
| 1. Visit of organic farms to study the various components and their utilization, Preparation of enrich compost, Preparation of vermicompost | 04 Hours |
| 2. Quality analysis of composts | 03 Hours |
| 3. Indigenous technology knowledge (itk) for nutrient manage | 04 Hours |
| 4. Preparation of bio-fertilizers/bio-inoculants | 03 Hours |
| 5. Indigenous technology knowledge (itk) for insect, pest and disease | 03 Hours |
| 6. Indigenous technology knowledge (itk) for weed management | 03 Hours |

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Preparation of vermicompost, Preparation of bio-fertilizers/bio-inoculants
2. Nutrient content of different fertilizers , Balanced Nutrients supply.
3. Submission of record book of silkworm rearing/ Field note book on Local silkworm rearing field visit .
4. Identification of weeds, pest and predator of silkworm based on external symptoms.
5. Laboratory Note Book.
6. Internal Assessment

One external and one internal examiners will conduct the examination.

REFERENCES

Sustainability of Organic Farming in Nepal
by Mrinila Singh and Keshav Lall Maharjan

Sociology, Organic Farming, Climate Change and Soil Science: 3 (Sustainable Agriculture Reviews)
by Eric Lichtfouse

Basics Of Organic Farming (Pb 2020) [Paperback] BANSAL M.
by BANSAL M.

Principles of Organic Farming
by S.R. Reddy

Arts & Science of Organic Farming
by Sujit Chakrabarty, Sumati Narayan, et al.