



UNIVERSITY OF CALCUTTA

Notification No. CSR/54/2026

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 his powers under 9(6) of the said Act, the Vice-Chancellor has, by an order dated 15.05.2026, the new revised Syllabus (including Question Patterns) of Sericulture (Core- Vocational) under CCF, 2022.

The above shall take effect from the Even semester examinations, 2026 and onwards.

SENATE HOUSE

Kolkata-700073

19.05.2026

Prof.(Dr.) Debasis Das

Registrar



UNIVERSITY OF CALCUTTA

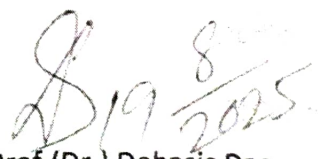
Notification No. CSR/56/2025

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 12.08.2025 approved the following amendment pertaining to the Course Structure (clause no.11) of the Admission Regulations (CSR/12/2023, 10.07.2023) for the Four-year B.A./B.Sc./B.Com. (Honours with Core Vocational Subject) Courses of Studies under CCF, 2022 under this University.

Students who opt minor subjects from the Humanities/Science/ Home Science divisions, shall study two papers from a single Minor subject (both either from m1 or from m2) in semester-5 and shall study two papers from another Minor subject (both either from m1 or from m2) in Semester-6 and shall appear in the Semester- 5 & 6 examinations accordingly. The Minor subject to be studied in semester-6 shall be different from the Minor subject studied in semester-5. The detail Course structure (semester-1 to 8) including credit distributions are laid down in the accompanying pamphlet. If all minor papers are opted from the B.Com. Honours Course (as mentioned in CSR/12/2023, dt. 10.07.2023), then it shall be in accordance with existing B.Com. Syllabus.

The above shall take effect for the Four-year B.A./ B.Sc./ B.Com. (Honours with a Core Vocational Subject) Courses under CCF, 2022, which was introduced from the academic session 2023-2024.

SENATE HOUSE
Kolkata-700073
19.08.2025


Prof.(Dr.) Debasis Das
Registrar

Amendments in Course Structure
as mentioned in Admission Regulations (Clause no. 11 of CSR/12/2023, dt.10.7.2023)
for A.Y. 2022-23 / B.Sc./ B.Com.--Honours with a Core Vocational subject

COURSE STRUCTURE

Semester	Core Vocational 64+36= 100		Minor (m1 & m2)	IDC	AEC	SEC	CVAC	Summer Internship	Total Credit
	Core Paper	Internship/ Project work							
	16x4= 64	2x16= 32 + Project Viva (4)= 36	8x4= 32	3x3= 9	4x2= 8	3x4=12	4x2= 8	1x3=3	172
1	1x4= 4 3TH+1P/TU		1x4= 4 (m1) 3TH+1P/TU	1x3= 3 2TH +1P/TU	1x2= 2 2TH +0P/TU	1x4= 4	2x2= 4		21
2	1x4= 4 3TH+1P/TU		1x4= 4 (m1) 3TH+1P/TU	1x3= 3 2TH +1P/TU	1x2= 2 2TH +0P/TU	1x4= 4	2x2= 4		21
3	2x4= 8 2x(3TH+1P/TU)		1x4= 4 (m2) 3TH+1P/TU	1x3= 3 2TH +1P/TU	1x2= 2 2TH +0P/TU	1x4= 4			21
4	4x4= 16 4x(3TH+1P/TU)		1x4= 4 (m2) 3TH+1P/TU		1x2= 2 2TH +0P/TU				22
5	4x4= 16 4x(3TH+1P/TU)		m1 or m2 2x4= 8 2x(3TH+1P/TU)						24
6	3x4= 12 3x(3TH+1P/TU)		m1 or m2 2x4= 8 2x(3TH+1P/TU)						20
7	1x4= 4 (3TH+ 1P/TU)	Internship 1x16= 16 (12 weeks)							20
8		Project 1x16= 16 + Project Viva (4)= 20							20
Credits	16x4= 64 + (2x16= 32+ Project Viva (4)= 36)= 100		8x4= 32	3x3=9	4x2=8	3x4= 12	4x2=8	1x3= 3	169+3=172
Marks	16x100= 1600+ (2x400)+ 100= 2500		8x100= 800	3x75= 225	4x50= 200	3x100 = 300	4x50 = 200	1x75= 75	Total Marks =4300

Marks= 25 marks per credit.

Outline structure of NEP Curriculum for Sericulture, C.U.

PART I, SEM I

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 1	VSEM	Basic Fundamentals of Sericulture	75	25
SEC 1	VSEM	Seri-biotechnology	75	25

PART I, SEM II

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 2	VSEM	Biology of Silkworm & Silkworm Crop Protection	75	25
SEC 2	VSEM	Apiculture	75	25

PART II, SEM III

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 3	VSEM	Sericulture crop improvement	75	25
DSCC 4	VSEM	Silk product science	75	25
SEC 3	VSEM	Applied and economic zoology	75	25

PART II, SEM IV

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 5	VSEM	Soil science & agricultural chemistry	75	25
DSCC 6	VSEM	Non- mulberry sericulture	75	25
DSCC 7	VSEM	Cocoon crop production	75	25
DSCC 8	VSEM	Organic farming	75	25

PART III, SEM V

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 9	VSEM	Sericultural statistics and economics	75	25
DSCC 10	VSEM	Agricultural entomology	75	25
DSCC 11	VSEM	Crop physiology	75	25
DSCC 12	VSEM	Forestry & environmental sciences	75	25

PART III, SEM VI

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 13	VSEM	Silkworm seed technology	75	25
DSCC 14	VSEM	Computer science & Agri – informatics	75	25
DSCC 15	VSEM	Agricultural extension & education	75	25
C.U. Summer Internship		As per CU instructions	75 (3 credits)	

PART IV, SEM VII

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
DSCC 16	VSEM	Entrepreneurship development and Value addition in sericulture	75	25
INTERNSHIP	VSEM	To be done from any institute or industries or farm related with sericulture (12 week)	400 (16 credits)	

PART IV, SEM VIII

SUBJECT CODE	COURSE	NAME OF PAPER	THEORY	PRACTICAL
Project Work	VSEM	Individual based project	500 (20 credits)	

University of Calcutta

Programme Curriculum of 4 Yrs. B.Sc. (Honours) in Sericulture Under
Notification No. CSR/12/2023; Dated 10th July, 2023

PART I; SEMESTER - I

Course Name	Course Type	L-T-P	Credits	Total Marks
Basic Fundamentals of Sericulture	DSCC 1	3-0-1	4	75+25
Botany/Zoology	Minor	3-0-1	4	75+25
Choose from the IDC subject list	IDC	2-0-1	3	50+25
Compulsory English	AEC	2-0-0	2	50
Seri-biotechnology	SEC 1	3-0-1	4	75+25
Environmental Studies	CVAC	2-0-0	2	50
Constitutional Values	CVAC	2-0-0	2	50
Total			21	525

Basic Fundamentals of Sericulture

DSCC – 1

UNIT 1: General Sericulture

[15H]

Introduction to Sericulture: Origin and history of sericulture. Silk route and map of India and World; Temperate and tropical climate for sericulture practice. Environmental impact of sericulture: Eco-friendly activity of sericulture; Employment generation in sericulture and role of women in sericulture. Characteristics of sericulture industry: Land and agro based part of industry. Industrial aspect of the industry; Silk reeling as a cottage industry; Handloom and power loom activities. Textile fibers: Natural and Synthetic fibers: Advantage of silk fiber over other fibers: International demand of silk. Function Central Silk Board; Role of State Department of Sericulture (Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal); Role of universities and NGOs in sericulture development. Prospects and problems of sericulture industry, SWOT Analysis of Sericulture industry

UNIT 2: Biology of silkworm

[12H]

Silkworm taxonomy & life-cycle. Races & classification of silkworm: Classification based on the number of Larval Moults, Moultnism and Voltinism. Indigenous pure race& cross breed of India. Races with sex limited

Characters. Silkworm morphology: Morphology of the egg, larva, pupa, adult. Silkworm Anatomy: Digestive system: Larva, Circulatory system: Larva, pupa, adult, Nervous system: Larva, adult, Silk gland: Larva, Reproductive system: Adult. Silkworm Diseases: Protozoan disease, Bacterial disease, Fungal disease, Viral disease, Sotro Silkworm Pests: Uzi fly, Ants, Dermestid Beetles.

UNIT 3: Rearing Technology

[9H]

Silkworm Rearing (C.S.B. proposed model rearing house). Rearing appliances, disinfection, disinfectants, bed cleaning, feeding of worms. Maintaining optimum condition of rearing, brushing, frequency of spacing, care during mounting. Mounting and mountage, process of spinning, cocoon harvesting. Rearing method: chawki rearing or young age worm rearing. Late age Silkworm rearing.

UNIT 4: Non-Mulberry sericulture

[9H]

Different serigenous insects; Non mulberry silkworms (Tasar, Muga, Eri Silk) and their distribution in India and other countries. Taxonomy of food plants of non-mulberry silkworms; salient features of the families of non-mulberry silkworms. Disease and pest of non-mulberry silkworm.

REFERENCES:

1. CHARSLEY, S.R. (1982). CULTURE AND SERICULTURE. ACADEMIC PRESS INC., NEW YORK, U.S.A
2. FAO MANUALS- I MULBERRY CULTIVATION. FAO ROME.
3. FOTH, H.D. (1984) FUNDAMENTALS OF SOIL SCIENCE. 7TH EDN. JOHN WILEY & SONS, NEW YORK.
4. GANGA, G., AND J. SULOCHANACHETTY. (1991) AN INTRODUCTION TO SERICULTURE. OXFORD & IBH PUBLISHING COMPANY.
5. HASAOARUGA (1994). PRINCIPLES OF SERICULTURE (TRANSLATED FROM JAPANESE) OXFORD & IBH PUBLISHING CO., PVT. LTD. NEW DELHI.
6. KICHISABURO M. (1997) MORICULTURE – SCIENCE OF MULBERRY CULTIVATION. OXFORD & IBH
7. KRISHNASWAMI, S.; NARASIMHANNA, M.N.; SURYANARAYAN, S.K AND KUMARARAJ, S. (1973) SERICULTURE MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME.

8. RAJANNA, L., DAS, P.K., RAVINDRAN, S., BHOGESHA, K., MISHRA, R.K., SINGHVI, N.R., KATIYAR, R.S. AND JAYARAM, H. (2005) MULBERRY CULTIVATION AND PHYSIOLOGY. CENTRAL SILK BOARD, BANGALORE.

9. MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME.

10. JOLLY, M.S. CHOWDHUTY, S.N AND SEN. (1975). NON-MULBERRY SERICULTURE IN INDIA. CENTRAL SILK

11. BOARD, BOMBAY, INDIA. 4. JOLLY, M.S (1998). TASAR CULTURE. CENTRAL SILK BOARD, BANGALORE, INDIA.

12. SARKAR, D.C. (1998) ERI CULTURE. CENTRAL SILK BOARD, BANGALORE 13. THANGAVELU, K.; CHAKRABORTY, A.K.; BHAGAWATI, A.K. AND ISA, MD. (1998) HANDBOOK OF MUGACULTURE. CSB, BANGALORE

List of practical

15 Hr

1. Sericulture maps: a) World maps and Silk Road, b) Sericulture map of India and West Bengal
2. Preparation of histograms and pie charts on: a) Production of Textile fiber in India, b) World Silk Production, c) Pie chart on mulberry and non-mulberry silk production in India
3. Organization set up in India: (Demonstration & Exercise) a) Govt. of India, b) Five traditional states viz., Karnataka, Andhra Pradesh, Tamil nadu, West Bengal and Jammu & Kashmir
4. Life Cycle of Bombyx mori a) Morphology of egg, larva, pupa and adult of silkworm Bombyx mori 5. Sex separation in larva, pupa and adult of silkworm Bombyx mori:
6. Anatomy of Silkworm
7. Silkworm rearing technology
8. Identification of egg, larva, pupa and moths of different non-mulberry insects.
9. Laboratory Note Book
10. Internal Assessment

REFERENCES:

1. FAO MANUALS- I MULBERRY CULTIVATION. FAO ROME.
2. GANGA, G., AND J. SULOCHANACHETTY. (1991) AN INTRODUCTION TO SERICULTURE. OXFORD & IBH PUBLISHING COMPANY.
3. KRISHNASWAMI, S.; NARASIMHANNA, M.N.; SURYANARAYAN, S.K AND KUMARARAJ, S. (1973) SERICULTURE MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME.
4. RAJANNA, L., DAS, P.K., RAVINDRAN, S., BHOGESHA, K., MISHRA, R.K., SINGHVI, N.R., KATIYAR, R.S. AND JAYARAM, H. (2005) MULBERRY CULTIVATION AND PHYSIOLOGY. CENTRAL SILK BOARD, BANGALORE.
5. JOLLY, M.S. CHOWDHUTY, S.N AND SEN. (1975). NON-MULBERRY SERICULTURE IN INDIA. CENTRAL SILK .

SERI-BIOTECHNOLOGY

SEC - 1

UNIT 1: [12H]

Introduction, scope and importance of plant biotechnology. Plant cell and tissue culture techniques, laboratory equipment, preparation of culture media, application of cell and tissue culture in mulberry plant.

UNIT 2: [10H]

Insect transgenesis: Silkworm transgenesis, application of silkworm transgenesis. Silkworm cell culture, Establishment of primary and secondary cell lines, composition and preparation of media for cell culture.

UNIT 3: [06H]

Types and mechanism of Polymerase Chain Reaction (PCR). Application of PCR in silkworm and mulberry breeding and genetic studies.

UNIT 4: [12H]

Recombinant DNA Technology: Cloning vectors for recombinant DNA, Cloning and expression of vector, transgenic plants and their role in crop improvement, molecular farming and regulated gene expression.

UNIT 5:**[10H]**

Concept and types of DNA markers. Detail study about molecular DNA markers like; RAPD, ISSR, SSR, SCAR, RFLP, AFLP.

UNIT 6:**[10H]**

Application of biotechnology in silk fiber improvement and marker assisted breeding both silkworm and mulberry plant. Commercial application of biotechnological tools in mulberry and silkworm in medical and industrial sectors.

REFERENCE:

1. BROWN, T. A. (2016) GENE CLONING AND DNA ANALYSIS: AN INTRODUCTION. JOHN WILEY & SONS.
2. GLICK, B.R., PASTERNAK, J.J. (2003) MOLECULAR BIOTECHNOLOGY- PRINCIPLES AND APPLICATIONS OF RECOMBINANT DNA. ASM PRESS, WASHINGTON.
3. KUNDU, S. (ED.). (2014). SILK BIOMATERIALS FOR TISSUE ENGINEERING AND REGENERATIVE MEDICINE. ELSEVIER.
4. MURRAY, D.R. (1991) ADVANCED METHODS IN PLANT BREEDING BIOTECHNOLOGY. CAB, INTERNATIONAL, WALLINGFORD, OXON, UNITED KINGDOM.
5. PEVSNER, J. (2009). BIOINFORMATICS AND FUNCTIONAL GENOMICS. II EDITION. JOHN WILEY & SONS.
6. RUSSELL, P. J. (2009). IGENETICS- A MOLECULAR APPROACH. III EDITION. BENJAMIN CUMMING

PART II; SEMESTER - II

Course Name	Course Type	L-T-P	Credits	Total Marks
Biology of Silkworm & Silkworm Crop Protection	DSCC 2	3-0-1	4	75+25
Botany/Zoology	Minor	3-0-1	4	75+25
Choose from the IDC subject list	IDC	2-0-1	3	50+25
Compulsory English	AEC	2-0-0	2	50
Apiculture	SEC 2	3-0-1	4	75+25
Environmental Studies	CVAC	2-0-0	2	50
From any other Departments	CVAC	2-0-0	2	50
Total			21	525

Biology of Silkworm & Silkworm Crop Protection DSCC - 2

UNIT 1: [05H]

Biological classification and taxonomy of Silkworms. Life-cycle pattern and general occurrence.

UNIT 2: [10H]

Races & classification of silkworm: Classification based on the number of Larval Moults, Moultnism and Voltinism. Indigenous pure race& cross breed of India. Races with sex limited Characters.

UNIT 3: [08H]

Silkworm morphology: Morphology of the egg, larva, pupa, adult.

UNIT 4: [10H]

Silkworm Anatomy: Digestive system: Larva, Circulatory system: Larva, pupa, adult, Nervous system: Larva, adult, Silk gland: Larva, Reproductive system: Adult.

UNIT 5: [10H]

Silkworm Diseases: Protozoan disease, Bacterial disease, Fungal disease, Viral disease, Sotro disease, septicemia, galtine.

UNIT 6: [02H]

Silkworm pests: uzi fly, ants, dermestid beetles.

REFERENCES:

1. CHARSLEY, S.R. (1982) CULTURE AND SERICULTURE. ACADEMIC PRESS INC., NEW YORK, U.S.A
2. GANGA, G., AND J. SULOCHANACHETTY. (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. YATAROTAZIMA (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.

LIST OF PRACTICAL

15 HR

Silkworm Biology

1. Life Cycle of Bombyxmori: a) Morphology of egg, larva, pupa and adult of silkworm Bombyxmori:
2. Sex separation in larva, pupa and adult of silkworm Bombyxmori:
3. Anatomy of Silkworm Dissection and respiratory system a) Digestive and respiratory system b) Mounting of larval mouth parts and spiracle c) Silk gland d) Nervous system of silkworm larva e) Reproductive system of male and female silkworm moth

4. Cocoon characters of popular uni-, bi- and multivoltine races.

Silkworm Crop Protection

1. Identification of different diseased silkworms based on external symptoms (Grasserie, Flacherie, Muscardine and Pebrine)

2. Identification of permanent slide of bacteria, spores of Pebrine, polyhedral of NPV, spores of Muscardine /mycelial mat.

3. Methods of applications of silkworm bed disinfectants for management of silkworm diseases.

4. Predators of silkworms

5. Laboratory Note Book

6. Internal Assessment

Apiculture

SEC - 2

UNIT 1: [08H]

Biology and taxonomy of Bees: History; Classification; Biology of Honey Bees; Social organization of Bee Colony.

UNIT 2: [14H]

Bee culture practice: Artificial Bee rearing (Apiary); Modern hives –Langstroth Box and its operation; Bee Pasturage; Selection of Bee Species for Apiculture, Bee Keeping Equipment; Methods of Extraction of Honey (Indigenous and Modern).

UNIT 3: [08H]

Diseases and Enemies: Bee Diseases, Enemies and pests; Control and Preventive measures.

UNIT 4: [10H]

Bee economy: products of apiculture industry and their uses.

UNIT 5: [20H]

Entrepreneurship in Apiculture: Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens. Queen rearing, low cost nursery raising techniques, value addition from bee-wax etc.

REFERENCE:

1. SARKAR, KUNDU AND CHAKI (2014) INTRODUCTION TO ECONOMIC ZOOLOGY. NCBA PUBLICATION, KOLKATA.
2. ATUAR RAHMAN (2017) APICULTURE IN INDIA. CHICKEN NECK PUBLISHERS.
3. GEORGE ARTHUR JOSEPH CARTER (2004) BEEKEEPING: A GUIDE TO THE BETTER UNDERSTANDING OF BEES, THEIR DISEASES, AND THE CHEMISTRY OF BEEKEEPING.

PART II; SEMESTER III

Course Name	Course Type	L-T-P	Credits	Total Marks
Sericulture crop improvement	DSCC 3	3-0-1	4	75+25
Silk product science	DSCC 4	3-0-1	4	75+25
Botany/zoology	Minor	2-0-1	4	75+25
Alternative English	AEC	2-0-0	2	50
Choose from the IDC subject list	IDC	3-0-1	3	50+25
Applied and economic zoology	SEC 3	2-0-0	4	75+25
Total			21	525

VSEM DSCC 3.TH	SERICULTURE CROP IMPROVEMENT	50 HOURS
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Unit 1: Botany and Cytology of Host Plants of Silkworms **10 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. Micro and megasporogenesis and fertilization in mulberry. Fruit seed development and parthenocarpy in mulberry.

Unit 2 : Genetics and Breeding of Host Plants of Silkworms**10 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. 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. Concept of Linkage. Genetic basis for hormonal control. Genetics of cocoon colour. Sex determination in mulberry silkworm.

Unit 4 : Silkworm Breeding**13 Hours**

History of silkworm breeding in Japan, China and India, Principles and objectives of silkworm breeding. Maintenance of silkworm germplasm bank. Maintenance of breeds / stocks, 3- tier multiplication of parental stock with silk yield attributes. 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.

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, 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. 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

REFERENCES

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
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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

VSEM DSCC 4.TH	SILK PRODUCT SCIENCE	50 HOURS
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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, 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-charkha, improved charkha, 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.

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**

1. 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**

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, **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. estimated 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 examiner will conduct the examination

REFERENCES

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.

Unit 1: Agricultural Pests**08 Hours**

Pest- definition and types (major and minor pests with example); Lifecycle, nature of damage and control of Pests: Scirpophagai ncertulus of paddy, Anomissa bulifera of Jute, Bandicoota– stored house pest; Insect Pest control: Chemical, Mechanical, Cultural and Biological control measures; Integrated Pest Management (IPM)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.

Unit 2: Beneficial Insects**08 Hours**

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.

Unit 3: Pisciculture**08 Hours**

Principles, definition and scope; Prawn culture: Penaeid and Palaemonid features with examples; Semi-intensive method of prawn culture; Application of prawn culture; Difference between major and minor carps with examples; Composite fish farming: General concepts, advantages and disadvantages.

Unit 4: Pearl Culture**10 Hours**

Introduction to pearl culture. Global and national status of pearl culture, History of pearl culture, Significance of pearl culture. Types of Pearls, Properties of Pearl, Pearl Producing Molluscs, Formation of Pearl.

Unit 5: Poultry farming**08 Hours**

Types of breeds (fowl) with features and examples; Rearing method: Deep litter system; feed formulation for chicks; poultry by products with economic importance; Diseases of poultry and their control measure. Importance of egg production, Nutritive value of eggs.

Unit 6: Lac culture**08 Hours**

Life cycle, host plants and strains of Lac insect; Lac cultivation: Local practice, improved practice, propagation of Lac insect, inoculation period, harvesting of Lac; Lac composition, processing, products and uses.

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

REFERENCES

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; SEMESTER IV

Course Name	Course Type	L-T-P	Credits	Total Marks
Soil science & agricultural chemistry	DSCC 5	3-0-1	4	75+25
Non- mulberry sericulture	DSCC 6	3-0-1	4	75+25
Cocoon crop production	DSCC 7	3-0-1	4	75+25
Organic farming	DSCC 8	3-0-1	4	75+25
Botany/zoology	Minor	3-0-1	4	75+25
Alternative English	AEC	2-0-0	2	50
Total			22	550

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

16 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 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

16 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; Reclamation and management of saline and sodic soils, acidic soils, Acid Sulphate soils,

Unit 4: Manures, Fertilizers and Soil Fertility Management

18 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, 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. 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

REFERENCES

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,

DSCC 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: 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. improved rearing methods for young and late age tasar, eri and muga silkworms. Mounting methods- different kinds of mountages- 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 Training- concepts and definition- different methods of training.

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.

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

REFERENCES

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.

DSCC 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. silk exchange. Price stabilization. R & D institutes of CSB, State Govt. & Universities.
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 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. 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, (*Exorista* spp). 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 measures chemo-sterilization, biological control, genetic control and use of bio-pesticides. Importance of cocoon pests in grainages. Biology, nature of damage and other hosts of *Dermestes* spp.: its preventions through physical, mechanical and chemical means, integrated management of the pest.

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

REFERENCES

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. CHARSLEY, 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

DSCC 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)

- 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

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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 Lo.cal 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.

PART III; SEMESTER V

Course Name	Course Type	L-T-P	Credits	Total Marks
Sericultural statistics and Economics	DSCC 9	3-0-1	4	75+25
Agricultural entomology	DSCC 10	3-0-1	4	75+25
Crop physiology	DSCC 11	3-0-1	4	75+25
Forestry & environmental Sciences	DSCC 12	3-0-1	4	75+25
Botany/zoology	Minor	3-0-1	4	75+25
Total			20	500

VSEM DSCC 9.TH	SERICULTURAL STATISTICS AND ECONOMICS 50 HOURS
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UNIT 1:

10 Hours

Introduction to Statistics and its Applications in Sericulture, Classification & Frequency Distributions of data, Diagrammatic Representation of Data: Bar & Pie diagrams, Graphical Representations of Data: Histogram, Frequency Polygon, Frequency curve and Cumulative frequency curve (Ogives). Measures of Central Tendency: Concepts & Definition, Characteristics of ideal Average, Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean (Ungrouped data).

Measures of Dispersion: Concepts & Definition, Types of Measures of Dispersion: Range, Absolute Mean Deviation from mean and median, Standard Deviation and Variance, Theoretical Probability distributions: Binomial, Poisson and Normal Distribution, their Properties & Applications.

UNIT 2:

08 Hours

Simple Correlation Analysis: Definition, Measures of Correlation: Scatter diagram, Karl Pearson product moment and Spearman's rank correlation coefficients and their properties. Simple Linear Regression Analysis: Definition, Fitting of simple linear regression equations Y on X and X on Y, Properties of regression coefficient, interrelation between correlation and regression.

UNIT 3: :

08 Hours

Introduction to Sampling Theory: Sampling versus Complete Enumeration, Methods of Sampling, Type of Sampling- Simple Random Sampling (with and without replacement), Use of Random Number Tables for selection of Simple Random Sample, Concept of Sampling distribution and standard error, concept of systematic, stratified and cluster sampling along with their advantage & disadvantages.

UNIT 4:

08 Hours

Test of Significance: Introduction, Null & Alternative hypothesis, Types of Errors, Level of significance, degrees of freedom, Critical & Acceptance regions. Z-Test for Means - One and Two sample Means for Known and Unknown population variance. Small sample test: Student t-test for Means - One and Two sample means, Paired t-test and F-test for two population variances. Chi-Square test: Test for Goodness of Fit, 2x2 contingency table with Yates correction, and test for single population variance.

UNIT 5 :

08 Hours

Introduction to Analysis of Variance and its Assumptions, Analysis of Variance for One & Two Way Classification. Concept of design of experiments: Basic Principle of Experimental Design: Randomization, Replication & Local control.

UNIT 6:

08 Hours

Economics: Principles of economics, micro and macroeconomics; classification of costs – explicit And implicit, fixed, variable, marginal, average; profits – gross and net. Advantages and characteristics of sericulture. Scope of sericulture in India – Vis-à- Vis other agricultural crops - income and employment generation. Economics of silkworm egg production in government and private grainage. Economics of mulberry production under rain-fed and irrigated systems; comparative economics of mulberry production under traditional and improved practices. Economics of raw silk production in charka, cottage basin and multi-end reeling units

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. Construction of Frequency Distribution tables. Diagrammatic presentation of data: Bar diagrams & pie diagrams. Graphical Representation of Data: Histogram, Frequency polygon, Frequency curve and Cumulative frequency curve (Ogives). Computation of Measures of Central Tendency: Arithmetic Mean, Median, Mode.

04 Hours

2. Computation of Measures of Dispersion: Range, Quartile deviation, Absolute Mean Deviation, Standard Deviation and Variance and Co-efficient of dispersion (both for Ungrouped and Grouped data). Problems on permutation and combination. Problems on Simple Probability, Addition and Multiplication rules. :

04 Hours

3. Computation of probabilities using Binomial, Poisson and Normal Distributions. Computation of Correlation Coefficient: Karl Pearson product moment and Spearman's rank correlation coefficients. Use of Random Number Tables for selection of Simple Random Sample. :

04 Hours

4.Problems on Large sample tests: Z-Test for Means - One and Two sample means for known and unknown population variance. Problems on Small sample tests: Student t-test for Means - One and Two sample means, Paired t-test, and F-test two population variances. Problems on Chi-Square test: Test for Goodness of Fit, 2x2 contingency table with Yates correction and test for single population variance

04 Hours

5.Mulberry cultivation (per hectare): Cost-return from irrigated and rain fed condition , Visit to field and farmers rearing house (Economics of silkworm rearing: Investment and return) , Visit to silk reeling establishments (Economics of silk reeling: cost and returns for different types of reeling establishment.

04 Hours

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Calculation of Cost-return from irrigated and rain fed condition per hectare basis/ calculation of the Economics of silkworm rearing: Investment and return/ Sericulture Vs. other agriculture crop (cost return analysis/hectare)
2. Calculation on Central Tendency: Mean, Median, Mode. /Measures of variation: Range, mean deviation, standard deviation, coefficient of variation
3. Chi-square test/ Paired t-test
4. Probability theory/ correlation / regression analysis.
5. Laboratory Note Book
6. Internal Assessment

One external and one internal examiner will conduct the examination

REFERENCES

1. CONCERNED LITERATURES WILL BE COMMUNICATED BY THE FACULTY MEMBERS.
2. KUMARESAN, P. AND SRINIVASA, G. (2005) SERICULTURE EXTENSION MANAGEMENT AND ECONOMICS. CENTRAL SILK BOARD, BANGALORE.

3. MC GRATH, E.H (1986): BASIC MANAGERIAL SKILL FOR ALL.
PRENTICE HAL OF INDIA PVT, LTD., NEW DELHI

4. FUNDAMENTAL OF STATISTICS, A.M GUIN, M.K GUPTA, B. DAS
GUPTA & Co.

VSEM DSCC 10.TH	AGRICUTURAL ENTOMOLOGY	50 HOURS
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UNIT 1: **04 Hours**

Fundamentals of Entomology : Position of the insect in Animal kingdom.
Factors for insect's abundance. Classification of phylum Arthropoda upto
classes.

UNIT 2: **12 Hours**

Morphology: Structure and functions of insect cuticle and molting. Body
segmentation. Structure of Head, thorax and abdomen. General external
structure and modifications of insect antennae, mouth parts, legs, Wing
venation. Structure of male and female genital organ. Metamorphosis and
diapause in insects. Types of larvae and pupae.

UNIT 3: **08 Hours**

Structure and functions of digestive, circulatory, excretory, respiratory, nervous,
and reproductive system in insects. Types of reproduction in insects. Major
sensory organs like simple and compound eyes, chemoreceptors.

UNIT 4: **10 Hours**

Systematics: Taxonomy –importance, history and development and binomial
nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and
Order. Importance of different insect order like Orthoptera, Dictyoptera,
Isoptera, Thysanoptera, Hemiptera, Neuroptera, Lepidoptera, Hymenoptera,
Coleoptera.

UNIT 5: **08 Hours**

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors—temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Categories of insect pests, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Important species of pollinator, weed killers and scavengers with their importance.

UNIT 6:

08 Hours

Pests of Host Plants of Silkworm and their Management : Concepts and principles of crop pest management, status of a pest. Insect and non-insect pests of Host plants of mulberry and non-mulberry silkworms (Host plants of tasar, eri and muga silkworms namely Terminalia spp. Sal, Oak, Castor 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. Methods of collection and preservation of insects including immature stages; External features of Cockroach/Grasshopper/Blister beetle; study of close

relatives of insects, phylum Arthropoda. Types of insect antennae, mouthparts

and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae.

04 Hours

2. Dissection of digestive system in insects (Grasshopper, Cockroach); Dissection of male and female reproductive systems in insects (Grasshopper, Cockroach); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

04 Hours

3. Methods of diagnosis and detection of various insect pests, Methods of insect pests measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies.

04 Hours

4. Identification and nature of damage of important insect pests and their management. Insecticides formulations, plant protection equipments, Crop (agro-ecosystem) dynamics of a selected insect pest. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, Awareness campaign at farmers' fields. Identification of major parasitoids and predators commonly being used in biological control.

04 Hours

Note: Students should submit 10 insect specimens representing parasitoids, predator, weed killer and scavengers.

5. Study of various pests of host plants, their diagnostic characters, symptoms of damage and management measures to be adopted. Visit to crop fields to record the incidence of pests noticed and control measures, management practices suggested in each case, in addition to recording nature and symptoms of damage and estimation of losses. Collection of pests and affected samples of host plants of silkworms.

04 Hours

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Demonstration of different parts of the body of insects (Dissected) 4. 5
2. Demonstration of Internal body and all the systems of cockroach
3. Techniques – Mounting, Haemolymph and Haemocyte Staining.

4. Collection and Preservation techniques

5. Identification of different races of silkworm, specimen A, B, C, D and E
6. Laboratory Note Book
7. Internal Assessment

One external and one internal examiners will conduct the examination

REFERENCES

1. GULLAN, P.J. AND CRANSTON, P.S. THE INSECTS: AN OUTLINE OF ENTOMOLOGY. PUBLISHER: BLACKWELL SCIENCE LTD, USA.
2. ROMOSER, W.S. AND STOFFOLANO, JR. J.G. THE SCIENCE OF ENTOMOLOGY. PUBLISHER: MCGRAW-HILL.
3. CHAPMAN, R.F. THE INSECTS: STRUCTURE AND FUNCTION. HARVARD UNIVERSITY PRESS.

VSEM DSCC 11.TH	CROP PHYSIOLOGY	50 HOURS
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UNIT 1: **07 Hours**

Fundamentals of Crop Physiology : Introduction: Importance of physiology in agriculture. Plant-water relations: Structure, properties and functions of water; concept of diffusion, osmosis and water potential; Water balance of plants: Water in soil; Water absorption and translocation in plant; soil-plant atmosphere continuum; Theories explaining water translocation.

UNIT 2: **06 Hours**

Transpiration: Significance of Transpiration; transpiration in relation to crop productivity, Stomatal physiology, Concept of water use efficiency.

UNIT 3: **08 Hours**

Mineral Nutrition: Importance of plant nutrients; Classification of plant nutrients; Nutrient uptake- Soil, root and microbes interaction, Microbial association for improved uptake of nutrients; Functions of plant nutrients Deficiency and toxicity symptoms of plant nutrients.

Photosynthesis: Definition, formula, process, steps, equation ,diagram, factor affecting photo synthesis ,importance of photosynthesis .Mechanism of carbon fixation by C3, C4 and CAM pathway and their significance; Photorespiration; Factors affecting photosynthesis and productivity.

UNIT 5:

06 Hours

Respiration: Significance; Respiratory metabolism, Alternative respiration, Factors regulating respiratory rates.

UNIT 6:

10 Hours

Plant Growth and Development: Concept of plant growth Hormones and plant growth regulators in modulating crop growth; Physiological importance of Auxins, GA, Cytokinin, ABA, Ethylene. applications of growth regulators in agriculture, horticulture and industry.

UNIT 7:

07 Hours

Photoperiodism and vernalization: Basic concepts and their relevance in crop productivity; Phytochromes and their role. Seed dormancy and viability: Basic concepts, seed germination and seedling vigor.

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. Preparation of standard solutions; Methods of measuring water status in plant tissue; Determination of soil water status; Determination of stomatal frequency and index; Measurement of stomatal conductance and transpiration; **05 Hours**

2. Measurement of water use efficiency at single leaf level; Extraction, separation and quantification of photosynthetic pigments; Measurement of photosynthetic rate; Measurement of growth and yield parameters; **05 Hours**

3. Measurement of respiration rate; Deficiency symptoms of nutrients and their identification; growth hormone bioassay; Seed dormancy and methods to break seed dormancy; Estimation of moisture percentage and moisture retention capacity of mulberry leaf . **05 Hours**

4. Measurement of Seed viability and seedling vigor; effect of moisture stress on seed germination and seedling vigor. Mulberry germplasm and multi-locational trials (field visit) 2.. Study of mitosis in onion root tip/mulberry root tip (Permanent slide Demonstration) **05 Hours**

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Determination of stomatal index/frequency.
2. Estimation of moisture percentage and moisture retention capacity of mulberry leaf.
3. Estimation of leaf protein/transpiration rate in mulberry leaf.
4. Study of mitosis in onion root tip/mulberry root tip (Permanent slide Demonstration.
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

REFERENCES

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, CAL CUTTA

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. P a g e 21 | 39 5. STRICKBERGER, M.W. (1996). GENETICS. PRENTICE-HALL OF INDIA, NEW DELHI

VSEM DSCC 12.TH	FORESTRY & ENVIRONMENTAL SCIENCES	50 HOURS
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UNIT 1:

06 Hours

Introduction to Forestry: Introduction–definitions of forest and forestry, branches of forestry, history and education of forestry in India. objectives of silviculture, forest classification, Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in India.

UNIT 2:

10 Hours

Environmental Studies: Multidisciplinary nature of environmental studies Definition, scope and importance.

Natural Resources: Renewable and non-renewable resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, mining, and their effects on forest.

b) Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems.

UNIT 3:

06 Hours

Ecosystems: Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries

UNIT 4:

08 Hours

Biodiversity and its conservation: - introduction, definition, genetic, species &

ecosystem. Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 5:

05 Hours

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

UNIT 6:

06 Hours

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion. Wasteland reclamation.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

UNIT 7:

03 Hours

Human Population and the Environment: population growth, variation among nations, population explosion, Environment and human health: Role of Information Technology in Environment and human health.

UNIT 8:

06 Hours

Disaster Management: Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, volcanic eruptions.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, forest fire, Disaster Management- Effect to mitigate natural disaster at national and global levels

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. Identification of tree-species, seedlings, seed and non-wood timber forest products.
Visits of nearby Botanical Garden/Agroforestry system.
2. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
3. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
4. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area,
5. Temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method)
6. Report on a visit to Bird /Wild life sanctuary/Zoological Garden/Botanical Garden

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method) (Any one)
4. Report on a visit to National Park/Biodiversity Park/Zoological Park/Botanical Park/Wild life sanctuary.
5. Identification of different common flora and fauna of various ecological habitats with characteristics, specimen A, B, C, D and E
6. Laboratory Note Book
7. Internal Assessment

One external and one internal examiner will conduct the examination

REFERENCES

1. COLINVAUX, P. A. (1993). ECOLOGY. II EDITION. WILEY, JOHN AND SONS, INC.
2. KREBS, C. J. (2001). ECOLOGY. VI EDITION. BENJAMIN CUMMINGS.
3. ODUM, E.P., (2008). FUNDAMENTALS OF ECOLOGY. INDIAN EDITION. BROOKS/COLE
4. ROBERT LEO SMITH ECOLOGY AND FIELD BIOLOGY HARPER AND ROW PUBLISHER 5. RICKLEFS, R.E., (2000). ECOLOGY. V EDITION. CHIRON PRESS.

PART III; SEMESTER VI

Course Name	Course Type	L-T-P	Credits	Total Marks
Silkworm seed technology	DSCC 13	3-0-1	4	75+25
Computer science & Agri – informatics	DSCC 14	3-0-1	4	75+25
Agricultural extension & education	DSCC 15	3-0-1	4	75+25
Botany/zoology As offered by the college	Minor	3-0-1	4	75+25
Summer Internship		0-0-3	4	100
Total			20	500

DSCC 13.TH	SILKWORM SEED TECHNOLOGY	50 HOURS
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UNIT 1: **10 Hours**

Importance of quality silkworm seed in sericultural industry. Embryology of *Bombyx mori*, *Samia cynthia ricini* and *Antheraea mylitta*. Morphological and Biochemical changes in eggs of different silkworms during embryogenesis. Seed areas, special features of seed areas and seed cocoon transaction.

UNIT 2: **10 Hours**

Seed organization in India and abroad. Three tier system of egg production (P3, P2 and P1). Special features of parental silkworm rearing, Basic seed and industrial seed and standards for the same. Hill amelioration, marketing of seed cocoons, Grainage techniques and steps in hybrid dfl preparation.

UNIT 3: **10 Hours**

Small scale production of hibernating and non-hibernating eggs in loose forms and on egg sheets. Methods of termination of hibernation, acid treatment for hibernating eggs. Egg borne diseases and methods of elimination. Pebrine disease management at various levels.

UNIT 4:**10 Hours**

Incubation and preservation of DFLs till disposal. Standards for quality eggs. Preservation and handling of eggs, different hibernation schedules. Cost structure of a model grainage and a private grainage.

UNIT 5:**10 Hours**

Economics of egg production, factors economizing the cost of production. Management of industrial grainages. Maintenance of records in grainages. Enumeration of seed legislation act.

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. Methods of embryo testing and preparation of permanent slides. Grainage plan and equipments, different grainage operations, procurement, transportation and preservation of seed cocoons, sexing, moth emergence, pairing, de-pairing, preparation of eggs on cards and as loose forms. Identification of good, dead, unfertile and hibernated eggs. Mother moth examination, disinfection of eggs. Acid treatment for hibernating eggs. Preparation of hybrid eggs. Visit to local grainage.

2. Morphology of silkworm egg. Seed cocoon processing/handling – deflossing, sorting and preservation – pupal examination and sex separation of pupa and moth. Treatment of eggs with acid, acid preparation.
3. Visit to seed cocoon markets, commercial grainage and cold storage Centre to know activities of cocoon markets, preparation of laying and cold storage of eggs.

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Sex separation from a given cocoon lot and determination the percentage of male and female pupa/hatching percentage / Pupa/ mother moth examination.
2. Preparation of acid for cold acid treatment of silkworm eggs.
3. Submission of two record books on commercial grainage visit / basic seed farm visit. (Field work)
4. Identification of different races of silkworm, specimen A, B, C, D and E
5. Laboratory Note Book
6. Internal Assessment

One external and one internal examiners will conduct the examination

REFERENCES

1. A.K. DHOTE. SILKWORM SEED PRODUCTION TECHNOLOGY,
2. M.N NARASIMHANA. MANUAL ON SILKWORM EGG PRODUCTION,
3. KRISHNASWAMI, S.; NARASIMHANNA, M.N.; SURYANARAYAN, S.K AND KUMARARAJ, S. (1973) SERICULTURE MANUAL-2 - SILKWORM REARING. AGRICULTURE SERVICE BULLETIN, FAO, ROME.
4. GANGA, G., AND J. SULOCHANA CHETTY. (1991) AN INTRODUCTION TO SERICULTURE. OXFORD & IBH PUBLISHIN

UNIT 1: **10 Hours**

Introduction to Computers, organization and architecture of Computers, Memory Concepts, Units of Memory, Operating System, definition and UNIX, WINDOWS.

UNIT 2: **10 Hours**

Working with Computers: Computer Terminology; Starting and stopping the computer; Using the Mouse

UNIT 3: **10 Hours**

Basic Computer networks, Internet and World Wide Web (WWW), Editing and Formatting a document, Database, concepts and types, creating database. Introduction to Computer C-Programming language, concepts and standard input/output operations. Introduction to ICT and uses in agriculture. Introduction to Computer-controlled devices (automated systems) for Agri-input management, Smartphone apps in Agriculture.

UNIT 4: **10 Hours**

Introduction to Bioinformatics and Omics database NCBI, searching and accessing genome sequences and protein sequences. Introduction to GIS and its applications in Agriculture. Introduction to MIS and Decision Support System and its applications in Agriculture.

UNIT 5: **10 Hours**

MS Word: Introduction; Working with documents; Formatting documents; Creating tables Drawing, tools, printing documents , MS Excel: Introduction; Working with spread sheet, formatting spread sheet, creating chart MS PowerPoint: Introduction; Opening new presentation; Different presentation templates; Setting backgrounds; Setting presentation layout; Creating presentation.

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. Identification of computer accessories.
2. Preparation of chart, graphs and power point presentation in computer

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Preparation of chart presentation in computer
2. Preparation of graphs presentation in computer
3. Preparation of power point presentation in computer
4. Identification of different races of silkworm, specimen A, B, C, D and E
5. Laboratory Note Book
6. Internal Assessment

One external and one internal examiners will conduct the examination

REFERENCES

1.B ANTONISAMY, PRASANNA S. , PREMKUMAR, CHRISTOPHER S-
PRINCIPLES AND PRACTICE OF BIOSTATISTIC, ELSEVIER INDIA

2.RAO. BIOSTATISTICS A MANUAL OF STATISTICAL METHODS FOR USE
IN HEALTH, NUTRITION AND ANTHROPOLOGY- JAYPEE BROTHERS
MEDICAL PUBLISHERS; SECOND EDITION

3. ARORA S. - COMPUTER APPLICATIONS: A TEXTBOOK. DHANPAT RAI
& CO. (P) LTD.

4. DIXIT P.G. AND RAYARIKAR A.V. - COMPUTER APPLICATIONS IN
STATISTICS. NIRALIPRAKASHAN.

DSCC 15.TH	AGRICULTURAL EXTENSION & EDUCATION 50 HOURS
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UNIT 1:

15 Hours

Fundamentals of Agricultural Extension Education : Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment) and post-independence era (Etawah Pilot Project, Nilokheri Experiment); various extension/ agriculture development programme launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP). New trends in agriculture extension: privatization of extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems.

UNIT 2:

15 Hours

Rural Development: concept, meaning, definition; various rural development programme launched by Govt. of India. Community Development-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.

UNIT 3:**07 Hours**

Meaning, objective and importance of sericulture extension. Principle and concept of extension education.

UNIT 4:**07 Hours**

Extension programme: concept and principle, role of extension personnel and farmers in programme planning, transfer of technology

UNIT 5:**06 Hours**

Training: different methods of training, teaching aids.

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. To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD

projector; preparation and use of AV aids. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories.

2. Presentation skills exercise; micro teaching exercise. A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level.

3. Visit to NGO and learning from their experience in rural development. Understanding PRA techniques and their application in village development planning; exposure to mass media .

4. Visit to rearer house and panel discussion with farmers

5. Visit to TSC and CRC

6. Presentation of statistical data – Bar Chart and Graph, Pie Chart of raw silk, cocoon area

7. Field/Institute Visit.

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Presentation of statistical data – Bar Chart and Graph, Pie Chart of raw silk, cocoon area.

2. Preparation of a survey based questionnaire on a given problem.

3. Tour/Visit report.

4. Laboratory Note Book

5. Internal Assessment

One external and one internal examiners will conduct the examination

REFERENCES

1. DHAMA, O.P. AND BHATNAGAR (1984): EDUCATION AND COMMUNICATION FOR DEVELOPMENT
2. FAO AGRICULTURAL EXTENSION MANUAL (SECOND EDITION).
3. S.V SUPE. AN INTRODUCTION TO EXTENTION EDUCATION,
4. G.L ROY. EXTENTION MANAGEMENT.

Summer Internship	Lab Maintenance, Reagents preparation, instrument handlings	100	
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PART IV; SEMESTER VII

Course Name	Course Type	L-T-P	Credits	Total Marks
Entrepreneurship development & value addition in sericulture	DSCC 16	3-0-1	16	75+25
Internship		0-0-3	4	400
Total			20	500

DSCC 18.TH	ENTREPRENEURSHIP DEVELOPMENT & VALUE ADDITION IN SERICULTURE	50 HOURS
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UNIT 1: **10 Hours**

Entrepreneurship Building: Meaning, Importance, Psychological, Sociological factors and distinctive competence. Entrepreneurship processes.

UNIT 2: **10 Hours**

Need, scope, characteristics and types of Entrepreneurship.

UNIT 3: **10 Hours**

Social responsibility and business ethics

UNIT 4: **10 Hours**

Human resource management; Leadership, Motivation attitude, communication, Group dynamics, Dedication, Setting of goals, self-assessment Transactional analysis, Creativity.

UNIT 5: **10 Hours**

Problem solving, Strength weakness opportunity and threat (SWOT) Techniques; Decision making, Stress management; Reinforcement, recruitment, selection and training

UNIT 6: **10 Hours**

General account of by-products /value added products in Sericulture 1. Importance and Scope of Sericulture value added/by product industry in India
2. Entrepreneurship development in by-products of Sericulture

UNIT 7:**10 Hours**

Pharmaceutical value of mulberry 1. Mulberry Leaf chemical composition
2. Medicinal value/pharmaceutical utility of mulberry leaf, mulberry fruit, mulberry stem and root .

UNIT 8:**10 Hours**

Value added products of Mulberry 1. Different recipes from mulberry leaf and fruit
2. Value added products from mulberry leaf , stem, root and fruit.

UNIT 9 :**10 Hours**

Value added products of Cocoon 1. Silkworm rearing bed refuge for vermi-compost preparation and Mushroom cultivation - Silkworm larvae for human consumption- nutrition value 2 Silkworm as biotechnological and laboratory tool 3. Cocoon based handicrafts, defective and double cocoons for production of dupion silk

UNIT 10:

Value added products of Silk 1. Value Adding Potentials and Prospects for Silk– types of silk wastes – spun silk- noil yarn and its utility. 2. Silk worm pupae as food material and - pupal oil extraction and its uses 3. Application of silk protein fibroin and Sericin as a biomaterial and other Seri-by-products pharmaceutical application- biomedical application- cosmetic application

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) EDP in raising mulberry saplings (Kisan nursery) and vermicomposting
- 2) EDP in organization of chawki rearing centres.
- 3) EDP in silkworm egg production and rearing.
- 4) EDP in silk reeling – charaka, cottage basin and multi-end reeling units.
- 5) EDP in mass production of parasitoids and predator.
- 6) Identification of wastes in different phases of Sericulture: a. Mulberry cultivation b. Silkworm rearing & Seed production c. Silk reeling and Weaving d. Silk cocoon handicrafts preparation
- 7) Demonstration on a. Vermicompost preparation using Sericulture waste b. Mushroom cultivation using silkworm rearing waste
- 8) Preparation of mulberry tea using leaf Mulberry jam preparation using mulberry fruit, Recipes from mulberry leaf.

PRACTICAL QUESTION PATTERN

Practical (Full Marks 25)

1. Deliberation of a topic on EDP in raising mulberry saplings (Kisan nursery) / vermicomposting/silkworm egg production and rearing/ mass production of parasitoids and predators with power point presentation.
2. Identification of different wastes in different phases of Sericulture (any five)
3. Demonstration on
 - Vermicompost preparation using Sericulture waste
 - Mushroom cultivation using silkworm rearing waste
4. Laboratory Note Book
5. Internal assessment.

One external and one internal examiners will conduct the examination

REFERENCES

1. S.S KHANKA. ENTREPRENEURIAL DEVELOPMENT, S.CHAND PUBLISHING
2. A. NIRJAR ENTREPRENEURSHIP DEVELOPMENT,SANBUN PUBLISHERS
3. V.S.P .RAO HUMAN RESOURCE MANAGEMENT,TAXMANN
4. PHILIP KOTLE MARKETING MANAGEMENT ANALYSIS,PLANNING,IMPLEMENTATION&CONTROL RPEARSON

PART IV; SEMESTER VIII

Course Name	Course Type	L-T-P	Credits	Total Marks
Project Work	Individual based project	0-0-16	16+4	
Total			20	500