



UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section

Email: academicsectionju14@gmail.com

NOTIFICATION (22/Sept./Adp/23)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Study in the subject of **Sericulture** of Semesters **Ist and IInd** for **Four Year Under Graduate Programme** under the **Choice Based Credit System** as per **NEP-2020** (as given in the annexure) for the examinations to be held in the years as per the details given below:

Subject	Semester	for the examination to be held in the years
Sericulture	Semester-I	December 2022, 2023 and 2024
	Semester-II	May 2023, 2024 and 2025

The Syllabi of the courses is available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/22/6056-6100

Dated: 19-9-2022

Copy for information and necessary action to:

1. Special Secretary to the Vice-Chancellor, University of Jammu for information of Hon'ble Vice-Chancellor
2. Dean, Faculty of Life Science
3. HOD/Convener, Board of Studies in **Sericulture**
4. Sr. P.A. to the Controller of Examinations
5. All members of the Board of Studies
6. Confidential Assistant to the Controller of Examinations
7. I/C Director, Computer Centre, University of Jammu
8. Deputy Registrar/Asst. Registrar (Conf. /Exams, UG/ Exam Eval Non-Prof/CDC)
9. Incharge, University Website for Uploading of the notification.

Sumita Sharma
Deputy Registrar (Academic) 16/9/22

(Signature)

Department of Zoology
University of Jammu
Course Scheme of Syllabus
Bachelor of Sericulture (General/Honors/Honors with Research)
(As per the Guidelines of National education Policy-2020)

SEMESTER-I

S No	Course Type	Course No.	Course Title	Credits	Marks				Total marks
					Theory		Practical		
					Mid Semester	End Exam	Assessment	Exam	
1.	Major	UMJSET101	Introduction to Sericulture & Soil Sciences	4(3T+1P)	15	60	10	15	100
2.	Minor	UMISET102	Basics of Sericulture & Soil Sciences	4(3T+1P)	15	60	10	15	100
3.	MDC	UMDSET103	General Sericulture-I	3	15	60	NA	NA	75
4.	SEC	USESET104	Mulberry Production Technology	2	5	40	NA	5	50

SEMESTER-II

S No	Course Type	Course No.	Course Title	Credits	Marks				Total marks
					Theory		Practical		
					Mid Semester	End Exam	Assessment	Exam	
1.	Major	UMJSET201	Silkworm Rearing Technology	4(3T+1P)	15	60	10	15	100
2.	Minor	UMISET202	Silkworm Biology & Practical Aspects of Silkworm Rearing	4(3T+1P)	15	60	10	15	100
3.	MDC	UMDSET203	General Sericulture-II	3	15	60	NA	NA	75
4.	SEC	USESET204	Silk Reeling Technology	2	5	40	NA	5	50

University of Jammu
Syllabi of Sericulture for FYUP under CBCS as per NEP-2020

SEMESTER-I
(Examination to be held in December 2022, 2023, 2024)

Major Course

Course Code: UMJSET101	Course Title: Introduction to Sericulture and Soil Sciences
Credits: 04 {03(Theory) + 01(Practical)}	Total no. of lectures: Theory: 45 hours Practical: 30 hours
Maximum Marks: 100	
Theory: 75	
Practical/Tutorial: 25	

Minor Course

Course Code: UMISET102	Course Title: Basics of Sericulture and Soil Sciences
Credits: 04{03(Theory) + 01(Practical)}	Total no. of lectures: Theory: 45 hours Practical: 30 hours
Maximum Marks: 100	
Theory: 75	
Practical/Tutorial: 25	

Multidisciplinary Course

Course Code: UMDSET103	Course Title: General Sericulture-1
Credits: 03	Total no. of lectures: Theory: 45 hours
Maximum Marks: 75	
Theory: 75	

Skill Enhancement Course

Course Code: USESET104	Course Title: Mulberry Production Technology
Credits: 02	Total no. of lectures: Theory/Practical: 45 hours (15 hours)/(30 hours)
Maximum Marks: 50	
Theory/Practical: 50	

UNIVERSITY OF JAMMU
SYLLABI AND COURSE OF STUDY IN SERICULTURE UNDER CBCS AS
PER NEP - 2020
(For the Examination to be held in Year Dec- 2022, 2023 & 2024)
(MAJOR COURSE)
UG SEMESTER-I

MAJOR CORE COURSE NO.	:	UMJSET101
MAJOR CORE COURSE TITLE	:	INTRODUCTION TO SERICULTURE AND SOIL SCIENCES
CREDITS	:	04{03 (Theory) +1 (Practicum)}
MAXIMUM MARKS THEORY	:	75
I) External Theory (University Exam)	:	60
II) Internal Assessment	:	15
DURATION OF UNIVERSITY THEORY EXAM	:	03 Hours
MAXIMUM MARKS PRACTICALS	:	25
I) Continuous Assessment	:	10
II) Final examination	:	15

Objectives and Expected Learning Outcomes

The course is designed in such a way that it will introduce the students to the basic theoretical and technological aspects of silkworm rearing and other aspects essential for sericulture industry. The knowledge thus gained by the students could not only be useful for them as an extension specialist in the sericulture but would also be helpful in case the students wish to do something for self-employment or for generating supplementary income for their families.

UNIT I **(10 Hours)**

- 1.1 Introduction to Sericulture, What is Sericulture - Scope of Sericulture, Origin and history of sericulture industry in India and other countries, Silk Route.
- 1.2 Silk Industry in world with special reference to China, Japan and India.
- 1.3 Present status of silk industry output in traditional and non-traditional silk producing states of India - cocoon and silk production, mulberry areas, sericulture villages, no. of families involved with sericulture industry.

UNIT II **(10 Hours)**

- 2.1 Introduction to seed organization-what is seed organization, need for seed organization.
- 2.2 Characteristics of sericulture industry, International demand of silk and constraints in silk production like labor, land and environmental conditions.
- 2.3 Employment potential of sericulture industry in rural India with special reference to J&K.
- 2.4 Role of women in sericulture - women participation in mulberry garden and rearing management.

UNIT III **(13 Hours)**

3.1 Role of Central Silk Board in research and development of sericulture in different states of India; Sericulture research and Development in Jammu and Kashmir.

3.2 Mulberry Sericulture- Introduction to mulberry silkworm and its food plants. Different breeds/hybrids of silkworms with special reference to J&K.

3.3 Characteristic features of different varieties of mulberry with special reference to J&K. Economic utility of mulberry.

3.4 Non-Mulberry Sericulture- Introduction to different species of non-mulberry silkworm and its food plants, their habit and habitat, Types of Cocoon and silk produced by non-mulberry silkworm.

UNIT IV

(12 Hours)

4.1 Definition of soil and introduction to soil forming factors.

4.2 Soil properties: Physical and Chemical, Carbon-Nitrogen ratio and its significance.

4.3 Mulberry growth and nutrition; essential elements, their types; Importance of soil with regards to mulberry cultivation.

4.4 Source of nutrient elements in soil and their role in plant growth, including their deficiency and toxicity.

4.5 Soil sampling, soil analysis, Soil pH; Acidic and alkaline soils: their problems and reclamation.

PRACTICUM

(30 Hours)

4.1 Sericulture Maps.

a. Silk Route.

b. World Maps and India

4.2 Organizational set up:

a. Central Silk Board

b. Jammu and Kashmir

4.3 Morphology for few important mulberry cultivators.

4.4 Identification and study of sericulture products

a. Cocoon and silk yarn -different types.

b. By-products of sericulture industry.

4.5 Study of soil profile

a. Soil sampling

b. Preparation of soil sample for analysis

c. Soil analysis for pH.

d. Determination of organic carbon

e. Determination of available nitrogen

f. Determination of available phosphorous and Potassium.

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr & 30 Minutes	15
External Theory End Semester	100%	3 Hrs	60

Continuous assessment	-	-	10 (Based on Daily Performance only)
Final examination	-	-	15

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., atleast one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

Recommended Readings

1. Johnson, M. and Kesary, M. (2020). Sericulture. (Ed. 1). Saras Publication.
2. Sarkar, S. (2022). A Textbook on Sericulture. (Ed. 1). Publisher Techno World.
3. Sarwar, S., Hussain, I. and Ahmad, A. Introduction to Sericulture Industry (Latest Edition). BismaBooks.
4. Chawala, N. K., (2017). Comprehensive Sericulture: Silkworm Rearing and Silk Rearing. Indian Books and Periodicals.
5. Madan Mohan Rao, M. (2019). An Introduction to Sericulture. (Ed. 2). B S Publications.
6. Ramamoorthy, R., Umapathy, G., Ambethgar, V. and Selvanarayanan, V. (2019). Glossary of Sericulture. (Ed. 1). Aknik Publications.
7. Bhaskar, R. N. and Anusha, H. G. (2002) Objective Question Bank on Sericulture, Agri Biovet Press.
8. Savithri, G., Sujathamma, P. and Neeraja, P. (2016). Sericulture: An Overview. Industry, Publisher Bio-GreenBooks.
9. Elumalai, D., Mohan Raj, P., Ramamoorthy, R., Mohan, C. and Poovizhiraja, B. (2021). Introduction to Non-mulberry Silkworm. (Ed.1). Om Publications/ Jaya Publication New Delhi.
10. Biswas, T. D. and Mukherjee, S. K. (2004). Textbook of Soil Science. (Ed. 12). Tata Mc. Hill Company Ltd., New Delhi.
11. Das, Dilip Kumar (2020). Introductory Soil Science. (Ed. 4). Kalyani Publishers.

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SYLLABI AND COURSE OF STUDY IN SERICULTURE UNDER CBCS AS
PER NEP - 2020
(For the Examination to be held in Year Dec- 2022, 2023 & 2024)
(MINOR COURSE)
UG SEMESTER-I

MINOR CORE COURSE NO.	:	UMISSET102
MINOR CORE COURSE TITLE	:	BASICS OF SERICULTURE AND SOIL SCIENCES
CREDITS	:	04{03 (Theory) +1 (Practicum)}
MAXIMUM MARKSTHEORY	:	75
III) External Theory (University Exam)	:	60
IV) Internal Assessment	:	15
DURATION OF UNIVERSITY THEORY EXAM	:	03 Hours
MAXIMUM MARKS PRACTICALS	:	25
III) Continuous Assessment	:	10
IV) Final examination	:	15

Objectives and Expected Learning Outcomes

The course is designed in such a way that it will introduce the students to the basic theoretical and technological aspects of silkworm rearing and other aspects essential for sericulture industry. The knowledge thus gained by the students could not only be useful for them as an extension specialist in the sericulture but would also be helpful in case the students wish to do something for self- employment or for generating supplementary income for their families.

UNIT I **(10 Hours)**

- 1.1 Introduction to Sericulture, What is Sericulture - Scope of Sericulture, Origin and history of sericulture industry in India and other countries, Silk Route.
- 1.2 Silk Industry in world with special reference to China, Japan and India.
- 1.3 Present status of silk industry output in traditional and non-traditional silk producing states of India - cocoon and silk production, mulberry areas, sericulture villages, no. of families involved with sericulture industry.

UNIT II **(10 Hours)**

- 2.1 Introduction to seed organization-what is seed organization, need for seed organization.
- 2.2 Employment potential of sericulture industry in rural India with special reference to J&K.
- 2.3 Role of women in sericulture - women participation in mulberry garden and rearing management.
- 2.4 Characteristics of sericulture industry, International demand of silk and constrains in silk production like labour, land and environmental conditions.

UNIT III **(13 Hours)**

- 3.1 Role of Central Silk Board in research and development of sericulture in different states of India; Sericulture research and Development in Jammu and Kashmir.
- 3.2 Mulberry Sericulture- Introduction to mulberry silkworm and its food plants. Different

breeds/hybrids of silkworms with special reference to J&K.

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Economic utility of mulberry.

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UNIT IV

(12 Hours)

4.1 Definition of soil and introduction to soil forming factors.

4.2 Soil properties: Physical and Chemical, Carbon-Nitrogen ratio and its significance.

4.3 Mulberry growth and nutrition; essential elements, their types; Importance of soil with regards to mulberry cultivation.

4.4 Source of nutrient elements in soil and their role in plant growth, including their deficiency and toxicity.

4.5 Soil sampling, soil analysis, Soil pH; Acidic and alkaline soils: their problems and reclamation.

PRACTICUM

(30 Hours)

4.1 Sericulture Maps.

a. Silk Route.

b. World Maps and India.

4.2 Organizational set up:

a. Central Silk Board.

b. Jammu and Kashmir.

4.3 Morphology for few important mulberry cultivators.

4.4 Identification and study of sericulture products

a. Cocoon and silk yarn -different types.

b. By-products of sericulture industry.

4.5 Study of soil profile

a. Soil sampling

b. Preparation of soil sample for analysis

c. Soil analysis for pH.

d. Determination of organic carbon

e. Determination of available nitrogen

f. Determination of available phosphorous and Potassium.

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to becovered in Examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr. & 30 Minutes	15
External Theory End Semester	100%	3 Hrs	60
Continuous assessment	-	-	10 (Based on Daily Performance only)
Final examination	-	-	15

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

Recommended Readings

1. Johnson, M. and Kesary, M. (2020). Sericulture. (Ed. 1). Saras Publication.
2. Sarkar, S. (2022). A Textbook on Sericulture. (Ed. 1). Publisher Techno World.
3. Sarwar, S., Hussain, I. and Ahmad, A. Introduction to Sericulture Industry (Latest Edition). BismaBooks.
4. Chawala, N. K., (2017). Comprehensive Sericulture: Silkworm Rearing and Silk Rearing. Indian Books and Periodicals.
5. Madan Mohan Rao, M. (2019). An Introduction to Sericulture. (Ed. 2). B S Publications.
6. Ramamoorthy, R., Umapathy, G., Ambethgar, V. and Selvanarayanan, V. (2019). Glossary of Sericulture. (Ed. 1). Aknik Publications.
7. Bhaskar, R. N. and Anusha, H. G. (2002) Objective Question Bank on Sericulture, Agri Biovet Press.
8. Savithri, G., Sujathamma, P. and Neeraja, P. (2016). Sericulture: An Overview. Industry, Publisher Bio-GreenBooks.
9. Elumalai, D., Mohan Raj, P., Ramamoorthy, R., Mohan, C. and Poovizhiraja, B. (2021). Introduction to Non-mulberry Silkworm. (Ed.1). Om Publications/ Jaya Publication New Delhi.
10. Biswas, T. D. and Mukherjee, S. K. (2004). Textbook of Soil Science. (Ed. 12). Tata Mc. Hill Company Ltd., New Delhi.
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UNIVERSITY OF JAMMU
SYLLABI AND COURSE OF STUDY IN SERICULTURE UNDER CBCS AS
PER NEP - 2020

(For the Examination to be held in Year Dec- 2022, 2023 & 2024)
(MULTIDISCIPLINARY COURSE)

UG SEMESTER-I

MULTIDISCIPLINARY COURSE NO.	:	UMDSET103
MULTIDISCIPLINARY COURSE TITLE	:	GENERAL SERICULTURE-I
CREDIT	:	03
MAXIMUM MARKS	:	75
I) External (University Exam):	:	60
II) Internal Assessment	:	15
TIME DURATION	:	03 Hours

Objectives and Expected Learning Outcomes

To acquaint the students with basic understanding of Sericulture, its history, characteristics, world output of silk, Central Silk Board and a detail account of textile fibre including silk. Upon successful completion of this course, the student should be able to know about Sericulture, organizational set up the apex bodies and the properties of silk and other textile fibres.

UNIT-I

(13 Hours)

- 1.1 Introduction to Sericulture: Scope and Importance of mulberry and non-mulberry sericulture in India
- 1.2 Origin and history of sericulture in India and other Countries, Silk route
- 1.3 World Output of Silk in different countries. Silk Industry in India – West Bengal, Jammu and Kashmir, Karnataka, Tamil Nadu, Andhra Pradesh, and other states. Mulberry areas, sericulture villages, no. of families, cocoon and silk production
- 1.4 Characteristics of sericulture industry.
- 1.5 Role of sericulture in rural development.

UNIT-II

(10 Hours)

- 2.1 Organization set up of Central Silk Board, Jammu and Kashmir Development Department with special reference to Sericulture
- 2.2 Role of Central Silk Board in research and development of sericulture in different states of India.
- 2.3 Participation of women in Mulberry garden, silkworm rearing, silk reeling, weaving and marketing.

UNIT-III

(10 Hours)

- 3.1 Silk grading
- 3.2 Brief account of silk conditioning and testing
- 3.3 By-products of sericulture
- 3.4 Utilization of by-products of mulberry silkworm, pupae and moths

UNIT-IV

(12 Hours)

- 4.1 Introduction to textile fibers; types: natural and synthetic fibers; importance, role of silk fibers

amongst natural fibres

4.2 Physical and chemical properties of silk

4.3 Advantages of silk fiber over the natural fibres

4.4 A comparative study of mulberry sericulture vis-à-vis other agriculture crops

4.5 Prospects and problems of sericulture industry.

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in Examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr. & 30 Minutes	15
External Theory End Semester	100%	3 Hrs.	60

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each

Recommended Readings

- Ganga, G. and Chetty, S. (2008) An Introduction to Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Singh, Tribhuvan and Sarachandra, Beera (2004) Principles and Techniques of Silkworm Seed Production. Discovery Publishing House, New Delhi.
- Rajan, R. K., and Himantharaj, M. T. (2005) Silkworm Rearing Technology. Central Silk Board, Bangalore.
- Johnson, M. and Kesary, M. (2020). Sericulture. (Ed. 1). Saras Publication.
- Sarkar, S. (2022). A Textbook on Sericulture. (Ed. 1). Publisher Techno World.
- Sarwar, S., Hussain, I. and Ahmad, A. Introduction to Sericulture Industry (Latest Edition). Bisma Books.
- Chawala, N. K., (2017). Comprehensive Sericulture: Silkworm Rearing and Silk Rearing. Indian Books and Periodicals.
- Madan Mohan Rao, M. (2019). An Introduction to Sericulture. (Ed. 2). B S Publications.
- Ramamoorthy, R., Umapathy, G., Ambethgar, V. and Selvanarayanan, V. (2019). Glossary of Sericulture (Ed. 1) Aknik Publications
- Bhaskar, R. N. and Anusha, H. G. (2002) Objective Question Bank on Sericulture, Agri Biovet Press.
- , D. Halliyal, V.G. et al., (2000) Mulberry Silk Reeling Technology. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
- Sonwalker, T.N. (2001) Hand Book of Silk Technology. New Age International (P) limited, New Delhi and Mumbai.
- Ananthanarayan, S.K. (2008) Silk Reeling. Biotech Books, Delhi.

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SYLLABI AND COURSE OF STUDY IN SERICULTURE UNDER CBCS
AS PER NEP - 2020
(For the Examination to be held in Year Dec- 2022, 2023 & 2024)
(SKILL ENHANCEMENT COURSE)
UG SEMESTER-I

SKILL ENHANCEMENT COURSE NO.	: USESET104
SKILL ENHANCEMENT COURSE TITLE	: MULBERRY PRODUCTION TECHNOLOGY
CREDITS	: 02
MAXIMUM MARKS	: 50
I) External (University Exam)	: 40
II) Internal Assessment	: 10
MINIMUM PASS MARKS	
DURATION OF UNIVERSITY EXAM	: 02 Hours

Objectives and Expected Learning Outcomes

To acquaint the students with basic understanding of mulberry biology which is the sole food of mulberry silkworm and its propagation. The course also gives an account of the establishment of mulberry garden and the necessary inputs required for its maintenance. After completing this course the learners will be able to increase their skill, and knowledge in establishing a mulberry garden for the quality mulberry leaf production.

UNIT-I: Biology of Mulberry (7 Hrs.)

- 1.1 Taxonomy of mulberry, different varieties of mulberry with special reference to J & K.
- 1.2 Morphology of mulberry i.e. stem, root and leaf.
- 1.3 Essential elements required for mulberry growth and their types.
- 1.4 Importance of soils with reference to mulberry cultivation.
- 1.5 Propagation of Mulberry-asexual and sexual methods

Unit-II: Mulberry Garden Establishment (8 Hrs.)

- 2.1 Establishment of mulberry garden under rain-fed and irrigated conditions:
 - (a) Planting season, selection and preparation of land, planting material
 - (b) Chawki and late age garden; importance and maintenance.
- 2.2 Manures and fertilizers: Types, dosage, application and schedule.
- 2.3 Pruning and training methods and their importance.
- 2.4 Weeds of mulberry garden: weeding and intercultural operations.
- 2.5 Leaf harvesting: Effects of harvest on mulberry plant; harvesting methods (leaf and shoot harvests); transportation and preservation of harvested leaf and shoot.

Unit-III: Practical Mulberry Production Technology

(30 Hrs.)

- 3.1 Morphology for few important mulberry cultivators.
- 3.2 Propagation methods:
 - a. Preparation of nursery beds.
 - b. Collection of fruits and separation of viable seeds, seed sowing, seed bed maintenance and raising of seedlings.
 - c. Selection of materials for cutting preparation and selection of cuttings, planting and raising of saplings in nursery beds and polythene bags. Selection and grading of saplings.
- 3.3 Farm implements and Machinery
- 3.4 Identification of common weeds of mulberry and weeding
- 3.5 Identification of different types of fertilizers, calculation of dosages, Preparation of compost
- 3.6 Visits to Govt. Mulberry farm and interaction with Officer Incharge.

NOTE FOR PAPER SETTERS

Total Marks of the USESET-104 is 50 of which 20% marks shall be reserved for internal assessment (10 marks). Remaining 80% of the marks (40 marks) shall be reserved for external examination to be conducted by the University/Colleges.

Internal Assessment Test (10 Marks)

Internal Assessment Paper of 10 Marks shall consist of Theory Question/s of 5 Marks from Unit I/II and 5 Marks of Practical Exercise from Unit III.

External End semester University / College Examination

External Theory Exam shall be of 40 Marks and consist of 2 sections:

Section A: Four (4) short answer questions representing all Units/Syllabi i.e., atleast one question from each unit. Each question shall be of 2.5 marks (All Compulsory)

Section B: Six (6) long answer questions (Three to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 10 marks

RECOMMENDED READINGS

1. Ganga, G. and Chetty, S. (2008) An Introduction to Sericulture. Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Ganga, G., (2003) Comprehensive Sericulture- Vol.-1 Morigulture, Oxford and IBH PublishingCo. Pvt. Ltd., New Delhi.
3. Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Kamili, A.S. and Masoodi, A.M. (2004). Principles of Temperate Sericulture. KalyaniPublishers, New Delhi-110002.
5. Jaswal, K., Trivedi, P.S., Pandey, B.N. and Khatri, R.K. (2009) Morigulture. APH PublishingCorporation, New Delhi.
6. Patnaik, R.K. (2008) Mulberry for Animal Production. Biotech Books, Delhi.
7. Rajanna, L., Das, P.K., Ravindran, S., Bhogेशha, K., Mishra, R.K., Singhvi, N.R., Katiyar, R.S. and Jayasan, H. (Ed.2005) Mulberry Cultivation and Physiology. Central Silk Board, Bangalore.
8. Govindaiah, Gupta, V.P., Sharma, D.D., Rajadurai, S. and Naik, Nishitta (2005) Mulberry Crop Protection. Central Silk Board, Bangalore.
9. Aruga, H. Principles of Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Bombay and Calcutta.
10. Khan, M.A., Dhar, A., Zeya, S.B and Trag, A.R. (2004) Pests and Diseases of Mulberry and their Management. Published by Bishan Singh and Mahendra Pal Singh, New ConnaughtPalace, Dehradun.
11. Mulberry Crop Protection (CSB)

UNIVERSITY OF JAMMU
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PER NEP - 2020
(For the Examination to be held in Year May- 2023, 2024 & 2025)
(MAJOR COURSE)
UG SEMESTER-II

MAJOR CORE COURSE NO.	:	UMJSET201
MAJOR CORE COURSE TITLE	:	SILKWORM REARING TECHNOLOGY
CREDITS	:	04{03 (Theory) + 01 (Practical)}
MAXIMUM MARKS	:	75
I) External (University Exam)	:	60
II) Internal Assessment	:	15
DURATION OF UNIVERSITY EXAM	:	03 Hours
MAXIMUM MARKSPRACTICALS	:	25
I) Continuous assessment	:	10
II) Final examination	:	15

Objectives and Expected Learning Outcomes

The course provides a detailed insight into basic aspects of practicing sericulture. It also gives an account of the management and various technological improvements in rearing silkworm. Students at the completion of course will be able to understand the practical as well commercial silkworm rearing aspects.

UNIT I:

(12 Hrs.)

- 1.1 Systematic position of silkworm and salient features of order Lepidoptera. Classification of silkworms races based on origin and geographical distribution, based on voltinism and multivoltinism and based on cocoon colour.
- 1.2 Life cycle of *Bombyx mori*; Morphology of egg, larva, pupa and adult. Moulting – signs of moulting and care during pre-moulting, moulting and post-moulting stage - hormonal control.
- 1.3 Metamorphosis and role of hormones in silkworm metamorphosis.
- 1.4 Structure of egg development. Nutrition: Factors influencing silkworm growth and development.
- 1.5 Morphology and physiology of mouth parts, digestive, excretory, respiratory and reproductive system of silkworm larva. Structure and function of silk gland - silk protein and their synthesis.

UNIT 2:

(10 Hrs.)

- 2.1 Silkworm rearing house - Requirement for ideal rearing house- orientation, selection of site and size of rearing house representing CSB model. Low cost rearing houses - advantage and disadvantages of different rearing houses.
- 2.2 Rearing appliances – early age and late age rearing appliances.
- 2.3 Disinfection - objectives and methods. Disinfectants – types and their concentrations.
- 2.4 Selection of silkworm breeds/hybrids for rearing - advantages and disadvantages of bivoltine, multivoltine and their hybrids. Estimation of leaf quality and leaf yield for silkworm rearing - appropriate time for estimation of leaf yield.
- 2.5 Incubation - methods of incubation; Black boxing – its significance and environmental conditions required for incubation and its influence on egg development.

UNIT 3:

(13 Hrs.)

- 3.1 Brushing - preparation for brushing, brushing methods - selection of leaf for brushing, advantages and disadvantages of different types of brushing methods.
- 3.2 Early age rearing (chawki rearing) - environmental conditions required for chawki rearing. Chawki rearing methods. Leaf requirement for early age worms, spacing, dusting and bed cleaning schedules; frequency of feeding.
- 3.3 Late age rearing - environmental conditions required for late age rearing. Different rearing methods- shelf, shoot and floor rearing - Advantages and disadvantages. Leaf requirement for late age worms, spacing, dusting and bed cleaning schedules; frequency of feeding.

UNIT 4:

(10 Hrs.)

- 4.1 Spinning and Mounting
 - 4.1.1 Spinning behaviour of silkworms, environmental conditions required for spinning;
 - 4.1.2 Preparation for mounting - methods of mounting, mounting density
 - 4.1.3 Types of mountages-advantages and disadvantages of different mountages.
- 4.2 Cocoon Harvesting - time of harvest of seed crop and hybrid crop.
- 4.3 Sorting, storage/preservation, packaging and transportation of cocoons. Leaf-cocoon ratio.

Practicum

(30 Hrs.)

- 4.1 Morphology of Larva, pupa, moth and adult.
- 4.2 Morphology and Anatomy of -
 - a. Mouth parts, digestive, excretory and respiratory system in silkworm larva.
 - b. Silk gland in silkworm.
 - c. Reproductive system in silk moth/adult.
- 4.3 Model rearing house-types of rearing houses; Rearing appliances.
- 4.4 Disinfection-Methods of disinfection. Disinfectants - types of disinfectants and preparation of disinfectants.
- 4.5 Rearing of silkworms (Compulsory).

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in Examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr. and 30 Minutes	15
External Theory End Semester	100%	3 Hrs	60
Continuous assessment	-	-	10 (Based on Daily Performance only)
Final examination	-	-	15

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e.,

two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

Recommended Readings

1. Ganga, G., (2003) Comprehensive Sericulture- Vol.-1 Moriculture, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Singh, Tribhuwan and Sarachandra, Beera (2004) Principles and Techniques of Silkworm Seed Production. Discovery Publishing House, New Delhi.
4. Rajan, R. K., and Himantharaj, M. T. (2005) Silkworm Rearing Technology. Central Silk Board, Bangalore.
5. Johnson, M. and Kesary, M. (2020). Sericulture. (Ed. 1). Saras Publication.
6. Sarkar, S. (2022). A Textbook on Sericulture. (Ed. 1). Publisher Techno World.
7. Sarwar, S., Hussain, I. and Ahmad, A. Introduction to Sericulture Industry (Latest Edition). Bisma Books.
8. Chawala, N. K., (2017). Comprehensive Sericulture: Silkworm Rearing and Silk Rearing. Indian Books and Periodicals.
9. Madan Mohan Rao, M. (2019). An Introduction to Sericulture. (Ed. 2). B S Publications.
10. Ramamoorthy, R., Umapathy, G., Ambethgar, V. and Selvanarayanan, V. (2019). Glossary of Sericulture. (Ed.1). Aknik Publications.
11. Bhaskar, R. N. and Anusha, H. G. (2002) Objective Question Bank on Sericulture, Agri Biovet Press.

UNIVERSITY OF JAMMU
SYLLABI AND COURSE OF STUDY IN SERICULTURE UNDER CBCS AS
PER NEP - 2020

(For the Examination to be held in Year May- 2023, 2024 & 2025)

(MINOR COURSE)

UG SEMESTER-II

MINOR CORE COURSE NO.	:	UMISSET202
MINOR CORE COURSE TITLE	:	SILKWORM BIOLOGY AND PRACTICAL ASPECTS OF SILKWORM REARING
CREDITS	:	04{03 (Theory) + 01 (Practical)}
MAXIMUM MARKS	:	75
I) External (University Exam)	:	60
II) Internal Assessment	:	15
DURATION OF UNIVERSITY EXAM	:	03 Hours
MAXIMUM MARKSPRACTICALS	:	25
I) Continuous Assessment	:	10
II) Final examination	:	15

Objectives and Expected Learning Outcomes

The course provides a detailed insight into basic aspects of practicing sericulture. It also gives an account of the management and various technological improvements in rearing silkworm. Students at the completion of course will be able to understand the practical as well commercial silkworm rearing aspects.

UNIT I:

(12 Hrs.)

- 1.1 Systematic position of silkworm and salient features of order Lepidoptera. Classification of silkworms races based on origin and geographical distribution, based on voltinism and multivoltinism and based on cocoon colour.
- 1.2 Life cycle of *Bombyx mori*; Morphology of egg, larva, pupa and adult. Moulting – signs of moulting and care during pre-moulting, moulting and post-moulting stage - hormonal control.
- 1.3 Metamorphosis and role of hormones in silkworm metamorphosis.
- 1.4 Structure of egg development. Nutrition: Factors influencing silkworm growth and development.
- 1.5 Morphology and physiology of mouth parts, digestive, excretory, respiratory and reproductive system of silkworm larva. Structure and function of silk gland - silk protein and their synthesis.

UNIT 2:

(10 Hrs.)

- 2.1 Silkworm rearing house - Requirement for ideal rearing house- orientation, selection of site and size of rearing house representing CSB model. Low cost rearing houses - advantage and disadvantages of different rearing houses.
- 2.2 Rearing appliances – early age and late age rearing appliances.
- 2.3 Disinfection - objectives and methods. Disinfectants – types and their concentrations. Selection of silkworm breeds/hybrids for rearing - advantages and disadvantages of bivoltine, multivoltine and their hybrids. Estimation of leaf quality and leaf yield for silkworm rearing - appropriate time for estimation of leaf yield.

2.4 Incubation - methods of incubation; Black boxing – its significance and environmental conditions required for incubation and its influence on egg development.

UNIT 3:

(13 Hrs.)

- 3.1 Brushing - preparation for brushing, brushing methods - selection of leaf for brushing, advantages and disadvantages of different types of brushing methods.
- 3.2 Early age rearing (chawki rearing) - environmental conditions required for chawki rearing. Chawki rearing methods. Leaf requirement for early age worms, spacing, dusting and bed cleaning schedules; frequency of feeding.
- 3.3 Late age rearing - environmental conditions required for late age rearing. Different rearing methods- shelf, shoot and floor rearing - Advantages and disadvantages. Leaf requirement for late age worms, spacing, dusting and bed cleaning schedules; frequency of feeding.

UNIT 4:

(10 Hrs.)

- 4.1 Spinning and Mounting
- 4.1.1 Spinning behaviour of silkworms, environmental conditions required for spinning;
- 4.1.2 Preparation for mounting - methods of mounting, mounting density
- 4.1.3 Types of mountages-advantages and disadvantages of different mountages.
- 4.2 Cocoon Harvesting - time of harvest of seed crop and hybrid crop.
- 4.3 Sorting, storage/preservation, packaging and transportation of cocoons. Leaf-cocoon ratio.

Practicum

(30 Hrs.)

- 4.1 Morphology of Larva, pupa, moth and adult.
- 4.2 Morphology and Anatomy of -
- a. Mouth parts, digestive, excretory and respiratory system in silkworm larva.
- b. Silk gland in silkworm.
- c. Reproductive system in silk moth/adult.
- 4.3 Model rearing house-types of rearing houses; Rearing appliances.
- 4.4 Disinfection-Methods of disinfection. Disinfectants - types of disinfectants and preparation of disinfectants.
- 4.5 Rearing of silkworms (Compulsory).

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in Examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr. and 30 Minutes	15
External Theory End Semester	100%	3 Hrs.	60
Continuous assessment	-	-	10 (Based on Daily Performance only)
Final examination	-	-	15

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e.,

two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

Recommended Readings

1. Ganga, G., (2003) Comprehensive Sericulture- Vol.-1 Moriculture, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling, Oxford and IBHPublishing Co. Pvt. Ltd., New Delhi.
3. Singh, Tribhuwan and Sarachandra, Beera (2004) Principles and Techniques of Silkworm Seed Production. Discovery Publishing House, New Delhi.
4. Rajan, R. K., and Himantharaj, M. T. (2005) Silkworm Rearing Technology. Central Silk Board, Bangalore.
5. Johnson, M. and Kesary, M. (2020). Sericulture. (Ed. 1). Saras Publication.
6. Sarkar, S. (2022). A Textbook on Sericulture. (Ed. 1). Publisher Techno World.
7. Sarwar, S., Hussain, I. and Ahmad, A. Introduction to Sericulture Industry (Latest Edition). Bisma Books.
8. Chawala, N. K., (2017). Comprehensive Sericulture: Silkworm Rearing and Silk Rearing. Indian Books and Periodicals.
9. Madan Mohan Rao, M. (2019). An Introduction to Sericulture. (Ed. 2). B S Publications.
10. Ramamoorthy, R., Umapathy, G., Ambethgar, V. and Selvanarayanan, V. (2019). Glossary of Sericulture. (Ed.1). Aknik Publications.
11. Bhaskar, R. N. and Anusha, H. G. (2002) Objective Question Bank on Sericulture, Agri Biovet Press.
12. Ganga, G. and Chetty, S. (2008) An Introduction to Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

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PER NEP - 2020

(For the Examination to be held in Year May- 2023, 2024 & 2025)

(MULTIDISCIPLINARY COURSE)

UG SEMESTER-II

MULTIDISCIPLINARY COURSE NO.	:	UMDSET203
MULTIDISCIPLINARY COURSE TITLE	:	General Sericulture-II
CREDITS	:	03
MAXIMUM MARKS	:	75
I) External (University Exam)	:	60
II) Internal Assessment	:	15
TIME DURATION	:	03 Hours

Objectives and Expected Learning Outcomes

The course is designed to acquaint the students with basic understanding of the mulberry biology, soil condition, silkworm seed production and silkworm rearing technology. Upon successful completion of this course, the student should be able to have some knowledge of some of the important aspects of sericulture.

Unit 1: (13 Hrs.)

- 1.1 Systematic position of the genus *Morus* L. Botanical description of mulberry, Economic importance of mulberry.
- 1.2 Mulberry varieties: Characteristic features of popular mulberry cultivars of tropical and temperate regions.
- 1.3 Soil for mulberry, systems of mulberry cultivation in different agro climatic conditions.
- 1.4 Planning for establishment for mulberry garden. Selection and preparation of planting material, different methods of planting for rain fed irrigated and hilly areas.
- 1.5 Essential elements and their types for the growth of mulberry. Role of plants nutrients in leaf production.

Unit 2: (12 Hrs.)

- 2.1 Silkworm egg production; Silkworm seed, its definition
- 2.2 Silkworm seed Organization concept, importance, Organizational set up, Norms for maintenance and multiplication silkworm seed.
- 2.3 Silkworm Hybrids –Characteristic features of some important hybrids
- 2.4 Seed Legislation Act. Rules and regulations in Karnataka, A.P, T.N, W.B and J&K
- 2.5 Seed areas concept, criteria for selection of seed areas and seed rearers

Unit 3: (10 Hrs.)

- 3.1 Mulberry sericulture
- 3.2 Mulberry silkworm and its food plant
- 3.3 Silkworm races: Classification of mulberry silkworm on the basis of its geographical distribution
- 3.4 Moulting and voltinism.

Unit 4:

(10 Hrs.)

- 4.1 Different types of cocoons, physical and commercial characters of mulberry silkworm reeling cocoons.
- 4.2 Disinfection
 - 4.2.1 Types of disinfectants
 - 4.2.2 Preparation of disinfectants
- 4.3 Young age and late age mulberry silkworm rearing: Characteristic features and different methods of young age and late age rearing.

NOTE FOR PAPER SETTING

Examination Theory/Practical	Syllabus to be covered in Examination	Time allotted for Exam	Marks
Internal Theory Assessment	50%	1 Hr & 30 Minutes	15
External Theory End Semester	100%	3 Hrs	60

External End Semester Theory Examination will have two sections (A & B) {Total marks 60}

Section A : Four short answer questions representing all units/syllabi i.e., one question from each unit. Each question shall be of 3 marks.

Section B: Eight long answer questions (Four to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 12 marks.

Internal Assessment {Total marks 15}

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

Recommended Readings

1. Ganga, G., (2003) Comprehensive Sericulture- Vol.-1 Moriculture, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Shamsuddin, Md. (2009) Silkworm Physiology- A Concise Textbook. Daya Publishing House, Delhi.
4. Jaswal, K., Trivedi, P.S., Pandey, B.N. and Khatri, R.K. (2009) Moriculture. APH Publishing Corporation, New Delhi.
5. Anathanarayanan, S.K. (2008) Silkworm Rearing. Biotech Books, New Delhi.
6. Patnaik, R.K. (2008) Sericulture Manual. Biotech Books, New Delhi.
7. Patnaik, R.K. (2008) Mulberry for Animal Production. Biotech Books, Delhi.
8. Dandin, S.B., Jayaswal, J. and Giridhar, K., Handbook of Sericulture Technologies. Central Silk Board, Bangalore.
9. Rajanna, L., Das, P.K., Ravindran, S., Bhogेशa, K., Mishra, R.K., Singhvi, N.R., Katiyar, R.S. and Jayasan, H. (Ed. 2005) Mulberry Cultivation and Physiology. Central Silk Board, Bangalore.
10. Ullal, S.R., Narasimhanna, M.N. (Ed. 1994) Handbook of Practical Sericulture. Central Silk Board, Bangalore.
11. Rajan, R.K., and Himantharaj, M.T. (Ed. 2005) Silkworm Rearing Technology. Central Silk Board, Bangalore.
12. Aruga, H. Principles of Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Bombay and Calcutta.

13. Narasiah, M. Laxmi, R. and Raya, G (1999) Development of Sericulture. Discovery Publishing House, New Delhi.
14. Kamili, A.S. and Masoodi, A.M. (2004). Principles of Temperate Sericulture. Kalyani Publishers, New Delhi-110002.
15. Singh, Tribhuwan and Sarachandra, Beera (Ed. 2004) Principles and Techniques of Silkworm Seed Production. Discovery Publishing House, New Delhi.
16. Ganga, G. and Chetty, S. (2008) An Introduction to Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

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(For the Examination to be held in Year May- 2023, 2024 & 2025)

(SKILL ENHANCEMENT COURSE)

UG SEMESTER-II

SKILL ENHANCEMENT COURSE NO.	:	USESET204
SKILL ENHANCEMENT COURSE TITLE	:	SILK REELING TECHNOLOGY
CREDIT	:	02
MAXIMUM MARKS	:	50
I) External (University Exam)	:	40
II) Internal Assessment	:	10
DURATION OF UNIVERSITY EXAM	:	02 Hours

Objectives and Expected Learning Outcomes

The objective of the course is to introduce general aspects of silk reeling covering the knowledge about textile fibre, cocoon stifling, cooking, reeling and reeling. After completing this course the learners will be able to understand the important processes involved in silk reeling.

UNIT-I

(7 Hrs.)

- 1.1. Introduction and classification of textile fibers.
- 1.2. Cocoons: Physical and commercial properties of cocoons.
- 1.3. Influence of cocoon quality on reeling and raw silk production.
- 1.4. Different types of defective cocoons, cocoon sorting method effect of defective cocoons in the reeling
- 1.5. Physical and chemical properties of silk.

Unit-II

(8 Hrs.)

- 2.1. Cocoon Stifling: Objectives, Different stifling methods
- 2.2. Cocoon Cooking: Objectives, Different cooking methods
- 2.3. Cocoon brushing: Importance of brushing, different devices for brushing, hand brushing-mechanical brushing.
- 2.4. Silk Reeling: Objectives, reeling machines-Charka, cottage basin. Multiend.
- 2.5. Re-reeling and Finishing

Unit-III

(30 Hrs.)

- 3.1. Identification of textile fibers by physical and chemical test, microscopic examinations, flame tests and solubility test for polyester, cotton and silk.
- 3.2. Identification of defective cocoon and their percentage in a lot of cocoon, determination of shell ratio of good cocoons.
- 3.3. Processing of seed cocoons, deflossing, sorting, selection of good cocoons, assessment of good cocoon, pupal examination.
- 3.4. Study of cottage, multiend silk reeling machines, practical demonstration, visit to filature

NOTE FOR PAPER SETTERS

Total Marks of the USESET204 is 50 of which 20% marks shall be reserved for internal assessment (10 marks). Remaining 80% of the marks (40 marks) shall be reserved for external examination to be conducted by the University/Colleges.

Internal Assessment Test (10 Marks)

Internal Assessment Paper of 10 Marks shall consist of Theory Question/s of 5 Marks from Unit I/II and 5 Marks of Practical Exercise from Unit III.

External End semester University / College Examination

External Theory Exam shall be of 40 Marks and consist of 2 sections:

Section A: Four (4) short answer questions representing all Units/Syllabi i.e., atleast one question from each unit. Each question shall be of 2.5 marks (All Compulsory)

Section B: Six (6) long answer questions (Three to be attempted) representing whole of the syllabi i.e., two questions from each unit. Each question shall be of 10 marks

Recommended Readings

1. Ganga, G. and Chetty, S. (2008) An Introduction to Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G., (2003) Comprehensive Sericulture- Vol.-2 Silkworm Rearing and Silk Reeling. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Kamili, A.S. and Masoodi, A.M. (2004). Principles of Temperate Sericulture. Kalyani Publishers, New Delhi-110002.
4. Patnaik, R.K. (2008) Sericulture Manual. Biotech Books, New Delhi.
5. Dandin, S.B., Jayaswal, J. and Giridhar, K., Handbook of Sericulture Technologies. Central Silk Board, Bangalore.
6. Ullal, S.R., Narasimhanna, M.N. (Ed. 1994) Handbook of Practical Sericulture. Central Silk Board, Bangalore.
7. Goel, R.K. Laboratory techniques in Sericulture. Central Silk Board, Bangalore.
8. Mahadevappa, D. Halliyal, V.G. *et. al.*, (2000) Mulberry Silk Reeling Technology. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
9. Sonwalker, T.N. (2001) Hand Book of Silk Technology. New Age International (P) limited, New Delhi and Mumbai.