

University of Agricultural Sciences, Bengaluru



Course Curriculum

(As per V Deans' Committee's Recommendations)

B.Sc.(Sericulture)

Degree Programme

College of Sericulture, Chintamani – 563 125

2016

University of Agricultural Sciences, Bengaluru

B.Sc. (Sericulture)

CONTENTS

| Sl. No. | Particulars | Page No. |
|----------------|---|-----------------|
| 1 | Semester-Wise Allocation of Courses | |
| 2 | Basic Sciences and Humanities | |
| 3 | Agricultural and Allied Subjects | |
| 4 | Sericultural Courses | |
| 5 | Rural Sericultural Work Experience | |
| 6 | Experiential Learning/Hands on Training | |

University of Agricultural Sciences, Bengaluru

B.Sc. (Sericulture)

| Sl. No. | Course No. | Course Title | Cr. Hrs. | Page No. |
|--------------------------------------|-------------------------|---|--------------|----------|
| 1 | 2 | 3 | 4 | 5 |
| Basic Sciences and Humanities | | | | |
| 1. | BCM. 111 | Plant Biochemistry | 1+1 | |
| 2. | CSC. 111 | Computer Science & Agri - Informatics | 1+1 | |
| 3. | ENG. 111 | Comprehension & Communication Skills in English | 1+1 | |
| 4. | AST. 221 | Agricultural Statistics | 2+1 | |
| 5. | PED. 111* | Physical Education & Yoga Practices | 0+1 | |
| 6. | NSS. 111* | National Service Scheme | 0+1 | |
| 7. | KAN. 111 / KAN. 112* | Kannada - I | 0+1 | |
| 8. | KAN. 121 / KAN. 122* | Kannada - II | 0+1 | |
| Total | | | 5+4=9 | |

* Non-gradila courses

Note: 1. PED. 111 (0+1) Spread over for one year

2. NSS. 111 (0+1) Spread over for two years

AGRICULTURAL AND ALIIED SUBJECTS

AGRONOMY

| | | | |
|--------------|----------|---|---------------|
| 1. | AGR. 111 | Fundamentals of Agronomy | 2+1 |
| 2. | AGR. 121 | Water Management | 1+1 |
| 3. | AGR. 122 | Introductory Agrometeorology & Climate Change | 1+1 |
| 4. | AGR. 321 | Farming System, Organic Farming and Precision Agriculture | 2+1 |
| 5. | AGR. 322 | Rainfed Agriculture & Watershed Management | 1+1 |
| Total | | | 7+5=12 |

AGRICULTURAL ECONOMICS

| | | | |
|--------------|----------|--|--------------|
| 1. | AEC. 111 | Fundamentals of Agricultural Economics | 2+0 |
| 2. | AEC. 312 | Seri Business Management | 1+1 |
| 3. | AEC. 321 | Farm Management, Production and Resource Economics | 1+1 |
| Total | | | 4+2=6 |

AGRICULTURAL ENGINEERING

| | | | |
|--------------|----------|---|--------------|
| 1. | AEG. 211 | Farm Machinery and Power | 1+1 |
| 2. | AEG. 221 | Renewable Energy and Green Technology | 1+1 |
| 3. | AEG. 222 | Management of Sericultural Machineries and Equipments | 0+1 |
| Total | | | 2+3=5 |

AGRICULTURAL ENTOMOLOGY

| | | | |
|--------------|----------|---|--------------|
| 1. | AET. 121 | Fundamentals of Entomology | 2+1 |
| 2. | AET. 211 | Insect Ecology, Principle of Integrated Pest Management and Natural Enemies | 2+1 |
| 3. | AET. 321 | Pests of Host Plants of Silkworm and their Management | 1+1 |
| Total | | | 5+3=8 |

AGRICULTURAL EXTENSION

| | | | |
|--------------|----------|--|--------------|
| 1. | AEX. 111 | Rural Sociology, Educational Psychology and Constitution of India | 0+2 |
| 2. | AEX. 121 | Fundamentals of Agricultural Extension Education and Rural Development | 1+1 |
| 3. | AEX. 211 | Communication and Diffusion of Agricultural Innovations | 1+1 |
| 4. | AEX. 321 | Entrepreneurship Development and Business Communication | 1+1 |
| Total | | | 3+5=8 |

AGRICULTURAL MICROBIOLOGY

| | | | |
|--------------|----------|-------------------------------|--------------|
| 1. | AMB. 111 | Fundamentals of Microbiology | 1+1 |
| 2. | AMB. 221 | Soil and Applied Microbiology | 1+1 |
| Total | | | 2+2=4 |

ANIMAL SCIENCE

| | | | |
|--------------|----------|---|--------------|
| 1. | ASC. 311 | Livestock, Poultry and Fish Production Management | 2+1 |
| Total | | | 2+1=3 |

APICULTURE

| | | | |
|--------------|-----------|----------------------------|--------------|
| 1. | API. 311* | Introduction to Apiculture | 1+1 |
| Total | | | 1+1=2 |

*To be offered by faculty of respective Department from CoA, GKVK

CROP PHYSIOLOGY

| | | | |
|--------------|----------|---------------------------------|--------------|
| 1. | CPH. 211 | Fundamentals of Crop Physiology | 2+1 |
| 2. | CPH. 222 | Nanotechnology in Agriculture | 0+1 |
| Total | | | 2+2=4 |

FOOD SCIENCE AND NUTRITION

| | | | |
|--------------|----------|--|--------------|
| 1. | FSN. 111 | Principles of Food Science & Nutrition | 2+0 |
| Total | | | 2+0=2 |

FORESTRY AND ENVIRONMENTAL SCIENCE

| | | | |
|--------------|----------|---|--------------|
| 1. | FES. 111 | Introduction to Forestry | 1+1 |
| 2. | FES. 221 | Environmental Studies & Disaster Management | 2+0 |
| Total | | | 3+1=4 |

GENETICS AND PLANT BREEDING

| | | | |
|--------------|----------|------------------------------|--------------|
| 1. | GPB. 211 | Fundamentals of Genetics | 1+1 |
| 2. | GPB. 321 | Intellectual Property Rights | 1+0 |
| Total | | | 2+1=3 |

HORTICULTURE

| | | | |
|--------------|----------|--|--------------|
| 1. | HRT. 122 | Fundamentals and Production Technology of Horticulture Crops | 2+1 |
| Total | | | 2+1=3 |

PLANT BIOTECHNOLOGY

| | | | |
|--------------|----------|-------------------------------------|--------------|
| 1. | PBT. 121 | Fundamentals of Plant Biotechnology | 2+1 |
| Total | | | 2+1=3 |

PLANT PATHOLOGY

| | | | |
|--------------|----------|---|--------------|
| 1. | PAT. 211 | Fundamentals of Plant Pathology | 2+1 |
| 2. | PAT. 222 | Diseases of Host Plants of Silkworms and Management | 1+1 |
| Total | | | 3+2=5 |

SEED SCIENCE & TECHNOLOGY

| | | | |
|--------------|----------|---|--------------|
| 1. | SST. 221 | Seed Production, Principles and Methods | 1+1 |
| Total | | | 1+1=2 |

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

| | | | |
|--------------|----------|--|--------------|
| 1. | SAC. 121 | Fundamentals of Soil Science | 2+1 |
| 2. | SAC. 311 | Problematic Soils and their Management, Geoinformatics | 1+1 |
| 3. | SAC. 321 | Manures, Fertilizers and Soil Fertility Management | 2+1 |
| Total | | | 5+3=8 |

SERICULTURAL COURSES

HOST PLANT PRODUCTION (HPP)

| | | | |
|--------------|----------|--|--------------|
| 1. | HPP. 121 | Cultivation of Host Plants of Silkworms | 1+1 |
| 2. | HPP. 221 | Mulberry Production and Management | 0+1 |
| 3. | HPP. 311 | Experimental Techniques in Sericultural Research | 1+1 |
| Total | | | 2+3=5 |

SERICULTURE CROP IMPROVEMENT (SCI)

| | | | |
|--------------|---------|---|---------------|
| 1. | SCI 121 | Botany and Cytology of Host Plants of Silkworms | 1+1 |
| 2. | SCI 211 | Genetics and Breeding of Host Plants of Silkworms | 2+1 |
| 3. | SCI 221 | Cytology and Genetics of Silkworms | 2+0 |
| 4. | SCI 311 | Seri Biotechnology | 2+1 |
| 5. | SCI 321 | Silkworm Breeding | 2+1 |
| Total | | | 9+4=13 |

COCOON CROP PRODUCTION (CCP)

| | | | |
|--------------|---------|---|----------------|
| 1. | CCP 111 | History, Development and Organization of Sericulture Industry | 1+0 |
| 2. | CCP 211 | Morphology and Systematics of Silkworms | 1+1 |
| 3. | CCP 212 | Mulberry Silkworm Rearing | 2+1 |
| 4. | CCP 221 | Silkworm Anatomy and Physiology | 1+1 |
| 5. | CCP 222 | Pests of Silkworms and Management | 1+1 |
| 6. | CCP 223 | Vanya Sericulture | 1+1 |
| 7. | CCP 311 | Silkworm Seed Technology | 2+1 |
| 8. | CCP 312 | Diseases of Silkworms and Management | 2+1 |
| 9. | CCP 322 | Bivoltine Sericulture | 0+1 |
| Total | | | 11+8=19 |

SILK PRODUCT SCIENCE (SPS)

| | | | |
|--------------|---------|-----------------------------------|--------------|
| 1. | SPS 211 | Physics and Chemistry of Fibres | 1+0 |
| 2. | SPS 311 | Raw Silk Technology | 2+1 |
| 3. | SPS 312 | Spun Silk Technology | 0+1 |
| 4. | SPS 322 | Silk Throwing, Dyeing and Weaving | 0+2 |
| 5. | SPS 323 | Apparels in Sericulture Industry | 0+1 |
| Total | | | 3+5=8 |

RURAL SERICULTURAL WORK EXPERIENCE

| | | | |
|--------------|------|------------------------------------|----------------|
| 1. | RSWE | Rural Sericultural Work Experience | 0+20 |
| Total | | | 0+20=20 |

EL/HoT-Experiential Learning/Hands on Training

| | | | |
|--------------|---------|--|----------------------------|
| 1. | SER 421 | Agri and Seri Clinic | 0+10 |
| 2. | SER 422 | Bivoltine Silkworm Rearing Technology | 0+10 |
| 3. | SER 423 | Chawki Rearing Technology | 0+10 |
| 4. | SER 424 | Value Addition to Mulberry/ Grainage and Rearing By-products | 0+10 |
| 5. | SER 425 | Grainage Technology | 0+10 |
| 6. | SER 426 | Commercial cocoon & Seed Cocoon Production Technology | 0+10 |
| 7. | SER 427 | Entrepreneurship Development in Post Silk Technology | 0+10 |
| 8. | SER 428 | Consultancy and Project Formulation in Sericulture Industry | 0+10 |
| 9. | SER 429 | Bio-Craft Technology | 0+10 |
| Total | | | 0 + 10 × 2 = 0 + 20 |

ABSTRACT

| | |
|--|---------------------------------|
| Basic Sciences and Humanities | 5+4 |
| Agricultural and Allied Subjects | 49+33 |
| Sericultural Courses | 25+20 |
| Student "READY" Programme | |
| • RSWE- Rural Sericultural Work Experience | 0+20 |
| • EL/HoT-Experiential Learning/Hands on Training | 0+20 |
| Non Gradial Courses | |
| • Physical Education | 0+1 |
| • NSS | 0+1 |
| • Kannada | 0+2 |
| • Educational Tour | 0+1 |
| • Remedial Courses | 2(1+2)/(2+0) |
| Grand Total | (9+82+45+20+20+7*) = 183 |

*Non-gradial Courses

SEMESTER-WISE ALLOCATION OF COURSES

| I Year I Semester | | | I Year II Semester | | |
|-------------------|---|-----------|--------------------|--|-----------|
| Course No. | Course Title | Cr. hrs | Course No. | Course Title | Cr. hrs |
| AEC 111 | Fundamentals of Agricultural Economics | 2+0 | AGR 121 | Water Management | 1+1 |
| AGR 111 | Fundamentals of Agronomy | 2+1 | AGR 122 | Introductory Agro meterology & Climate Change | 1+1 |
| AMB 111 | Fundamentals of Microbiology | 1+1 | AET 121 | Fundamentals of Entomology | 2+1 |
| BCM 111 | Plant Biochemistry | 1+1 | AEX 121 | Fundamentals of Agricultural Extension Education and Rural Development | 1+1 |
| CSC 111 | Computer Science and Agri-informatics | 1+1 | SAC 121 | Fundamentals of Soil Science | 2+1 |
| ENG 111 | Comprehensive & Communication Skills in English | 1+1 | PBT 121 | Fundamentals of Plant Biotechnology | 2+1 |
| FES 111 | Introduction to Forestry | 1+1 | HRT 122 | Fundamentals and Production Technology of Horticulture Crops | 2+1 |
| FSN 111 | Principles of Food Science & Nutrition | 2+0 | SCI 121 | Botany and Cytology of Host Plants of Silkworms | 1+1 |
| CCP 111 | History, Development & Organisation of Sericulture Industry | 1+0 | HPP 121 | Cultivation of Host Plants of Silkworms | 1+1 |
| AEX 111 | Rural Sociology, Education Psychology and Constitution of India | 0+2 | KAN 121 /122 | Kannada-II* | 0+1 |
| NSS 111 | National Service Scheme* | 0+1 | PED | Physical Education & Yoga Practices\$ | 0+1 |
| PED 111 | Physical Education & Yoga Practices\$ | 0+1 | NSS | National Service Scheme * | 0+1 |
| KAN 111 / 112 | Kannada-I* | 0+1 | Total | | 22 |
| BIO 111 | Introductory Biology # | 1+1 | | | |
| MAT 111 | Elementary Mathematics # | 2+0 | | | |
| Total | | 20 | | | |

Remedial Courses (either of one), *Spread over in first four Semesters

**Compulsory Non-gradual course, \$Spread over in first two semesters

| II Year I Semester | | | II Year II Semester | | |
|--------------------|---|-----------|---------------------|---|-----------|
| Course No. | Course Title | Cr. hrs | Course No. | Course Title | Cr. hrs |
| AET 211 | Insect Ecology, Principles of Pest Management and Natural Enemies | 2+1 | AEG 221 | Renewable Energy and Green Technology | 1+1 |
| AEG 211 | Farm Machinery and Power | 1+1 | AMB 221 | Soil and Applied Microbiology | 1+1 |
| AEX 211 | Communication and Diffusion of Agricultural Innovations | 1+1 | AST 221 | Agricultural Statistics | 2+1 |
| CPH 211 | Fundamentals of Crop Physiology | 2+1 | FES 221 | Environmental studies and Disaster Management | 2+0 |
| GPB 211 | Fundamentals of Genetics | 1+1 | PAT 222 | Diseases of Host Plants of Silkworms and Management | 1+1 |
| PAT 211 | Fundamentals of Plant Pathology | 2+1 | SST 221 | Seed Production, Principles and Methods | 1+1 |
| SCI 211 | Genetics and Breeding of Host Plants of Silkworms | 2+1 | SCI 221 | Cytology and Genetics of Silkworms | 2+0 |
| SPS 211 | Physics and Chemistry of Fibres | 1+0 | CCP 221 | Silkworm Anatomy and Physiology | 1+1 |
| CCP 211 | Morphology and Systematics of Silkworm | 1+1 | CCP 222 | Pests of Silkworms and Management | 1+1 |
| CCP 212 | Mulberry Silkworm Rearing | 2+1 | AEG 222 | Management of Sericultural Machineries and Equipments | 0+1 |
| NSS | National Service Scheme * | 0+1 | HPP 221 | Mulberry Production and Management | 0+1 |
| Total | | 24 | CPH 222 | Nanotechnology in Agriculture | 0+1 |
| | | | NSS | National Service Scheme* | 0+1 |
| | | | Total | | 22 |

| III Year I Semester | | | III Year II Semester | | |
|---------------------|---|-----------|----------------------|--|-----------|
| Course No. | Course Title | Cr. hrs | Course No. | Course Title | Cr. hrs |
| API 311 | Introduction to Apiculture | 1+1 | AGR 321 | Farming Systems, Organic Farming and Precision Agriculture | 2+1 |
| ASC 311 | Livestock, Poultry & Fish Production Management | 2+1 | AGR 322 | Rainfed Agriculture and Watershed Management | 1+1 |
| AEC 312 | Seri Business Management | 1+1 | AEC 321 | Farm Management, Production and Resource Economics | 1+1 |
| SAC 311 | Problematic Soils and their Management & Geoinformatics | 1+1 | AET 321 | Pests of Host Plants of Silkworm and their Management | 1+1 |
| SCI 311 | Seri Biotechnology | 2+1 | AEX 321 | Entrepreneurship Development and Business Communication | 1+1 |
| CCP 311 | Silkworm Seed Technology | 2+1 | GPB 321 | Intellectual Property Rights | 1+0 |
| CCP 312 | Diseases of Silkworms and Management | 2+1 | SAC 321 | Manures, Fertilizers and Soil Fertility Management | 2+1 |
| CCP 313 | Vanya Sericulture | 1+1 | SCI 321 | Silkworm Breeding | 2+1 |
| SPS 311 | Raw Silk Technology | 2+1 | HPP 321 | Experimental Technique in Sericultural Research | 1+1 |
| SPS 312 | Spun Silk Technology | 0+1 | CCP 321 | Bivoltine Sericulture | 0+1 |
| EDT 311 | Educational Tour [#] | 0+1 | SPS 321 | Silk Throwing, Dyeing and Weaving | 0+2 |
| Total | | 24 | SPS 322 | Apparels in Sericulture Industry | 0+1 |
| | | | Total | | 24 |

| IV Year I Semester | | | IV Year II Semester | | |
|--------------------|------------------------------------|-----------|---------------------|--|-----------|
| Course No. | Course Title | Cr. hrs | Course No. | Course Title | Cr. hrs |
| RSWE | Rural Sericultural Work Experience | 0+20 | SER 421 | Agri and Seri Clinic | 0+10 |
| Total | | 20 | SER 422 | Bivoltine Silkworm Rearing Technology | 0+10 |
| | | | SER 423 | Chawki Rearing Technology | 0+10 |
| | | | SER 424 | Value addition to Mulberry, Grainage and Rearing By-products | 0+10 |
| | | | SER 425 | Grainage Technology | 0+10 |
| | | | SER 426 | Commercial Cocoon / Seed Cocoon Production Technology | 0+10 |
| | | | SER 427 | Entrepreneurship Development in Post Silk Technology | 0+10 |
| | | | SER 428 | Consultancy and Project Formulation in Sericulture Industry | 0+10 |
| | | | SER 429 | Bio-Craft Technology | 0+10 |
| | | | Total | | 20 |

Note: Students should register any two of the modules, each carrying 10 cr. hrs.

BASIC SCIENCES AND HUMANITIES

BCM. 111

Plant Biochemistry

1+1

Theory: Biochemistry- Introduction and importance, Plant cell- Structure and organellar functions. Biomolecules–Structure, properties and reactions: amino acids, peptides and proteins, lipids, carbohydrates, nucleotides and nucleic acids. Enzymes- Factors affecting the activities, classifications, immobilization and other industrial applications. Metabolism – Basic concepts. glycolysis, citric acid cycle, pentose phosphate pathway, β -oxidation of fatty acids, electron transport and oxidative phosphorylation. General reactions of amino acids degradation. Metabolic regulation. Secondary metabolites- terpenoids, alkaloids, phenolics.

Practical: Protein denaturation- heat, pH, precipitation of proteins with heavy metals, Estimation of crude protein, Estimation of protein by Lowry method, Enzymes assays; Extraction of nucleic acids; Extraction of oil from oil seeds; Estimation of crude fat, Estimation of iodine number and saponification value of an oil, Quantitative and qualitative determination of sugars, Paper chromatography for the separation of sugars, Determination of phenols, chlorophyll and ascorbic acid.

CSC. 111

Computer Science & Agri – Informatics

1+1

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

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. 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.

Practical: Introduction of different operating systems such as DOS and WINDOWS. Creating Files & Folders. Introduction of programming languages. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Demonstration of HTML page design of e-Agriculture. Omics database of NCBI searching and accessing genome sequences and protein sequences, alignment of two genome sequences and alignment of two protein sequences.

ENG. 111

Comprehension and Communication Skills in English

1+1

Theory: Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Writing Skills: Paragraph writing, Précis writing, Report writing, Proposal writing and Letter Writing. Interview Skills. Resume/CV Preparation and Job applications. Synopsis Writing.

Practical: Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Presentation skills and Public speaking. Reading skills: Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; Group discussion.

AST. 221

Agricultural Statistics

2+1

Theory: Introduction to Statistics and its Applications in Agriculture, 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, Quartiles, Deciles & Percentiles (both for Ungrouped and Grouped data), Geometric Mean and Harmonic Mean (Ungrouped data). Measures of Dispersion: Concepts & Definition, Types of Measures of Dispersion: Range, Quartile deviation, Absolute Mean Deviation from mean and median, Standard Deviation and Variance, and Co-efficient of

dispersion (both for Ungrouped and Grouped data). Moments, Measures of Skewness and Kurtosis (both for Ungrouped and Grouped data). Concept of Set Theory: Permutation & Combinations. Theory: of Probability: Concept & Definition, Addition and Multiplication rules (without proof). Theoretical Probability distributions: Binomial, Poisson and Normal Distribution, their Properties & Applications.

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.

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.

Test of Significance: Introduction, Null & Alternative hypothesis, Types of Errors, Level of significance, degrees of freedom, Critical & Acceptance regions. Large sample tests: 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, Test for independence of attributes for $r \times c$ contingency table, 2×2 contingency table with Yates correction, and test for single population variance.

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, Basic Designs: CRD, RCBD and LSD, their advantages and disadvantages.

Practical: 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, Quartiles, Deciles & Percentiles (both for Ungrouped and Grouped data), Geometric Mean and Harmonic Mean (Ungrouped data). 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). Computation of Moments, Measures of Skewness and Kurtosis (both for Ungrouped and Grouped data), Problems on permutation and combination. Problems on Simple Probability, Addition and Multiplication rules. Computation of probabilities using Binomial, Poisson and Normal Distributions. Computation of Correlation Coefficient: Karl Pearson product moment and Spearman's rank correlation coefficients. Fitting of Simple linear Regression Equations Y on X, & X on Y. Use of Random Number Tables for selection of Simple Random Sample. 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, Test for independence of attributes for $r \times c$ contingency table, 2×2 contingency table with Yates correction and test for single population variance. Problems on Analysis of Variance for One & Two Way Classified data. Problems on CRD, RCBD and LSD.

PED. 111

Physical Education & Yoga Practices

0+1

PART I

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Badminton)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Badminton)
3. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
4. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
6. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation

8. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
9. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
11. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Badminton and Volleyball).

PART II

1. Teaching of skills of Hockey – demonstration practice of the skills and correction.
2. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
3. Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
4. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
5. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation
6. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
7. Teaching of different track events – demonstration practice of the skills and correction.
8. Teaching of different track events – demonstration practice of the skills and correction.
9. Teaching of different track events – demonstration practice of the skills and correction with competition among them.
10. Teaching of different field events – demonstration practice of the skills and correction.
11. Teaching of different field events – demonstration practice of the skills and correction.
12. Teaching of different field events – demonstration practice of the skills and correction.
13. Teaching of different field events – demonstration practice of the skills and correction with competition among them.
14. Teaching of different asanas – demonstration practice and correction.
15. Teaching of different asanas – demonstration practice and correction.
16. Teaching of different asanas – demonstration practice and correction.
17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of weight training – demonstration practice and correction.
19. Teaching of circuit training – demonstration practice and correction.
20. Teaching of calisthenics – demonstration practice and correction.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants)

2) The games mentioned in the practical may be inter changed depending on the season and facilities

PART I

Introduction and basic components of NSS : Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health.

NSS programmes and activities: Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary.

Understanding youth: Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.

Community mobilization: Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership.

Social harmony and national integration: Indian history and culture, role of youth in nation building, conflict resolution and peace-building.

Volunteerism and shramdan: Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism.

Citizenship, constitution, human rights, human values and ethics: Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information, human values and ethics.

Family and society: Concept of family, community (PRIs and other community based organisations) and society.

PART II

Importance and role of youth leadership: Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies: Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes: Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation: Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid: Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga: History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

PART III

Vocational skill development: To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment: Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management: Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development: Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project: Planning, implementation, management and impact assessment of project

Documentation and data reporting: Collection and analysis of data, documentation and dissemination of project reports

PART IV

Youth and crime: Sociological and psychological factors influencing youth crime, cyber crime, peer mentoring in preventing crime and awareness for juvenile justice

Civil/self defence: Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilization: Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills: Positive thinking, self-confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ

ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ

KAN. 111

0+1

ಅ. ಕಾವ್ಯ – ಕಥೆ

ಜನಪದ ಗೀತೆಗಳು-ಜನಪದರು; ಶರಣರ ವಚನಗಳು-ಜೇಡರದಾಸಿಮಯ್ಯ, ಬಸವಣ್ಣ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ; ಹೊಸ ಬಾಳಿನ ಗೀತೆ – ಕುವೆಂಪು; ತಿಳಿದವರೇ ಹೇಳಿ – ವೈದೇಹಿ; ಜೀತ – ಡಾ|| ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ; ಒಂದು ಖಾಸಗಿ ಪತ್ರ – ವಿನಯಾ ಒಕ್ಕಂದ.

ಆ. ಕೃಷಿ ಬರಹ

ಆಧುನಿಕ ಪೂರ್ವ ಕನ್ನಡ ಕೃಷಿ ಸಾಹಿತ್ಯ ಪರಿಚಯ – ಡಾ||ಜಿ.ವೀರಭದ್ರಗೌಡ, ಕನ್ನಡದಲ್ಲಿ ಕೃಷಿವಿಜ್ಞಾನ ಸಾಹಿತ್ಯದ ಉಗಮ ಮತ್ತು ವಿಕಾಸ – ಡಾ|| ಜೆ. ಬಾಲಕೃಷ್ಣ, ಎಲ್ ಫಾರ್ ಲೈನ್ ಅಲ್ಲ: ಲಕ್ಷ್ಮಣಯ್ಯ – ಡಾ|| ಟಿ.ಎಸ್. ಚನ್ನೇಶ್, ಅಹಾರವೆಂಬ ಅಯುಧ – ನಾಗೇಶ ಹೆಗಡೆ.

ಇ. ಪ್ರಾಯೋಗಿಕ

ಅನುವಾದ, ಪಾರಿಭಾಷಿಕ ಪದರಚನೆಯ ವಿಧಾನಗಳು.

ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ / **For Non Kannada Speaking Students**

KAN. 112

0+1

Development of listening and speaking skills with Kannada structure pattern – Introducing each other – Conversation between friends – Enquiring about family – Plan to go for a movie – Routine activities of a student – In a book shop – Introducing College / University – Conversation between a farmer and a Scientist – Data collection in a village – Conversation on going on a tour.

Development of writing and reading skills with Kannada structure pattern – Kannada Script practice and reading.

ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ

KAN. 121

0+1

ಅ. ಕಾವ್ಯ - ಕಥೆ - ಜನಪದ - ಸಂಸ್ಕೃತಿ ಮತ್ತು ಕನ್ನಡ ಪ್ರಜ್ಞೆ - ಸಂಕೀರ್ಣ

ಬೇವಿನಹಟ್ಟಿ ಕಾಳಮ್ಮನ ಸಾಲು - ಜನಪದ, ಗೋವಿನ ಹಾಡು - ಜನಪದ, ಕರ್ನಾಟಕ ಜಾನಪದ ಲೋಕದೃಷ್ಟಿ - ಪುರುಷೋತ್ತಮ ಬಿಳಿಮಲೆ, ಕೆರೆಗೆ ಹಾರ - ಜನಪದ, ನೇರಂಬ ಜೀವ ದ್ರವ - ಜಿ. ಬಾಲಾಕೃಷ್ಣ, ಸೂಫಿ ಕತೆಗಳು, ಕನ್ನಡದ ಶುದ್ಧತೆ - ಕೆ.ವಿ. ನಾರಾಯಣ, ವಚನಕಾರರು ಮತ್ತು ಭಾಷೆ, ಕದಂಬರ ಕನ್ನಡ ಲಿಪಿ - ಷ. ಶೆಟ್ಟರ್, ಅವನತಿ - ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ, ಇಲ್ಲಿ ಯಾರೂ ಮುಖ್ಯರಲ್ಲ, ಯಾರೂ ಅಮುಖ್ಯರಲ್ಲ... - ಕೃಪಾಕರ ಸೆನಾನಿ, ಕೃಷಿ ಗಾದೆಗಳು - ಜನಪದ, ಕೃಷಿ ಗಾದೆಗಳ ಅವಲೋಕನ - ಜಿ. ವೀರಭದ್ರಗೌಡ.

ಈ. ಪ್ರಾಯೋಗಿಕ

ಕನ್ನಡದಲ್ಲಿ ಕೃಷಿ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳು ಮತ್ತು ಅವುಗಳ ರಚನಾ ಸ್ವರೂಪ; ವ್ಯವಹಾರ ಕನ್ನಡ - ಪತ್ರಲೇಖ.

ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ / For Non Kannada Speaking Students

KAN. 122

0+1

Development of listening and speaking skills with Kannada structure pattern – Conversation between a Doctor and a Patient; About Children’s Education; Halebid – Belur; Discussing about Examination and Future Plan.

Development of writing and reading skills with Kannada structure pattern: Translation of simple sentences English into Kannada, Selected lesson for reading (Nada Geete, Kannada Habbagalu, Prekshaniya Sthalagalalu, Kannada Kavi, Kannada Vignani).

REMEDIAL COURSES

BIO 111

Introductory Biology

1+1

Theory: Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division. Morphology of flowering plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical : Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

MAT 111

Elementary Mathematics

2+0

Theory : Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$. Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it). Integral Calculus : Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it). Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

AGRICULTURAL AND ALLIED SUBJECTS

AGRONOMY

AGR. 111

Fundamentals of Agronomy

2+1

Theory: Agronomy and its scope, Agriculture as an art, science and business of crop production, Factors affecting crop production, History of agriculture development in India and Karnataka, Importance and scope of agriculture, classification of crops, Seeds and sowing, Soil and its components, properties, fertility and productivity and their management, Tillage and tilling, Crop density and geometry, Crop nutrition - manures and fertilizers, nutrient use efficiency, Growth and development of crops, ideotypes, Crop systems and its principles, Crop adaptation and distribution, crop management technologies in problematic areas, Harvesting and threshing of crops. Weeds-importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

Practical: Identification of crops, seeds and fertilizers, Classification of field crops, tillage implements, Study of different methods of ploughing, Study of different methods of sowing, Study of seed drills, intercultural implements, Study of fertilizers, manures and green manures, Calculation of fertilizers and seed rates, Study on seed germination and plant population, Preparation of FYM and compost, Participation in ongoing field operations, Study of agro-climatic zones of Karnataka and India. Study and identification of dry land and waste land weeds. Study and identification of garden land, wet land and aquatic weeds. Calculation of herbicide doses and their spray.

AGR. 121

Water Management

1+1

Theory: Definition of irrigation, water resources; soil water relations; Basic terms in water management and irrigation. Study of soil moisture constant and hydrodynamic relation. Measurement of soil moisture-direct and indirect methods; Expression of soil moisture and their mutual relations, Plant water relationship –critical stages. Meaning and impact of water stress, water availability and its relationship with nutrient availability and losses. Water management of crops – its definition, meaning, measurement and relevance in crop production, concept of evapotranspiration and its management, factors affecting water management, study of water requirement of field and horticultural crops, methods of irrigation – surface, subsurface, sprinkler and drip, constraints and advantages of different methods. Efficiency of irrigation and methods to measure them, Quantitative estimation of irrigation water – direct and indirect methods, Expression of flowing water and mutual relations, Concept of water use efficiency and methods to improve water use efficiency, Assessment of irrigation requirement, Scheduling of irrigation –Approaches and methods, Suitability of water for irrigation, Concept of drainage and methods.

Practical: Soil moisture determination by direct and indirect methods, Study and installation of tensiometer and soil moisture gauges, Determination of maximum water holding capacity, field capacity, permanent wilting point and bulk density, Determination of infiltration rate and capillarity in soil, Study of methods of flow measurement, use of weirs, orifices, Parshall flume and water meters, Surface & sub-surface irrigation methods, Micro irrigation methods, Water requirement of different crops, On-farm irrigation structures, Drainage structures, Practice of numerical examples.

AGR. 122

Introductory Agro-meteorology & Climate Change

1+1

Theory: Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting-types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture and mitigation strategies

Practical: Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of windrose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

AGR. 321 Farming Systems, Organic Farming and Precision Agriculture 2+1

Theory: Farming System-scope, importance and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit to IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field. Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products. Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture.

Practical: Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

AGR. 322 Rainfed Agriculture and Watershed Management 1+1

Theory: Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical: Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

AGRICULTURAL ECONOMICS

AEC. 111

Fundamentals of Agricultural Economics

2+0

Theory: *Economics:* Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic Theory: ; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. **Technical change and types,** Agricultural planning and development in the country. **Land reforms: meaning of land tenure, land tenancy, land reform measures – abolition of intermediaries, tenancy reforms, fixation of ceiling on land holdings, consolidation of holdings, development of cooperative farming. Agricultural labour and farm mechanization.** Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility Theory: law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Production: process, creation of utility, factors of production, laws of returns and returns to scale. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Distribution Theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. **National income:** Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. **Tax:** meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning, *NITI Ayoga*.

AEC. 312

Seri-Business Management

1+1

Theory: Importance of sericulture in rural, national and world economy. Employment generation under different enterprises of sericulture, special characteristics of sericulture visa-vis other agricultural enterprises.

Marketing Management: Concepts and definitions of market, marketing, agricultural marketing, classification and characteristics of agricultural markets. Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus. Market structure, Segmentation targeting & positioning, Market Integration. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods.

Seri-value chain: Understanding primary and support activities and their linkages. Future trading speculation, Arbitrage and hedging, contract farming.

Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and **Financial management of seri-business.** Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. Financial statements and their importance (solvency ratios, Liquidity ratios, Efficiency ratios and profitability ratios). Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

International trade: Present status and prospects of international trade in sericulture; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical: Economics of Mulberry Production, Economics of Grainage and Chawki rearing, Economics of cocoon production, Economics of Reeling (Charaka, Cottage basin, Multiend), Economics of Twisting and Dyeing, Economics of Weaving including visits. Study of semi-input markets: Seedlings/seeds, fertilizers, pesticides. Study of output markets: cocoon market. Study of product markets: raw silk market (silk exchange and private negotiations) and silk fabric market and intuitional visits. Study of sericulture institutions: Central Silk Board, KSIC and KSMB, silk exchange and visits. Study of financing institutions: Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD including institutional visits. Preparations of projects and Feasibility reports for sericulture entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques (payback period, Break even analysis and B: C ratio) and discounting techniques (Discounted B:C ratio, NPV and IRR).

AEC. 321

Farm Management, Production and Resource Economics

1+1

Theory: Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: *Differences between farm management and production economics*, concept of production function and its type - *Linear, quadratic, Cobb Douglas models, meaning and interpretation*. Uses of production function in decision-making, *Laws of returns: Law of variable proportions (factor-product)*, factor-factor and product-product relationships, law of equi-marginal returns, principle of opportunity cost, law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, *fixed costs, sunken costs, valuation and depreciation of farm assets*, total and average cost curves in the short and long run and farm management cost concepts (CACP), Concept and estimation- gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. *Discounted Cash Flow Measures and their role in financial evaluation, equipping farmer as decision maker – production, strategic decisions etc.*, Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, *single entry and double entry book keeping*, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting, linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty *in farming*, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance *schemes* – weather based crop insurance, features, determinants of compensation, PMFBY.

Concepts of resource economics, *Significance of NRE in farming*, differences between NRE and agricultural economics, *unique properties of natural resources - land, surface water, groundwater, environment, biodiversity, ecosystem services: uniqueness, indispensability, irreversibility, invisibility, remoteness, intricacy, synergy, ambiguous property rights, externalities, market failure, free riding, property rights*. Positive and negative externalities in agriculture, inefficiency and welfare loss, internalization of externalities, important issues in economics and management of common property resources of land, water, *pasture, fishery and forest resources* etc.

Practical: Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. *Illustration of loss minimization principle*, Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. *Formulation of LP problems*. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, *partial budgeting exercises, Exercise on book keeping in farm, Amortization, Illustration of costing of groundwater irrigation. Visit to IFS farms, farm section office, cooperative farms, and other representative farms.*

AGRICULTURAL ENGINEERING

AEG. 211

Farm Machinery and Power

1+1

Theory: Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical: Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

AEG. 221

Renewable Energy and Green Technology

1+1

Theory: Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical: Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

AEG. 222

Management of Sericultural Machineries and Equipments

0+1

Study of hand tools, Primary and Secondary tillage implements, intercultural implements, used in mulberry gardens. Mulberry harvesting and chopping machines. Introduction to environment engineering- Psychrometric parameters and process, study of rearing houses and equipment. Low cost ventilation techniques. Study of mountages and mounting sheds. Revolving mountages- cocoon stifling structures. Cocoon driers. Cocoon sorting machines-riddling-deflossing machines. Cocoon cooking and Brushing machines. Reeling machines – charaka, cottage basin and filature basins- automatic reeling machines-re-reeling machines. Boilers for production of steam design and planning filature and cotton basin units. Permeation chambers – sophisticated testing equipments- Tasar and muga reeling machines. Silk twisting and throwing equipment. Non-Mulberry cocoon reeling machines. Maintenance of machineries.

AGRICULTURAL ENTOMOLOGY

AET. 121

Fundamentals of Entomology

2+1

Theory: History of Entomology in India. Position of the insect in Animal kingdom. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. 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, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptors. Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Miridae, Reduviidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleyrodidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Hemirobidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Nymphalidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Encyrtidae; Bethyidae, Formicidae, Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae, Tabanidae, Syrphidae.

Practical: 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; 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.

Note: Students should submit 50 insect specimens representing different families and orders.

AET. 211

Insect Ecology, Principle of Pest Management and Natural Enemies

2+1

Theory: 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. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem.

Categories of insect pests, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests and pest risk analysis. Methods of detection and diagnosis of insect pest. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests management. Survey surveillance and forecasting of Insect pest. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest). Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Study of insecticides including mode of actions, formulations. Pest resurgence and insecticide resistance.

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical: 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. Mass multiplication of NPV, coccinella, green lace wing and other important bioagents. 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, pest

and diseases, Awareness campaign at farmers' fields. Identification of major parasitoids and predators commonly being used in biological control.

Note: Students should submit 25 insect specimens representing parasitoids, predator, weed killer and scavengers.

AET. 321

Pests of Host Plants of Silkworm and their Management

1+1

Theory: Concepts and principles of crop pest management, status of a pest. Biotic potential and environmental resistance. 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.) sequence of their appearance, duration, intensity, nature and symptoms of attack. Bioecology of pests, Management practices, measures of control. Pesticides residue problems, safety periods to be observed.

Practical: 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 loses. Collection of pests and affected samples of host plants of silkworms.

AGRICULTURAL EXTENSION

AEX. 111 Rural Sociology, Educational Psychology and Constitution of India 0+2

Practical: Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Constitution of India: Meaning, Preamble and Characteristics of Constitution of India. Fundamental Rights and Duties. Directive Principles of State Policy. Constitutional provisions for welfare of SCs and STs, Minorities, Women and Children. Union Executive: President, Vice-President, Prime Minister, Council of Ministers – Powers and Functions. Parliament and Supreme Court of India – Powers and Functions. State Executive: Governor, Chief Minister, Council of Ministers. Legislature and Judiciary: Powers and Functions; Electoral Process; Human Rights Commission – Structure, Powers and Functions

AEX. 121 Fundamentals of Agricultural Extension Education and Rural Development 2+1

Theory: 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 programmes 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.

Rural Development: concept, meaning, definition; various rural development programmes 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.

Practical: 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. 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. 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.

AEX. 211 Communication and Diffusion of Agricultural Innovations 1+1

Theory: Communication: meaning and definition; Principles and Functions of Communication. Models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption. Extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies. Diffusion and Adoption of Innovations – Meaning, Definition, Models and adoption Process, Innovation – Decision Process – Elements, Adopter categories and their characteristics, Factors influencing adoption process; Capacity building of Extension Personnel and Farmers - Meaning, Definition, Types of training, Training of farmers, farm women and Rural youth – FTC and KVK.

Practical: Simulated exercises on communication; Identifying the Problems, Fixing the Priorities and selecting the most important problem for preparation of a project. Developing a project based on identified problem in a selected village. Organization of Group discussion and Method demonstration. Visit to KVK / FTC. Planning and Writing of scripts for Radio and Television. Audio Visual aids – Meaning, Importance and Classification. Visit to community radio and television studio for understanding the process of programme production. Planning & Preparation of visual aids - Charts, Posters, Over Head Projector (OHP) Transparencies, Power Point Slides. Planning and Preparation of Agricultural Information materials – Leaflet, Folder, Pamphlet, News Stories, Success Stories. Field diary and lab record; indexing, footnote and bibliographic procedures. Handling of Public

Address Equipment (PAE) System, Still camera, Video Camera and Liquid Crystal Display (LCD) Projector. Development of schedules, Questionnaires and field visits for Data Collection.

AEX. 321

Entrepreneurship Development and Business Communication

1+1

Theory : Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agrienterprises, Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

Practical : Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

AGRICULTURAL MICROBIOLOGY

AMB. 111

Fundamentals of Microbiology

1+1

Theory: Origin and evolution of Microbial life. Brief history of microbiology. Microscopes and microscopy. Overview of cell structure of prokaryotes and eukaryotes. General properties of viruses, overview of plant, animal and bacterial viruses, viroids and prions. Different groups of Microorganisms- Bacteria, Fungi, Algae and Protozoa. Microbial nutrition and culture media. Overview of microbial metabolism: glycolysis, citric acid cycle, anaerobic respiration, photosynthesis and fermentation. Microbial growth - measurement of growth, effect of environmental factors on growth. Qualitative and quantitative methods for the study of microorganisms. Microbial genetics: genetic recombination, conjugation, transformation, transduction, mutation and mutants, plasmids, transposons and insertion sequences, cloning vectors. Control of microbial growth: heat sterilization, radiation sterilization, filter sterilization, chemical growth control, disinfectants, antiseptics and antibiotics. Microbial ecology - Microorganisms in nature and their interaction, methods in microbial ecology, Microbial interactions with higher organisms – plants and animals. Concepts of Immunology - Cells and organs of immune system, antigen- antibody reactions, types of immunity, polyclonal and monoclonal antibodies.

Practical: Equipments used in a microbiology laboratory. Microscopy – principles and applications. Preparation of different culture media and sterilization methods. Isolation, pure culture and preservation of microorganisms. Staining techniques- simple, negative, capsule, endospore, Gram's staining etc. Qualitative and quantitative methods for the study of microorganisms. Influence of environmental factors on microorganisms. Biochemical activities of bacteria. Microscopic observation of bacteria, fungi, algae and protozoa.

AMB. 221

Soil and Applied Microbiology

1+1

Theory: Occurrence and distribution of microorganisms in nature. Soil as a habitat for microbes. Soil microorganisms - bacteria, fungi, algae, protozoa and viruses. Soil enzymes. Role of microorganisms in biogeochemical cycles of carbon, nitrogen, potassium, phosphorus, sulphur and secondary and tertiary nutrients. Soil biotechnology - utilization of microorganisms in improving soil productivity. Microbial interactions - neutralism, commensalism, synergism, mutualism, competition, amensalism, parasitism and predation. Plant microbe interactions and their biotechnological implications, rhizosphere microflora, symbiotic and free living nitrogen fixing microorganisms, ectomycorrhizal and endomycorrhizal associations. Microbiology of hydrosphere and atmosphere. Microorganisms associated with animals and insects. Potentials and limitations of using microorganisms as agents of biological control of insect pests and diseases. Pesticide micro-flora interactions. Biodegradation, bioconversion of industrial, domestic and agricultural wastes. Industrial use of microorganisms - biochemical processes involved and biotechnological applications. Microbiology of milk and milk products. Single cell protein. Role of microorganisms in biochemical transformation of raw and processed foods. Food spoilage, food poisoning and food borne infections. Principles and methods of Food preservation.

Practical: Determination of enzyme activities in soil. Mineralization of carbon, nitrogen, phosphorus and sulphur. Plant microbe interactions: free living nitrogen fixers, legume - *Rhizobium* symbiosis, mycorrhizal symbiosis, microbial inoculants, Azolla - *Anabena* symbiosis, *Casurina* - *Frankia* symbiosis, Study of epiphytic microorganisms. Study of beneficial microorganisms in Agriculture - Biofertilizer preparation, Compost making, Biogas production etc. Cultivation of mushrooms. Microbiological examination of water and effluents. Microorganisms in bread and wine making. Microflora associated with vertebrates and invertebrates. Microbiological examination of raw processed foods. Microbiological examination of milk and milk products.

ANIMAL SCIENCE

ASC. 311

Livestock, Poultry and Fish Production Management

2+1

Theory: Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Broiler Production. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Importance of Indigenous livestock and poultry species. Feeding principles of livestock and poultry. Feed ingredients. Feed supplements and additives for livestock and poultry ration. Study of livestock and poultry diseases. Prevention, vaccination schedule and control of important diseases of livestock and poultry. Marketing and Economics of livestock and poultry. Fisheries resources of India. Importance of Inland fisheries. Important fishes and their production. New vistas in Inland fish production.

Practical: External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock and poultry. Computation of rations for livestock. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. De-beaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production. Visit to inland fisheries unit.

APICULTURE

API. 311

Introduction to Apiculture

1+1

Theory: : Importance of Bees and Beekeeping, History and Development of Beekeeping; Species of honeybees and their colony structure; Morphology of honeybees; Anatomy of honeybees – Digestive, reproductive, nervous, Circulatory and Glandular system; Colony organization; Bee biology; Caste determination in honeybees; Age related activities of workers; Nest architecture; Behaviors in honeybees- Foraging, Communication, Robbing, Swarming and Homeostasis; How, when and where to start beekeeping; Bee flora; Seasonal management of bee colonies; Management of Robbing, Swarming and Queenless colonies; Uniting and division of honeybee colonies; Queen rearing; Bees as pollinators and pollination management; Pests and Diseases of bees and their management; Hive products – Honey, Bee pollen, Bee wax, Propolis, Bee venom, Royal jelly and their extraction, processing, properties and uses; Poisoning of bees and its prevention; Economics of beekeeping.

Practical: Identification of honeybee species; Identification of honeybee castes and their stages; Study of nest architecture; Handling and inspection of bee colonies; Study of bee hives and bee keeping equipments; Dissection of worker bees to study different morphological structures; Dissection of worker bees to study different anatomical structures; Hiving of feral colony; Management of bee colonies - feeding, Prevention of swarming, robbing and absconding; Mass queen rearing technique; Fixing comb foundation sheet and providing of super chamber to the bee colonies; Uniting and dividing of colonies; Extraction and processing of honey; Testing of honey for its purity; Extraction and processing of other bee products; Study of bees as pollinators; Identification of bee flora;. Identification of bee pests and diseases; Visit to important apiaries and bee keeping societies around the region; Working out economics of beekeeping.

CROP PHYSIOLOGY

CPH. 211

Fundamentals of Crop Physiology

2+1

Theory: 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.

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

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; Hydroponics, aeroponics. Mechanism of ion absorption and translocation. Membrane transporters and carriers.

Photosynthesis: Mechanism of carbon fixation by C₃, C₄ and CAM pathway and their significance; Plant responses to elevated CO₂/climate change; Relation of photosynthesis and crop productivity; Starch and sucrose synthesis; Translocation of Assimilates; Source and sink concept; Photorespiration; Factors affecting photosynthesis and productivity; Dry matter partitioning; Harvest index of crops.

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

Plant Growth and Development: Concept of plant growth and morphogenesis; Growth and yield parameters and their measurements; Hormones and plant growth regulators in modulating crop growth; Physiological importance of Auxins, GA, Cytokinin, ABA, Ethylene, Brassinosteroids and strigolactones; biosynthesis and mode of action of plant hormones; applications of growth regulators in agriculture, horticulture and industry.

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 vigour.

Stress Physiology: Plant responses to abiotic stresses; Key concepts and definition; acclimation and adaptation mechanisms.

Practical: 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; 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; Measurement of respiration rate; Deficiency symptoms of nutrients and their identification; growth hormone bioassay; Seed dormancy and methods to break seed dormancy; Measurement of Seed viability and seedling vigor; effect of moisture stress on seed germination and seedling vigor.

CPH. 222

Nanotechnology in Agriculture

0+1

Basic concepts of Nanoscience and Nanotechnology: Introduction, definition and meaning of nanotechnology, classification of nanomaterials, scientific revolutions – time and length scale in structures. Size effects on structure and morphology of nanoparticles. Synthesis of nano materials: Physical, chemical and biological methods. Role in Social, economic, ethical and ecological spheres. Green nanotechnology.

Application of nanotechnology in Agriculture: Effects of seed priming and foliar application of nanomaterial on growth and productivity of crops. Uptake and translocation of nanoparticles. Quantification of enhanced nano-nutrient content in edible parts. In vitro and field efficacy of nanoparticles (pesticides) against plant pathogens. Bioassay of nano-formulations of insecticide. Bio-safety of nano-formulations on natural enemies. Study the fate and behavior of nano fertilizers in soils. Application of nano technology in recycling of Agriculture waste. Safety, toxicity and adoption of nanoparticles in the soil and aquatic life. Nano sensors in agriculture-nutrient, water, soil.

FOOD SCIENCE AND NUTRITION

FSN. 111

Principles of Food Science and Nutrition

2+0

Theory: Concepts of Food Science (definitions, measurements, density, phase, change, pH, Osmosis, Surface tension, colloidal systems etc.): Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions): Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/modified diets, Menu planning, New Trends in food science and nutrition.

FORESTRY & ENVIRONMENTAL SCIENCES

FES. 111

Introduction to Forestry

1+1

Theory: Introduction–definitions of forest and forestry, branches of forestry, history and education of forestry in India. objectives of silviculture, forest classification, salient features of Indian Forest Policies and Acts. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations–weeding, cleaning, thinning– mechanical, ordinary, crown and advance thinning. Forest mensuration–objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement-geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Indian wild life and management. Social forestry and its branches. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important tree species of the region (Teak & Casurina).

Practical: Identification of tree-species, seedlings, seed and non-wood timber forest products. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, Pencil method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries or National park/Agroforestry system/JFPM.

FES. 221

Environmental Studies and Disaster Management

2+0

Theory: 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. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. d) Energy resources: Growing energy needs, use of alternate energy sources. e) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

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)

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.

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.

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. Consumerism and waste products. 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.

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.

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

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, forest fire, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to mitigate natural disaster at national and global levels. International strategy for disaster reduction. Role of NGOs, and media. Central, state, district and local administration; Disaster response of Armed forces, Police and other organizations.

GENETICS AND PLANT BREEDING

GPB. 211

Fundamentals of Genetics

1+1

Theory: Pre- and Post-mendelian concepts of heredity, Mendelian principles of heredity. Probability and Chi-square. Types of dominance, epistatic interactions with examples. Multiple alleles, pleiotropism, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Mutation, classification, mutagenic agents and induction of mutation. Qualitative & Quantitative traits. Polygenes and continuous variations, multiple factor hypothesis, cytoplasmic inheritance. Protein synthesis, Transcription and translational mechanism of genetic material, gene concept: gene structure, function and regulation, Lac and Trp operons.

Practical: Solving problems on monohybrid, dihybrid, trihybrid, test cross and back cross, Solving problems on epistatic interactions including test cross and back cross, Concepts of probability and Chi-square test and their application in genetics. Detection and estimation of linkage through two point test cross and three point test cross data. Solving problems of sex linkage.

GPB. 321

Intellectual Property Rights

1+0

Theory: Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Geographical indications, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features access and benefit sharing.

HORTICULTURE

HRT. 122

Fundamentals and Production Technology of Horticulture Crops

2+1

Theory: Horticulture-definition and branches; Importance and scope; Classification of horticultural crops; Plant propagation - methods and propagating structures; Production technology of Mango, Banana, Mandarin, Grapes, Guava, Sapota, Papaya, Coffee, Tea, Coconut, Arecanut, Cashew nut, Pepper, Cardamom, , Potato, Tomato, Chilli, Cabbage, Cauliflower, Carrot, Onion, Okra, French bean, Cucumber, Watermelon, Rose, Chrysanthemum and Jasmine with respect to origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties/ hybrids, planting methods, nutrition, irrigation, weed management, pruning and training, inter and mixed cropping, harvesting and yield.

Practical: Orchard layout and planting systems; Pruning and training methods; Growth regulators; Irrigation and nutrient management practices; Description and identification of varieties of the above crops.

PLANT BIOTECHNOLOGY

PBT 121

Fundamentals of Plant Biotechnology

2+1

Theory: : Concept of Plant Biotechnology – History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement – Totipotency and Morphogenesis, Nutritional requirements of *in-vitro* cultures; Techniques of *in-vitro* cultures; Micro-propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Endosperm Culture and its applications. Somaclonal variation: Types, Reasons. Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering: Restriction enzymes; vectors for gene transfer- Gene cloning, direct and indirect method of gene transfer, Transgenic plants and their applications. Blotting techniques- DNA finger printing, DNA based markers- RFLP, AFLP, RAPD, SSR and DNA probes. Marker-assisted selection and its recent advances.

Practical: Requirements for plant tissue culture laboratory; Techniques in plant tissue culture; Media components and preparations, Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant regeneration; Micro-propagation of important crops, Anther, Embryo and Endosperm culture; Hardening/ Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast, demonstration of culturing of protoplast, demonstration of isolation of DNA, Demonstration of gene transfer techniques-direct methods and indirect methods; Demonstration of confirmation of Genetic transformation, Demonstration of gel electrophoresis techniques. Restriction enzymes for digestion of DNA. Polymorphism, monomorphism, hybridity testing.

PLANT PATHOLOGY

PAT. 211

Fundamentals of Plant Pathology

2+1

Theory: Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Cause and classification of plant diseases. Important plant pathogenic organisms, fungi, bacteria, fastidious vascular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic agents. Fungi: general characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Binomial system of nomenclature, rules of nomenclature. Classification of fungi, keys to phylum, classes, order and families. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Keys to major plant pathogenic bacterial genera. Viruses: nature, morphology, replication and transmission and classification of plant viruses. Keys to important plant virus families / genera. Nematodes: General morphology and reproduction, classification, keys to important plant pathogenic nematode genera, symptoms and nature of damage caused by plant nematodes. Phanerogamic plant parasites: Common characteristic of important parasites, disease development, survival and spread. Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenicity: phenomenon of by Fungi, Bacteria, Viruses, mollicutes and nematodes. Pathogenesis: Penetration and colonization. Role of enzymes, toxins and growth regulators in disease development and their classification. Introduction to principles of plant disease management.

Practical: Acquaintance with various laboratory equipments and microscopy. Study of symptoms of various plant diseases caused by fungi, viruses, bacteria, nematodes and mollicutes. Field visit to get acquainted with plant disease symptom. Collection and preservation of plant disease specimens. Study of morphology of fungi, viruses, bacteria, nematodes and phytoplasma. Study of life cycle / disease cycle of major fungal, bacterial, viral, nematode and phanerogamic plant parasites diseases. Macroscopic and microscopic examination of plant pathogens including staining techniques for bacteria. Preparation of culture media and sterilization. Different methods of isolation and purification of fungi, bacteria, viruses and extraction of nematodes. Study of different methods of artificial inoculation / transmission and proving Koch's postulates for different plant pathogens. Study of liberation of fungal spore. Study of micrometry.

PAT. 222

Diseases of Host Plants of Silkworms and Principles of Plant Disease Management

1+1

Theory: Economic importance, symptoms, causes, epidemiology, disease cycle/life cycle and integrated management of diseases of *Morus alba*, *Ricinus communis*, *Manihot utilisima*, *Michilium champaka*, *Zizyphus* spp., *Machilus bombycina*, *Shorea robusta*, *Ailanthus* spp., and other hosts of silkworms. Epidemiology, development of epidemics, disease forecasting; crop loss assessment. Principles and methods of plant disease management: Avoidance of the pathogen: Choice of geographical area, selection of field and planting stock. Exclusion: Plant quarantine regulations and inspections, Post entry quarantine. Eradication: Cultural and physical methods of eradication and inoculum reduction. Biological methods: Crops rotation, use of trap crops, plant and plant products, use of biological control agents, their mass multiplication mechanisms of biocontrol. Breeding for disease resistance: Types of resistance, Development of resistant varieties, induced resistance. Protection chemical methods: Nature, classification, mode of action and formulations of fungicides, bactericides antibiotics and nematicides; methods of applications of chemicals. Application of biotechnology in plant disease management.

Practical : Study of symptoms, etiology and life cycle/disease cycle of the diseases of *Morus alba*, *Ricinus communis*, *Manihot utilisima*, *Michilium champaka*, *Zizyphus* spp., *Quercus* spp., *Machilus bombycina*, *Shorea robusta*, *Ailanthus* spp., and other hosts of silkworms. Study of fungicides, bactericides, nematicides and methods of applications. Isolation, mass multiplication of Biocontrol agents and their bioassay. Study of plant protection equipments. (Submission of 15 well preserved disease specimens and 15 semi-permanent slides depicting different plant pathogens).

SEED SCIENCE & TECHNOLOGY

SST. 221

Seed Production, Principles and Methods

1+1

Theory: Introduction to seed science and technology, seed and its importance. Seed quality – characteristics of quality seeds, factors affecting seed quality and its maintenance. History and development of seed industry, Seed programmes, types, planning and execution. Different classes of seed, generation system of seed multiplication, seed replacement and varietal replacement rates- seed multiplication ratio, seed renewal and seed plan, Agencies involved in seed production at state and national level. Seed certification – control of seed source, field inspection, field counts, field standards. Principles of seed production- genetic, agronomic and economic principles, Maintenance of genetic purity during seed production. Deterioration of crop varieties — factors and their control, Requirements for hybrid seed production and types of hybrids. Systems and techniques of hybrid seed production, male sterility, self incompatibility, CHA and EGMS. Planning for breeder, foundation, truthfully labelled and certified class of seed production. Seed production- foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); rice, sorghum and bajra (varieties and hybrids); greengram, blackgram, bengalgram, cowpea (varieties) ; soybean, groundnut (varieties); sunflower (varieties and hybrids); castor (varieties and hybrids); cotton (varieties and hybrids); tomato and brinjal (varieties and hybrids); chilli and bhendi (varieties and hybrids), onion and melons and gourds (varieties and hybrids) and potato (varieties and true potato seeds), seed crop harvesting methods and management; Seed production under protected cultivation. Seed marketing and distribution strategies– organizations, structures, sales, International trade. Export and import policies for seed trade, generation activities, sales promotional media and factors affecting seed marketing. Seed Sales, License, pricing policy, cost benefit ratio, economic feasibility and factors influencing.

Practical: Identification of seeds of agricultural/ horticulture crops. Study of seed structure in monocot and dicot seeds in agricultural and horticulture crops. Study of floral biology in self, cross and often cross pollinated crops. Identification of different varieties based on seed morphological characters in agriculture and horticulture crops. Study of seed dormancy and breaking methods in problematic crops. Isolation types, measurement and determination in self and cross pollinated crops. Carrying out field inspection and taking field counts. Study of different contaminants and practicing rouging. Practicing hybrid seed production techniques – hand emasculation and pollination in cotton, bhendi, tomato, brinjal. Carrying out detassling techniques in hybrid maize seed production. Diagnostic identification of A, B and R line hybrid seed production of sunflower, paddy, sorghum and bajra. Studies on planting ratio, border rows and synchronization and supplementary pollination techniques in hybrid seed production in sunflower and paddy. Determination of physiological maturity in agri-horticultural crops. Visit to seed certification agency and grow out test farms. Visit to seed production plots (OPV and hybrids) of public and private organizations. Calculation of economics of seed production (OPV and Hybrids). Visit to seed production under protected cultivation.

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

SAC. 121

Fundamentals of Soil Science

2+1

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

Practical: 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.

SAC. 311

Problematic Soils and their Management, Geoinformatics

1+1

Theory: Soil quality and health, Distribution of waste land and problem soils in India. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; Their categorization based on properties. Reclamation and management of saline and sodic soils, acidic soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils-Soil pollution-behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water – quality and standards, utilization of saline water in agriculture. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems. Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping: fertilizer recommendation using geospatial technologies: Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs. Remote sensing and GIS in diagnosis and management of problem soils.

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

SAC. 321

Manures, Fertilizers and Soil Fertility Management

2+1

Theory: 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, Fertilizer Storage, Fertilizer Control Order.

History of soil fertility and plant nutrition. criteria of essentiality. 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 fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

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

SERICULTURAL COURSES
HOST PLANT PRODUCTION (HPP)

HPP 121 **Cultivation of Host Plants of Silkworms** **1+1**

Theory: Introduction. Garden implements description and uses. Soil sampling. Propagation of layout and land for planting. Climatic requirements. Propagation, pruning, irrigation schedules. Green manuring, manurial and fertilizer schedules. Weed control practices. Harvesting under different planting system of mulberry and other host plants. Leaf preservation. Mulberry cultivation under rainfed condition and irrigated condition. Tree mulberry plantation and chawki / young age mulberry plantation. Mulberry varieties. Nursery techniques in mulberry. Cultivation and propagation of host plants of Eri silkworms: castor, tapioca and kesaru, cultivation and propagation of host plants of tropical tasar silkworms: Asan, Arjun and sal and temperate tasar / oak tasar silkworms: Quercus serrata and Quercus incana. Cultivation and propagation of host plants of muga silkworms som and soalu.

Practicals: Identification and uses of garden implements. Soil sampling technique. Sexual propagation and asexual propagation in mulberry. Nursery techniques in mulberry. Mulberry varieties. Manures and fertilizer application. Planting methods. Irrigation methods, pruning methods, weed management. Harvesting and preservation of mulberry leaves. Host plants of Eri silkworm, host plants of tasar silkworms and host plants of muga silkworms. Cultivation of primary host plants of eri silkworms. Cultivation of primary host plants of tasar silkworms and cultivation of primary host plants of muga silkworms. Herbarium preparation for the host plants and weeds.

HPP 221 **Mulberry Production and Management** **0+1**

Practical: Mulberry nursery management for sapling production, Kissan nursery, package of practices for mulberry cultivation under rainfed condition, Package of practices for mulberry cultivation under irrigated conditions. Bush and tree cultivation, Pruning and training of mulberry, raising mulberry garden exclusively for young age silkworm rearing. Integrated nutrient management, Organic farming, Weeds and its management. Cultivations practices for mulberry commencing from pruning to harvesting of mulberry leaf for silkworm rearing. Maintenance of cultivation sheet and recording the seasonal growth and yield of mulberry. Estimating the leaf yield and forecasting number of DFLs for rearing. Economics of leaf production per unit area under rainfed and irrigated conditions. Identification of non-cash inputs in cultivation. UAS Seri-Suvarna method.

HPP 311 **Experimental Techniques in Sericultural Research** **1+1**

Theory: Development of sericulture research. Modern trends, concepts in sericulture research and their impact on productivity. Essence of research levels and methods of research. Review of literature. Aims and objectives of laboratory and field experiments. Selection of site for experiments. Sources of variation in experiments, uniformity trials and the interpretation of blocks. Factors considered in fixing treatments and in fitting experiments. Different types of experiments-varietal, cultural, manurial, irrigation, weed control, silkworm rearing, silkworm breeding, grainage, pests, diseases and silk technology. Experiments on mulberry and non mulberry host plants. Short and long duration trials. Maintenance of experimental records. Recording of observations, sampling techniques, tabulation, analysis and interpretation of results. Preparation of data for scientific papers and presentation of results. Scientific photography and preparation of transparencies for slide projector and overhead projector.

Practical: Types of laboratory and field experimentation. Selection of site and land allotment. Experiments on grainage, mulberry silkworm rearing and silk technology. Techniques for assessment of damage of pests, diseases and weeds among the host plants of silkworms. Assessment of soil fertility before experimentation and plot work. Techniques to record observations in mulberry and silkworms, growth and growth analysis in mulberry. Methods of measuring leaf area in mulberry. Calculation of measures of Central tendency and dispersion. Analysis of variance technique in computation of 'F' & 'T' tables for the analysis of data from a Completely Randomised Design (CRD), Randomised Block Design (RBD), Latin Square Design (LSD), simple factorial experiment and split plot design.

SERICULTURE CROP IMPROVEMENT (SCI)

- SCI 121** **Botany and Cytology of Host Plants of Silkworms** **1+1**
Theory: 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. Polyembryonic seed in mulberry. Mitosis and karyomorphological studies in host plants of silkworms. Micro and megasporogenesis and fertilization in mulberry. Fruit seed development and parthenocarpy in mulberry.
Practical: 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. Karyomorphology and idiogram in some host plants of silkworms.
- SCI 211** **Genetics and Breeding of Host Plants of Silkworms** **2+1**
Theory: Germplasm sources, geographical distribution and exploration. Centres involved in crop improvement programme of host plants of silkworms. Conservation and role of germplasm in crop improvement. Inheritance of economic characters (quantitative and qualitative characters). Objectives and pre-requisites of breeding. Methods of breeding, *viz.*, introduction and acclimatisation, methods of selection in mulberry. Hybridization, heterosis breeding, breeding methods for self and cross pollinated crops, backcross, population improvement, mutation breeding, polyploid breeding. Breeding for resistance to biotic and abiotic factors - drought, diseases, pests, salinity and alkalinity. Breeding for leaf quality. Evaluation and statistical approach for yield test in mulberry. Varietal multiplication and dissemination.
Practical: 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.
- SCI 221** **Cytology and Genetics of Silkworms** **2+0**
Theory: Concepts and principles of genetics. Cell division, Oogenesis, spermatogenesis and fertilization. Structure and chemical composition of chromosome and nucleic acids. Genotype and phenotype, qualitative and quantitative traits. Laws of inheritance. Crossing over, categories of crossing over, mechanism of crossing over. Chromosomal maps, pleiotropy, penetrance and expressivity. Concept of Linkage. Phenotypic variance, Geneotypic variance, Heritability and Genetic advance. Genetic stocks of silkworms, morphological and biochemical traits, differentiation and development. Genetic basis for hormonal control. Genetics of cocoon colour. Sex determination in mulberry silkworm.
- SCI 311** **Seri Biotechnology** **2+1**
Theory: Introduction to Biotechnology. Principles and methods of plant tissue culture techniques. Micro propagation in mulberry. Secondary metabolites and their applications. Recombinant DNA technology – Principles and applications in sericulture, PCR Techniques and their types. Restriction Enzymes, Vectors, Host and steps in gene cloning and expression. Transgenics- Methods of Gene Transformation (Agrobacterium and Ballistic Gene gun method). Molecular markers and their application in sericulture. Introduction to Genome Mapping. Nanotechnology and its application in sericulture. Introduction to Bioinformatics. Principles, Methods and Applications of gene sequencing. Gene silencing and its importance in sericulture. BmNPV vector and its applications.
Practical : Requirements for plant tissue culture lab. Techniques in Plant Tissue Culture- Sterilization Techniques, Plant Tissue Culture Media, Preparation of MS Medium. Micropropagation in Sericulture. Preparation of synthetic seeds in mulberry. Genomic DNA Isolation in mulberry and silkworm. Study of Gel Electrophoresis. Study of Polymorphism- PCR and Non-PCR based molecular markers. Gene Transformation Techniques- Agrobacterium mediated transformation and Ballistic Genegun method. An overview of Bioinformatics tools. Visit to Biotechnology Laboratory.

Theory: History of silkworm breeding in Japan, China and India, Principles and objectives of silkworm breeding. Establishing / activities of silkworm breeding programme. Maintenance of silkworm germplasm bank. Maintenance of breeds / stocks, 3- tier multiplication of parental stock with silk yield attributes. Genetic basis for silkworm breeding programmes. 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. Handling of mutated population. Methods of measurement of mutation frequency. Applications, limitation and achievements of mutation breeding. Chromosomal aberrations. Ploidy breeding – heteroploid, autopolyploids, significance of polyploids. Breeding silkworms for biotic (disease) and abiotic (high temperature) stress tolerance, season and region specific hybrids. Concepts of breeding auto-sexing silkworm breeds (*B. mori*). Authorization of silkworm breeds and their hybrids. Breeding of non-mulberry silkworms.

Practicals: Study of breed characteristics of *Bombyx mori*, *Antheraea sp.*, and *Samia cynthia ricini*. Procedure and maintenance of silkworm germplasm bank. Procedure for hybridization in silkworms, Procedure for selection-pedigree and mass method. Assessment of variability (ANOVA). Genetic analysis of qualitative and quantitative traits. Estimation of heterosis. Diallel (partial and complete) and three way cross analysis. Analysis of double cross hybrids. Line X Tester analysis. Path analysis. Induction of mutation in silkworms. Measurement of mutation frequency. Induction of polyploidy in silkworms. Breeding procedure for non-mulberry silkworms. Visit to germplasm bank and silkworm breeding stations. Study of performance of silkworm hybrids.

COCOON CROP PRODUCTION (CPP)

- CCP 111** **History, Development and Organization of Sericulture Industry** **1+0**
- Theory:** Origin and history of sericulture in the World, India and Karnataka. Features and importance of sericulture in the world. National and International Silk Organizations, Organizational set up in different countries including India. Development of sericulture through plans, World Bank Projects. Sericulture organization at State Level with reference to the planning and quality control, marketing, silk exchange, export–import policy and laws. Laws relating to the production of seed, cocoon, raw silk and transport. Price stabilization. Internal consumption. R & D institutes of CSB, State Govt. & Universities. Literature in Sericulture.
- CCP 211** **Morphology and Systematics of Silkworms** **1+1**
- Theory:** Introductory remarks on general insect morphology. Insect classification. Study of systematics of sericigenous insects. External morphology of different life stages (egg, larva, pupa, cocoon and adult) of mulberry silkworm, tasar, muga and eri silkworms. Changes during moulting and ripening. Changes in pupal morphology with age. Cocoon characters.
- Practical :** Collection of sericigenous insects of sericultural importance. Preparation of slides of the structures of life stages of mulberry, tasar, muga and eri. Study of different life stages and morphology of mulberry silkworm, tasar, muga and eri silkworm.
- CCP 212** **Mulberry Silkworm Rearing** **2+1**
- Theory :** Biology of mulberry silkworm, popular polyvoltine & bivoltine breeds. Rearing houses and appliances. Planning for silkworm rearing suitable to different sized mulberry holdings, rearing house, equipment and labour availability. Shoot rearing and shelf rearing. Importance of disinfection, care in handling and incubation of eggs and black- boxing. Environmental conditions for rearing of young and late age silkworms. Brushing, leaf selection for different instars, frequency and quantum of feeding. Care at moulting. Spacing of worms. Bed cleaning. Rearing practices for young and late age silkworms. Mounting of worms. Effective rate of rearing. Cocoon harvesting and sorting. Transporting and marketing of cocoons. Assessment of cocoon yield and quality. Leaf cocoon ratio and consumption indices. Feed utilization and conversion efficiency. Nutritional requirement of silkworms, vis-à-vis, their availability in mulberry leaf. Different nutrients and their role in silkworm growth, development and silk production. Nutrient deficiency and its impact on silkworm biology. Nutrient supplements through mulberry leaf fortification. Maintenance of rearing records. Innovations and indigenous technology know how. Benefit cost ratio of silkworm rearing. Artificial diets and juvenile hormone analogues in practical sericulture.
- Practical :** Biology of Polyvoltine and Bivoltine silkworms. Popular breeds of silkworms Plan of rearing house. Rearing appliances. Disinfection. Incubation. Brushing. Leaf preservation. Chawki and late age rearing. Bed cleaning and Spacing. Bed disinfection, Rearing of popular silkworm hybrids and maintenance of rearing records. Planning of small and large scale silkworm rearings based on facilities, management of diseases and natural enemies.
- CCP 221** **Silkworm Anatomy and Physiology** **1+1**
- Theory:** Digestive, circulatory, respiratory, excretory, nervous, reproductive and muscular systems of larva, pupa and adult of mulberry silkworm and comparative anatomy in non-mulberry silkworms. Physiology of digestion, respiration, circulation, excretion and reproduction. Silk glands and silk secretion. Endocrinology, sensory physiology. Olfactory and gustatory stimuli of feeding. Sex attractants. Nutrition and host preference. Artificial diets. Effect of juvenile hormones and JH analogues on moulting, silk secretion and oviposition.
- Practical :** Dissection of larva and adult stages of silkworm species for all the internal systems. Study of pulse rate and reversal of blood flow during spinning in larvae. Artificial diets and their components.

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

Practical : Study of different insect and non-insect pests. Uji fly life cycle, identification of pest damaged worms and cocoons, case studies. Management of Pests.

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

Practical: Study of host plants and life stages of different non-mulberry silkworms. Natural enemies of non-mulberry silkworms. Rearing of non-mulberry silkworms (eri & tasar). Field visit for collection of non-mulberry silkworm stages.

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

Practical : 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, depairing, 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 grainages.

Theory : Introduction and importance of silkworm diseases, Nature and extent of damages caused to sericulture due to biotic and abiotic factors. Infectious and non-infectious diseases of silkworms including non-mulberry silkworms. Koch's postulates. Non-infectious diseases including physical and chemical injuries, nutritional and genetic disorders. Important infectious diseases – pebrine, flacherie, muscardine and grasserie: - Causal agents, life cycles, incubation periods, symptoms, diagnosis, seasonal factors, epizootiology, prevention and management. Cross infectivity of pathogens of crop pests to silkworms. Impact of insect crop pests on silkworm. Impact of biological pest control on sericulture. Infectivity techniques. Determination of LC50 and ET50. Disinfection and hygiene, disinfectants and their mode of action.

Practical : Study of gross pathology of different diseases, Effect of different insecticides on silkworms, Causal agents of infectious diseases & symptoms, Isolation and culturing of silkworm pathogens, Koch's postulates, Preparation of permanent slides, Infectivity techniques, Cross infectivity, Determination of LC50 and ET50, Silkworm breeds and instars susceptibility, Histopathological techniques, Patho-physiological techniques, Preventive measures of infectious diseases, Disinfection & hygiene.

JICA method of mulberry cultivation and silkworm rearing. Disinfection at three levels- rearing house, surroundings, entrance, rotary mountage. Incubation of loose egg in incubation frames, black boxing brushing with double net. Selection of leaf for Chawki rearing. Transferring of larvae to rearing trays, bed cleaning, care during moulting, distribution of chawki larvae. Late age silkworm rearing, silkworm rearing house, shoot rearing stand, hygiene maintenance, transportation and preservation of mulberry shoots, nylon net for uzifly prevention, space requirement according to instar wise. Mounting of larvae, jobrai method of collection of mature larvae mounting of worms to rotary mountage. Harvesting of cocoons, sorting, packing and marketing.

SILK PRODUCT SCIENCE

SPS 211

Physics and Chemistry of Fibres

1+0

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

SPS 311

Raw Silk Technology

2+1

Theory: Introduction- world raw silk production and present silk production in India, Cocoon formation, Physical characteristics of mulberry cocoon- colour, shape, wrinkles etc, etc, Cocoon markets-its functions, method of transaction, method of fixing the cocoon price, Transportation of cocoons-care and handling, Cocoon testing and grading, Cocoon sorting-manual and mechanical method Different types of defective cocoons, Mulberry silk reeling process-steps involved in silk reeling, Cocoon stifling and methods, storage of stifled cocoons-sun drying, steam stifling, hot air drying, Cocoon cooking and its systems, - open pan, two pan, three pan, pressurized cooking method/circular cocoon boiling machine, mechanical cooking, brushing methods, Evolution of reeling machines. General principles in reeling, different reeling machines-charakha, improved charakha, cottage basin/domestic basin, multi-end reeling machine, semi automatic and automatic reeling machine. Re-reeling and lacing, Silk examination, skeining, book and bale making, Storage and selling raw silk, silk exchange, Physical properties of Tasar, Muga, eri cocoon, Tasar cocoon reeling- stifling, cooking, reeling machines, Muga cocoon reeling- stifling, cooking, reeling machines, Eri cocoon cooking, spinning methods, Filature water engineering. Marketing of silk, silk exchanges and price stabilization of silk. Objectives and advantages of raw silk testing and grading. Qualities of silk, major and minor characters of quality silk, silk testing and conditioning houses, BIS and ISA specifications of testing and grading of silk, condition test, winding test, size test, strength test, evenness, cleanness and neatness tests, cohesion test, standard tables for grading of silk.

Practical: 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

SPS 312

Spun Silk Technology

0+1

Practical: 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.

SPS 322

Silk Throwing, Dyeing and Weaving

0+2

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

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

STUDENT “READY” (RURAL ENTREPRENEURSHIP AWARENESS DEVELOPMENT YOJANA) PROGRAMME

Concepts of the programme:

- i. Experiential Learning/Hands on Training/Skill Development Training
- ii. Rural Sericultural Work Experience
- iii. In Plant Training/ Industrial Attachment/Students Projects

I Experiential Learning

- To be offered during Eighth semester
- **0+20** Credit hours
- Register for nay of two modules
- Each module of **0+10** credit hours.

a) Concept

- ❖ ‘Experiential’ means that learning and development are achieved through personally determined experience and involvement.
- ❖ Experiential learning is a business curriculum related endeavour which is interactive.
- ❖ EL is for building (or reinforcing) skills in
 - Project development and execution
 - Decision – making
 - Individual and team coordination
 - Approach to problem solving
 - Accounting, marketing and resolving conflicts etc.
- ❖ End to end approach
- ❖ Carefully calibrated activities move participants to explore and discover their own potential.
- ❖ Both activities and facilitation play a critical role in enhancing team performance.

b) Objectives

- To provide excellent opportunity to develop analytical and entrepreneurial skills, and knowledge through meaningful hands on experience, confidence in their ability to design and execute project work.

The main objectives of EL are:

- To promote professional skills and knowledge.
- To build confidence and to work in project mode.
- To acquire enterprise management capabilities.

c) Duration

- 180 days (one semester) period in final year.
- Students and faculty are expected to attend the activities even on institutional holidays with total commitment, and without any time limit or restriction of working hours.

d) Attendance

- ❖ Minimum attendance required is 85%
- ❖ Any student in the event of recording shortage of attendance has to re-register the EL when offered next by paying the assigned fee.

e) Students' Eligibility

- To get the eligibility for registering the EL programme, the students should have completed all the courses successfully.
- Assignment /allotment of the EL programme shall be based on merit of the student at the end of 5th semester.

II RURAL SERICULTURAL WORK EXPERIENCE

- To be offered during Seventh semester
- 0+20 credit hours in two parts: RAWE and AIA
- Attachment in University/College/KVK or a Research Station
- Helps the students primarily to understand the rural situations, status of Agricultural technologies adopted by farmers, prioritize the farmer's problems and develop skills and attitude of working with farm families for overall development in rural area.
- Timings for RSWE can be flexible for specific regions to coincide with the main cropping season.

Objectives

- To provide an opportunity to students to understand the rural setting in relation to **agriculture** and allied activities
- To make the students familiar with socio-economic conditions of the farmers and their problems.
- To impart diagnostic and remedial knowledge to the students relevant to real field situations through practical training.
- To develop communication skills in students using extension teaching methods in transfer of technology.
- To develop confidence and competence to solve agricultural problems.
- To acquaint students with on-going extension and rural development programmes.

| VII Semester | | | |
|--|--|---------------------|--------------------|
| Rural Sericultural Work Experience (RSWE) | | | |
| Sl. No. | Activities | No. of weeks | Credit Hrs. |
| 01. | General Orientation & On Campus Training by Different Faculties | 01 | 14 |
| 02. | Village Attachment Training Programme | 08 | |
| 03. | Unit Attachment in Univ./ College. KVK / CSB / KSSRDI Attachment | 05 | |
| 04. | Seri Clinic | 02 | 02 |
| 05. | Govt. Model Grainage Attachment | 03 | 03 |
| 06. | Project Report Preparation, Presentation and Evaluation | 01 | 01 |
| TOTAL | | 20 | 20 |

RSWE Components

Component – I: Village Attachment Training Programme

| Sl. No. | Activities | Duration |
|---------|--|----------|
| 01. | Orientation and Survey of Village | 1 week |
| 02. | Agronomical Interventions | 1 week |
| 03. | Plant Protection Interventions | 1 week |
| 04. | Soil Improvement Interventions (Soil sampling and testing) | 1 week |
| 05. | Mulberry, Vegetable and Fruit production interventions | 1 week |
| 06. | Cocoon production interventions | 1 week |
| 07. | Animal Production Interventions | 1 week |
| 08. | Extension and Transfer of Technology activities | 1 week |

Component – II: Attachment to Government Model Grainage (GMG)

- Students shall be placed in model grainages (GOK and NSSO) for 03 weeks, Seri Clinic for 02 weeks & KSSRDI / CSB placement for 05 weeks.

Activities and Tasks during model grainage and KSSRDI / CSRTI Attachment Programme :

- Acquaintance with institution and staff
- Study of structure, functioning, objective and mandates of the grainage
- Study of various processing units and hands-on trainings under supervision of GMG staff
- Ethics of GMG
- Employment generated by the GMG
- Contribution of the GMG to farming community and industries (spun silk & carpet making)
- Learning business network including outlets of the GMG
- Skill development in all crucial tasks of the grainage
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

VIII Semester**MODULES FOR SKILL DEVELOPMENT AND ENTREPRENEURSHIP**

A student has to register 20 credits opting for two modules of (0+10) credits each (totalling to 20 credits) from the package of modules in the **VIII semester**.

| Sl. No. | Course No. | Title of the module | Credit Hrs. |
|----------------|-------------------|--|----------------------------|
| 01. | SER 421 | Agri and Seri Clinic | 0+10 |
| 02. | SER 422 | Bivoltine Silkworm Rearing Technology | 0+10 |
| 03. | SER 423 | Chawki Rearing Technology | 0+10 |
| 04. | SER 424 | Value Addition to Mulberry/ Grainage and Rearing By-products | 0+10 |
| 05. | SER 425 | Grainage Technology | 0+10 |
| 06. | SER 426 | Commercial cocoon & Seed Cocoon Production Technology | 0+10 |
| 07. | SER 427 | Entrepreneurship Development in Post Silk Technology | 0+10 |
| 08. | SER 428 | Consultancy and Project Formulation in Sericulture Industry | 0+10 |
| 09. | SER 429 | Bio-Craft Technology | 0+10 |
| TOTAL | | | 0 + 10 × 2 = 0 + 20 |

NOTE: In addition to above ELP modules other important modules may be given to the students by SAUs.

Soil Health diagnosis, INM practices to improve the soil and plant health, Identification of deficiency symptoms in mulberry and acquainting with remedial measures, Diagnosis of pest and diseases of silkworm and acquainting with remedial measures, Survey of problematic mulberry garden and rearing houses and find out the remedies for the cause, Assessment of quality of the inputs, leaf and DFL's., Assessment of toxicity, their nature, level and suggest remedies, Development of INM and IDPM schedules for management of Nutrition and pest & diseases in mulberry.

SER 422**Bivoltine Silkworm Rearing Technology****0+10**

1. Leaf quality management: Establishment and management of mulberry garden-chawki and late age, leaf yield assessment in mulberry, leaf fortification
2. Silkworm rearing management:
 - a. Disinfection in sericulture: Types of disinfectants, methods of disinfection, instruments and chemical used in disinfection, estimation of quantity of disinfectant per unit area, preparation of disinfectant solutions, factors influencing effective disinfection, importance of hand and foot disinfection in silkworm rearing, bed disinfectants and their utility in silkworm rearing
 - b. Young age (Chawki) Rearing management: Incubation, black boxing, brushing of chawki worms, feed management, micro climate management, spacing management, moult management in chawki rearing, disease management – disease identification and management, Use of Artificial diets in chawki rearing
 - c. Late age rearing management: Procurement and transportation of chawki, methods of late age rearing, maintenance and management of temperature, humidity and spacing in late age silkworm rearing, feeding management – quantum, frequency, method of feeding, spacing and bed cleaning in late age silkworm rearing, moult management, pest and disease management
3. Mounting and harvesting: identification of ripe worms, feed management during ripening stage, chemicals for regulation of ripening in silkworms, collection and mounting of ripe worms, factors for effective collection of ripe worms, use of different mountages in BV silkworm rearing, mountage management, density of larvae per unit area on different mountages, importance of mounting hall, regulation of temperature, RH, light and ventilation during mounting, management of spinning larvae, harvesting, cleaning, sorting and grading of cocoons
4. Marketing of cocoons: Packing, transportation and sale of cocoons, important cocoon markets for BV
5. Maintenance of rearing records, calculation of Cost: benefit ratio
6. Documentation of innovations and ITKs in BV silkworms rearing
7. Visit to progressive BV farmers fields

SER 423**Chawki Rearing Technology****0+10**

Chawki Rearing – Definition, role & importance, Chawki mulberry garden maintenance & management, Commercial chawki rearing techniques, Disinfection & hygienic, Handling of silkworm eggs, Incubation of silkworm eggs, Black boxing of silkworm eggs, Brushing of chawki worms, Characteristics of chawki worms, Chawki rearing house, Chawki rearing environment, Chawki rearing method, Feeding of chawki worms, Spacing for chawki worms, Bed cleaning method, Moulting care, Chawki certification, Transportation of chawki, Artificial diet for chawki worms, Economics of chawki rearing, CRC registration, Success Stories of CRCs.

SER 424

**Value Addition To Mulberry, Grainage
and Rearing By-Products**

0+10

Mulberry induces fairness, Pharmaceutical value of mulberry: Stem, Root, Fruit, Medicinal values of mulberry, Mulberry and its Therapeutic values, Mulberry and Medicament

Value addition to mulberry leaf:

Animal Feed importance, Mulberry Leaf Anti-oxidation and Anti-aging, Mulberry Leaf Extract in: reducing Blood Glucose, Reducing Blood Pressure, Reducing Blood Fat, Strengthening Blood vessel and Heart, Improving Blood Circulation, Cosmetics Production, Skin and Hair Caring Products, Hairdressing Products, Mulberry Leaf Soap, Mulberry Tea: Health benefits of mulberry tea, Fights Diabetes, Weight Loss, Fights Atherosclerosis.

Value addition to mulberry fruit: Multipurpose uses of mulberry fruit, Mulberry Fruit Jam, Mulberry fruit Syrup, **Mulberry fruit Chutney**, Mulberry fruit Juice

Value added products from mulberry stem: Adhesive from Waste Mulberry stem, Mulberry as fodder and fuel, Mulberry wood art, Mulberry root art, Utilization of mulberry twigs for basket making

Value added products from silkworm: Silkworm powder for diabetes control

Recycling technology of sericultural waste: Preparation of compost from sericulture waste, Silkworm larval litter for biogas generation, Vermi composting of Sericulture Waste

Value addition to silkworm pupae: Paints and Varnishes, Utility of silkworm pupae as food and medicine, As an animal feed, Silkworm pupa as astronaut food, Silkworm Pupal Oil

Silk reeling waste utilization for value addition and sericin and its use: use of sericin in cosmetics, Sericin-A Bio-Molecule of value, Sericin as a textile finishes to silk, Sericin finish for polyester, Sericin finishes for cotton and other fibres

Grainage wastes and value addition: Versatile fashionable Handicrafts from silk waste, Value addition to Silk moths

Non-mulberry sericulture waste utilization for value addition: Spun silk, Jharcrafts, importance of silk quilts, by products from vanya silks and its utility

SER 425

Grainage Technology

0+10

Planning and designing of grainage: as per the NSSO standers, disinfection and hygiene of grainage and equipment. Procurement of seed cocoon: visit to seed area and seed cocoon markets for selection of parental seed cocoons, quality assessment of seed cocoons, purchase and transportation. Caring of seed cocoons: sorting, assessment, preliminary examination of pupa, sex assessment and preservation.

Grainage activities: moth emergence, picking, identification and separation of males and females, pairing, depairing, oviposition, mother mothe examination (MME), preservation and reuse of male moths, preparation of egg on cards and loose eggs, surface disinfection of eggs, acid treatment, washing and selection of quality DFLs, refrigeration/ incubation, sale of DFLs. Development of enterprising abilities in grainage.

SER 426

**Commercial Cocoon/Seed Cocoons
Production Technology**

0+10

Importance of quality cocoon production (commercial and seed cocoons), special features of commercial and seed cocoons, requirements for commercial and seed cocoon production, mulberry production technology and feed quality management, planning for suitable rearing space and equipments for different sized mulberry garden, low cost rearing houses in silkworm rearing, disinfection and hygiene in sericulture, procurement of disease free layings, improved incubation and black boxing methods for quality chawki production, different methods of chawki and late age silkworm rearing for commercial and seed cocoon production, feed management for different methods of rearing silkworms, feed fortification and use of artificial diets in silk cocoon production, management of microclimate, spacing and silkworm bed cleaning in the rearing house, hygiene in silkworm rearing bed, moult management, management of pests and diseases, ripe worm management, use of chemicals and hormones in silkworm rearing, use of different mounting structures, spinning worm management, harvesting, cleaning, sorting and grading of cocoons, packing, transportation and sale of cocoons. Important seed and commercial cocoon markets for MV and BV silkworms, innovations and ITKs cocoon production technology, maintenance of records in silkworm rearing, visit to MV and BV seed areas, visit to progressive commercial and seed cocoon farmers fields.

SER 427

**Entrepreneurship Development in
Post Silk Technology**

0+10

Entrepreneurship – Meaning, types, concept of entrepreneurship, entrepreneurial, managerial characteristics maintaining an enterprise. Importance of planning, monitoring evaluation and follow up managing competition SWOT analysis, generation, incubation and commercialization of ideas and innovations experiential learning through EDP capsules.

Visit to private to organizations to study the development activities of various steps in post silk technology viz., throwsters unit, weaving unit, apparel unit Review of selected case studies. SWOT analysis of selected entrepreneurs and also enterprises of post silk industry. Visit to Govt. organizations involved in post silk technology public-private partnership units. Government policy on small and medium enterprises (SMEs/SSIs export and import policies relevant to silk industry ventures capital, joint ventures, public-private partnership. Societies involved in encouraging post silk enterprises. Government schemes and incentives for promotions of entrepreneurship.

SER 428

**Consultancy and Project Formulation
in Sericulture Industry**

0+10

Consultancy- Visit to private consultant firms related to agriculture. Registration procedure for consultant an firm Empanelment of technical experts. How to apply for RFP (Required for Proposals) calls. How to prepare technical and financial proposals for competitive bidding, Negotiating skills, conducting market and other related surveys report preparation and presentation. Sources of finance to start consultancy firms. Agro Based Industry and Agri-clinics.

Project formulation- Project-Meaning, need types (Primate and public, dependent and independent). Steps in project preparation-identification, formulation, appraisal, implementation, monitoring and evaluation. Identification of investment opportunities in seri business- social and private investments. Assessment of project costs and benefits for identified seri-business Development of cash flow statements for identified business-costing and pricing. Valuation of inputs and outputs, project evaluation techniques- discounted and undiscounted measures. Appraisal of projects data collection from project implementing Agency and beneficiaries. Format for preparation of project. Detailed project preparation-techno-economic appraisal. Generation and compilation of data for the project-detailed physical and financial data. Scrutiny, appraisal and analysis of data generated for selected project-techno-economic feasibility, break even analysis.

SER 429

Bio-Craft Technology

0+10

Introduction to By products and its importance of its value addition in Sericulture, By products in grainage: cut / pierced cocoons a potential material for value addition, , Process of making of cocoon crafts : cocoon sorting, cleaning, dyeing with fabric, natural and food dyes, learning about different equipment / tools required for cocoon craft making, Design, Development and Diversification of Cocoon crafts : hands on learning the skill and art of making single flowers, different types of garlands ; cocoon, silk ball, cocoon cap, VIP big garlands. Different forms of bouquets, Ikebana of cocoon craft flowers, arranging flowers using different types of vases; wooden, plastic, glass, bamboo, porcelain, mud pots.

Preparation of Cocoon craft photo frames, wall hangings, wall plates, buntings, car interior hangings, door, window hangings, making of key chains using cocoons, dolls etc.,

Interior decoration using cocoon crafts for different functions, learning skills of decoration for stage programmes.

Integrating Agri, Horti wastes in cocoon crafts and value addition, learning the entrepreneurial skills of Cocoon crafts.

Utility of silk waste for preparation of silk bangles, necklaces, Anklets, earrings, finger rings etc.,

Utility of silk border/waste cloth in making ladies purses, Hand bags, vanity bags, office files other usable materials.

| Evaluation of Experiential Learning (EL)/Hands on Training (HoT) Programme | | |
|---|------------------------------|-------------------|
| Sl. No. | Parameters | Max. Marks |
| 01. | Project Planning and Writing | 10 |
| 02. | Presentation | 10 |
| 03. | Regularity | 10 |
| 04. | Monthly Assessment | 10 |
| 05. | Output delivery | 10 |
| 06. | Technical Skill Development | 10 |
| 07. | Entrepreneurship Skills | 10 |
| 08. | Business networking skills | 10 |
| 09. | Report Writing Skills | 10 |
| 10. | Final Presentation | 10 |
| TOTAL | | 100 |

EVALUATION OF STUDENT READY PROGRAM

- Students shall be evaluated component-wise under village attachment/Government grainage/CSB/KSSRDI /hands on training/skill development training/experiential learning/student projects.
- Each College of the University will designate a Student READY Program Coordinator and component wise evaluation committees. These committees will evolve a method of evaluation depending upon the component undertaken giving due weightage to the observations made by the Scientists/Agro-industrial Officer and the Program Coordinator with whom they are attached.
- Since the Credit Hours allotted to the Student READY program are gradial, the minimum condition of attendance and grading system will apply for the program as will be applicable to other courses.
- It is expected that at the end of the Student READY program, the students should gain competency for entrepreneurship, which should be innovative and creative in nature. The evaluation committee must ensure percentage increase in the competency at the end & successful organization of all Student READY programs.

Educational Tour

One Education tour for 15 days during break period after the V Semester shall be conducted and grading shall be done as Satisfactory/Non satisfactory.

EXAMINATION AND EVALUATION SYSTEM

Declaration of division (I, II and III divisions, distinctions etc.) in the degree certificate to be made compulsory by all Universities:

1. Examination

- External theory (50%)
- Internal Theory + Practical (50%)

➤ Courses with Theory and Practical

Mid-term Exam (30%) + Assignment (5%) in practical oriented courses + Practical (15%)

➤ **Courses with only Theory**
Mid-term Exam (40%) + Assignment (10%)

➤ **Courses with only Practical:**
(100%) Internal

- Paper to be set by external: HOD shall ensure the coverage of syllabus. If needed moderation can be done.
- Evaluation to be done internally by the faculty other than the Course Instructor. Syllabus of the concerned course shall be sent to the external examiner, who shall prepare the question papers. For practical, it is recommended that examination shall be conducted by course instructor(s) and one teacher nominated by HOD.

2. Evaluation

| Percentage of Marks Obtained | Conversion into Points | OGPA | Division |
|------------------------------------|------------------------|-----------------|-----------------------------|
| 100 | 10 points | | |
| 90 to < 100 | 9 to < 10 | 5.000 – 5.999 | Pass |
| 80 to < 90 | 8 to < 9 | 6.000 – 6.999 | II division |
| 70 to < 80 | 7 to < 8 | 7.000 – 7.999 | I division |
| 60 to < 70 | 6 to < 7 | | |
| 50 to < 60 | 5 to < 6 | | |
| < 50 (Fail) | < 5 | 8.000 and above | I division with distinction |
| Eg. 80.76 | 8.076 | | |
| 43.60 | 4.360 | | |
| 72.50 (but shortage in attendance) | Fail (1 point) | | |

GPA = Total points scored / Total credits (for 1 semester)

CGPA = Σ Total points scored / Course credits

OGPA = Σ Total points scored (after excluding failure points) / Course credits

% of Marks = OGPA x 100/10