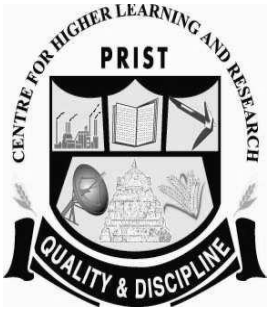

Ponnaiyah Ramajayam Institute of Science & Technology [PRIST]

(Institution Deemed to be University – U/s 3 of the UGC Act, 1956)

Vallam, Thanjavur – 613 403, TAMIL NADU

B.Sc. (Agriculture) Syllabus

2016-2017 Regulation

Programme educational objectives

The educational objectives are intended to impart high quality education so as to produce not just agricultural graduates but agro technocrats with practical and conceptual skills. With precise and deliberate course modules, which provides education, research and training along with first hand field experiences, the students would sure be transformed as skilled human resources.

During the programme of four year duration, the students will undergo 71 courses in the domain of agriculture, horticulture, agricultural engineering, and information technology including linguistics. The students would gain in depth expertise in scientific farm management and post harvest technologies. The students are also taught with elective courses on mushroom cultivation, sericulture, tissue culture crops and bio fertilizer production, which could explore the graduates' entrepreneurial skills and also add students 'competitive values' in job market.

Programme outcome

At the end of the programme, the graduate should be able to:

1. Recognize the importance of agriculture in providing food, fibre and income as well as nation building.
2. Understand scientific methods of cultivation of field crops and horticultural crops along with animal production.
3. Establish agro based start-ups for the upliftment of rural community
4. Initiate rural enterprises there by providing jobs for the jobless.
5. Carry out basic and applied research geared towards augmentation of crop and animal production
6. Transfer of agro technologies to the farming community via public and private sector stakeholders.
7. Pursue advanced courses and trainings in International and National institutions

CREDIT DISTRIBUTION (2016-2017)

Semester	CORE COURSES		EXPERIENTIAL LEARNING COURSES		ELECTIVE COURSES		RESEARCH		Total Credits for OGPA
	No.	Credits	No.	Credits	No.	Credits	No.	Credits	
I	7	13	-	-	-	-	-	-	13
II	9	19	-	-	-	-	-	-	19
III	10	25	-	-	-	-	-	-	25
IV	11	24	-	-	-	-	-	-	24
V	11	24	-	-	-	-	-	-	24
VI	11	21	1	3	-	-	-	-	24
VII	2	6	-	-	-	-	1	2	8
VIII	6	15	1	3	1	2	-	-	20
Total	**67**	**147**	**2**	**6**	**1**	**2**	**1**	**2**	**157**

Semester – wise distribution of courses

I Year I Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 101	Principles of Agronomy and Agricultural Heritage	1+1
2	16 COM 111	Fundamentals of Information Technology	1+1
3.	16 MAT 111	Applied Mathematics	1+1
4.	16 SAC 101	Principles of Analytical Chemistry	1+1
5.	16 PBG 101	Introduction to Agricultural Botany	1+1
6.	16 ENG 101	English for effective communication	0+1
7.	16 AEX 101	Fundamentals of Rural Sociology and Educational Psychology	1+1
		Total	**6+7=13**

I Year II Semester

S. No.	Course No.	Course Title	Credit Hours
1.	16 AGR 102	Fundamentals of Agricultural Meteorology	1+1
2.	16 BIC 101	Fundamentals of Biochemistry	2+1
3.	16 CRP 101	Fundamentals of Plant Physiology	2+1
4.	16 AEC 101	Principles of Economics	1+1
5.	16 SER 121	Principles and practices of sericulture	1+1
6.	16 ENS 101	Principles of Environmental Sciences	1+1
7.	16 FSN 111	Principles of Food Science and Nutrition	1+1
8.	16 FOR 121	Agro Forestry	1+ 1
9.	16 TAM 101	தமிழ் இலக்கியங்களில் வேளாண்மையும் அறிவியல் தமிழ்ப் பயன்பாடும்	0+1
	16 ENG 103	Development Education- for non Tamil students	
		Total	**10+9=19**

II year III Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 201	Weed Management	1+1
2.	16 AEN 201	Fundamentals of Entomology	2+1
3.	16 AGR 202	Irrigation Management	1+1
4.	16 PAT 201	Fundamentals of Plant Pathology	2+1
5.	16 SAC 201	Fundamentals of Soil Science	2+1
6.	16 AMP 201	Livestock and Poultry Production Management	2+1
7.	16 AGM 201	Fundamentals of Microbiology	2+1
8.	16 AEX 201	Dimensions of Agricultural Extension	1+1
9.	16 FMP 211	Farm Power and Machinery	1+1
10.	16 AEC 201	Production Economics and Farm Management	1+1
		Total	**15+10=25**

II year IV Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 203	Agronomy of field Crops- I	1+1
2.	16 HOR 211	Production Technology of Fruits and Plantation Crops	2+1
3.	16 SST 201	Principles and Practices of Seed Production	1+1
4.	16 SWE 211	Fundamentals of Soil and Water Conservation Engineering	2+1
5.	16 STA 211	Applied Statistics	1+1
6.	16 ERG 211	Renewable Energy	1+0
7.	16 AGR 204	Study Tour (10 days)	0+1
8.	16 AEN 202	Economic Entomology and Principles of Pest Management	2+1
9.	16 PBG 201	Principles of Genetics and Cytogenetics	2+1
10.	16 SAC 202	Soil Resource Inventory and Problem Soils	1+1
11.	16 ANM 201	Agricultural Nematology	1+1
		Total	**14+10=24**

III year V semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 301	Crop Production-I	0+1
2.	16 AGR 302	Agronomy of field Crops- II	1+1
3.	16 SAC 301	Soil Fertility, Fertilizers and Manures	2+1
4.	16 AEN 301	Pests of Field Crops and their Management	1+1
5.	16 PAT 301	Diseases of Field Crops and their Management	1+1
6.	16 ABT 301	Plant Biotechnology	2+1
7.	16 PBG 301	Principles and Methods of Plant Breeding	2+1
8.	16 AGM 301	Soil and Applied Microbiology	1+1
9.	16 AEC 301	Agricultural Marketing, Trade and Prices	1+1
10.	16 ARM 301	Agribusiness Management and Entrepreneurship	1+1
11.	16 SST 301	Seed Quality Regulation and Storage	1+1
		Total	**13+11=24**

III year VI semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 304	Principles and practices of cropping and Farming Systems	1+1
2.	16 AGR 303	Crop Production – II	0+1
3.	16 SAC 302	Crop and Pesticide Chemistry	2+1
4.	16 AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1 +1
5.	16 AEN 302	Pests of Horticultural Crops and their Management	1+1
6.	16 NST 301	Fundamentals and Applications of nanotechnology	1+0
7.	16 FPE 301	Post Harvest and Food Engineering	1+1
8.	16 ENS 301	Environmental Pollution and Management	1+1
9.	16 HOR 311	Production Technology of Vegetables and Spice crops	2+1
10.	16 ENG 301	Soft skills for Employability	0+1
11.	16 EXP 301	Experiential Learning - I*	0+3
12.	16 PAT 301	Principles of plant disease management	1+1
	Total		**11+13=24**

* Experiential Learning Course (List of options given in page number 8)

IV year VII semester

S.No	Course No.	Course Title	Credit Hours
1.	16 AEX 401	Rural Agricultural Work Experience - RAWE (VSP+ADA+NGO+INDUSTRY)	0+5
2.	16 PRJ 401	Project Work**	0+2
3.	16 AEX 402	All India Tour (21 days)	0+1
		Total	**0+8=8**

** Research course (Project Topic based on current issue)

IV year VIII semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 401	Organic Farming	1+1
2.	16 PBG 401	Breeding Field and Horticultural crops	2+1
3.	16 PAT 401	Diseases of Horticultural crops and their management	2+1
4.	16 AEC 401	Agricultural Finance, Banking and Co-operation	1+1
5.	16 HOR 411	Production Technology of Flowers, Medicinal and Aromatic Crops	2+1
6.	16 EXP 401	Experiential Learning – II*	0+3
7.	16 ENS 401	Climate Change and Disaster Management	2+0
8.	16 OPT 401	Optional Course***	1+1
		Total	**11+9= 20**

* Experiential Learning Course (List of options given in page number 8)

*** Elective course (List of options given in page No. 9)

LIST OF EXPERIENTIAL COURSES

S. No.	Titles of the module	Credit Hours
1.	Bio-agents and Bio-fertilizer production	0+10
2.	Hybrid Seed Production in Vegetables Crops	0+10
3.	On Farm Advisory for Soil Health, Water Quality & Plant Nutrition	0+10
4.	Commercial Beekeeping	0+10
5.	Commercial Cocoon Production	0+10
6.	Commercial Plant Tissue Culture	0+10
7.	Commercial Nursery Technology of Horticultural Crops	0+10
8.	Commercial Landscape Gardening	0+10
9.	Commercial production of Bio-control agents	0+10
10.	Commercial mushroom production	0+10
11.	Commercial broiler and layer production	0+10
12.	Commercial seed production	0+10
13.	Hybrid pearl millet seed production	0+10
14.	Hybrid rice parental line seed production	0+10
15.	Managerial skill for Agribusiness	0+10
16.	Export Import and Protection of Property Rights in Agriculture	0+10
17.	Development of Integrated Farming system Model	0+10
18.	Protected cultivation of Vegetable crops	0+10
19.	Composting technology	0+10
20.	Utilization of Rearing Bed Refuse, Pupae and Unreelable Cocoons	0+10
21.	Agri-business management	0+10

LIST OF ELECTIVE COURSES

Elective courses : A student can select one optional course out of the following offered during VIII semester.

S. No.	Optional courses for 2 credits	Credit Hours
1.	Applied Crop Physiology	1+1
2.	Designer fertilizer Production	1+1
3.	Rejuvenation of Deteriorated lands	1+1
4.	Soilless crop production	1+1
5.	Instrumental methods of analysis	1+1
6.	Seed entrepreneurship skill development and management	1+1
7.	Production Technology of Field Crops	1+1
8.	Weed and water management	1+1
9.	Plant Genetic Resources Collection, Conservation and Utilization	1+1
10.	Commercial Production of Nematode Antagonistic bio-agents	1+1
11.	Downstream Processing for Industrially Important Microbial Products	1+1
12.	Microbial Enzymes	1+1
13.	Plant –Microbe Interaction	1+1
14.	Quality Control of Bio-inoculants	1+1
15.	Crop and Pesticide Chemistry	1+1

I Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 101	Principles of Agronomy and Agricultural Heritage	1+1
2	16 COM 111	Fundamentals of Information Technology	1+1
3.	16 MAT 111	Applied Mathematics	1+1
4.	16 SAC 101	Principles of Analytical Chemistry	1+1
5.	16 PBG 101	Introduction to Agricultural Botany	1+1
6.	16 ENG 101	English for effective communication	0+1
7.	16 AEX 101	Fundamentals of Rural Sociology and Educational Psychology	1+1
		Total	**6+7=13**

16 AGR101 PRINCIPLES OF AGRONOMY AND AGRICULTURAL HERITAGE (1+1)

Theory:

Unit - I:

Agriculture - Definition - Importance and scope - Branches of agriculture - Evolution of man and agriculture - History of agricultural development in the World and India.

Unit - II:

Agriculture heritage - Agriculture in ancient India - Stages of agriculture development - Era of civilization - Importance of Neolithic civilization - Chronological agricultural technology development in India - Kautilya‘s Arthasasthra - Sangam literature - Kambar Eaer Ezhupathu - ITK - Development of scientific Agriculture - National and International Agricultural Research Institutes in India - Indian agriculture.

Unit - III:

Agronomy - Definition - Importance - Meaning and scope - Agro-climatic zones of Tamil Nadu - Agro ecological zones of India - Crops and their classification - Economic and agronomic - Major crops of India and Tamil Nadu - Major soils of Tamil Nadu - Factors affecting crop production - climatic - edaphic - biotic - physiographic and socio economic factors.

Unit - IV:

Tillage - Definition - Types - Objectives - Modern concepts of tillage - Main field preparations - Seeds - seed rate - sowing methods - Crop establishment methods - Planting geometry and its effect on growth and yield - After cultivation -Thinning - Gap filling - Weeds - Definition - Weed control methods.

Unit - V:

Manures and fertilizers (organic, in-organic, green manure) - time and method of application - Irrigation - Principles and concepts - Cropping patterns and cropping systems - Sustainable agriculture - integrated farming systems - Organic agriculture - Principles and concepts - Dry farming - Principles and concepts.

Practical:

Visit to college farm - Study of farm features and measurements - identification of crops and seeds - working out seed rate - Study of seed treatment practices - Study of tillage implements; practicing ploughing, puddling operations, practicing seeding different methods of sowing and planting - Study and practicing inter-cultivation implements; Practicing fertilizer applications - Participation in ongoing field operations.

Theory - Lecture Schedule:

1. Agriculture - Definition - Importance and scope - Branches of agriculture - Evolution of man and agriculture.

2. Indian agriculture - Indian economy - National income - per capita income - Agricultural income in GDP - Women in agriculture and empowerment.
3. History of agricultural development in the world and India. Agriculture heritage - Agriculture in ancient India.
4. Stages of agriculture development - Era of civilization - Importance of Neolithic civilization.
5. Chronological agricultural technology development in India. Kautilya‘s Arthasasthra - Sangam literature - rainfall prediction - ITK - Tamil Almanac.
6. Development of scientific agriculture - National and International Agricultural Research Institutes.
7. Agronomy - definition - meaning and scope. Agro-climatic zones of India and Tamil Nadu - Agro ecological zones of India and Tamil Nadu.
8. **Mid-semester Examination.**
9. Crops and major soils - classification - Economic and agricultural importance in Tamil Nadu and India.
10. Factors affecting crop production - climatic - edaphic - biotic- physiographic and socio economic factors.
11. Tillage - Definition - objectives - types of tillage - modern concepts of tillage - main field preparation.
12. Seeds - Seed rate - sowing methods - Germination - Crop stand establishment - Planting geometry.
13. Weeds - Definition - harmful and beneficial effects of weeds - crop weed competition and management of weeds - IWM.
14. Role of manures and fertilizers in crop production - Inter cultivation - Thinning - gap filling and other intercultural operations.
15. Irrigation - time and methods - Modern techniques of irrigation - Drainage and its importance.
16. Cropping patterns and cropping system - intensive cropping - sustainable agriculture – IFS.
17. Organic / eco - friendly agriculture - Dry farming- principles and concepts.

Practical schedule

1. Visit to college farm to observe wetland farming system and identification of crops.
2. Visit to college farm to observe garden land and dry land farming systems and identification of crops.
3. Identification of seeds, manures, fertilizers, green manures and green leaf manures.
4. Identification of tools and implements.
5. Acquiring skill in handling primary and secondary tillage implements.
6. Practicing different methods of land configuration for raising nursery for wet land crops.
7. Practicing different methods of land configuration for raising nursery for garden land crops.
8. Practicing different methods of seed treatments, methods of sowing and seeding

implements.

9. Working out seed rates and practicing thinning, gap filling operations for optimum crop stand and intercultural operations.
10. Working out manure and fertilizer requirement of crops.
11. Practicing methods of application: manures and fertilizers and incorporation of green manure and green leaf manure.
12. Identification of weeds, weeding practices and handling of weeding tools and implements.
13. Observing various irrigation methods.
14. Practicing harvesting operations in major field crops.
15. Participation in on-going field operations during on campus / off campus visit.
16. Visit to nearby Agricultural Research station.
17. **Practical Examination.**

References

1. Yellamananda Reddy, T. and G.H. Sankara Reddi. 1997. Principles of Agronomy. Kalyani Publishers, New Delhi.
2. Sankaran, S. and V.T. Subbiah Mudaliar. 1997. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
3. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

E-References

http://icar.res.in
ww.webcast.gov.in
ww.icar.org.in/nasm.html

16 COM 111 FUNDAMENTALS OF INFORMATION TECHNOLOGY (1+1)

Theory

UNIT I: COMPUTER BASICS

Introduction to Computer – Evolution and Generation of Computers - Classification of Computers – Computer Organization and Architecture - Data Representation - Memory and Storage - Input Output Media - Current Trends in Computer.

UNIT II: OPERATING SYSTEM AND SOFTWARE

Introduction to Software - Categories – System Software - Evolution and Types of Operating System - Functions of Operating System - Application Software - Installation and Un-installation – Office Automation Software - Word Processing – Spread sheet - Presentation – Multimedia and its Building Blocks - Multimedia Applications – Virtual Reality – Current Trends in System and Application softwares.

UNIT III: COMPUTER NETWORKS AND INTERNET

Introduction to Computer Networks – Topologies – Communication Protocol – Network Devices - Introduction to Internet – Internet Applications – Internet Tools - Web Browser – Email client – Search Engines – Instant Messaging – Computer Security - Current Trends in Computer Networks and Internet.

UNIT IV: COMPUTER PROGRAMMING AND LANGUAGES

Introduction to Computer Programming – Algorithm – Flowchart – Decision Tables – Pseudo code – Program Control Structures – Programming paradigms – Introduction to Programming Languages – Generation of Programming Languages - Current Trends in Computer Programming and Languages.

UNIT V: DATABASE MANAGEMENT SYSTEMS

Introduction to Database - Logical and Physical Data Concepts – Data Base Management System - DBMS Architecture - Database Models – Normalization Techniques – Types of Databases – Introduction to Structured Query Language – SQL Commands - Current Trends in Database Management Systems.

Theory – Lecture Schedule

1	Introduction to Computer, Evolution of Computers, Generation of Computers and Classification of Computers.
2	The Computer System, Computer Organization and Architecture, Central Processing Unit, Inside a Computer.
3	Data Representation in Computers, Computer Memory and Storage, Input Output Media and Current Trends in Computer.

4	Introduction to Software, Categories of Software, System Software, Evolution of Operating System, Types of Operating System, Functions of Operating System.
5	Introduction to Application Software**,** Installation and Un-installation of software, Software Piracy, Software Terminologies, Office Automation Software, Word Processing, Spread sheet, Presentation.
6	Introduction to Multimedia, Building Blocks of Multimedia, Multimedia Systems, Multimedia Applications, Virtual Reality. Current Trends in System and Application softwares.
7	Introduction to Computer Networks**,** Network Topologies, Communication Protocol, Network Devices
8	Introduction to Internet, Internet Applications, Internet Tools, Web Browser and Email client
9	**Mid-semester examination**
10	Search Engines, Instant Messaging, Computer Security. Current Trends in Computer Networks and Internet.
11	Introduction to Computer Programming, Algorithm, Flowchart, Decision Tables, Pseudo code and Program Control Structures
12	Programming paradigms, Introduction to Programming Languages
13	Generation of Programming Languages, Current Trends in Computer Programming and Languages.
14	Introduction to Database, Logical and Physical Data Concepts, Data Base Management System and its Architecture, Database Models
15	Normalization Techniques, Types of Databases, Introduction to Structured Query Language
16	Data Definition Language, Data Manipulation Language
17	Current Trends in Database Management Systems.

Practical Schedule

1. Working with basic Computer Hardware
2. Number System conversion : Decimal, Binary, Octal, Hexa Decimal, Binary addition and subtraction
3. Conversion between bits, bytes, kilobits, kilobytes, megabits, megabytes, gigabits, gigabytes
4. Working with MS DOS commands
5. Working with Windows Operating system
6. Working with Linux Operating System
7. Working with Word Processing Software
8. Working with Presentation Software
9. Working with Spreadsheet Software

10. Working with Image Editing Software
11. Working with basic networking commands
12. Working with Web Browsers and Search Engines
13. Working with Emails
14. Working with Programming basics : Algorithm, Flowchart, Pseudo Code and Coding
15. Working with DBMS softwares
16. Working with SQL commands
17. **Final Pracitcal Examination**

Text book

1. Pearson , Introduction to Information Technology, 2013 Second Edition, ITL Education Solutions Limited.

Reference book

1. Pearson , Express Learning: Introduction to Information Technology, 2012 Edition, ITL Education Solutions Limited.

e-reference :
http://pearsoned.co.in/ITLEducationSolutionsLimited/

16 MAT 111 APPLIED MATHEMATICS (1+1)

Aim

To understand and apply fundamental concepts of mathematics applicable in biology and to acquire about theoretical concepts of Algebra, Calculus and Mathematical Modeling.

Theory

Unit I Algebra

Permutation and Combination -meaning of nPr and nCr and simple problems. Progressions - Arithmetic, Geometric and Harmonic progressions. Matrices: Types - Algebra of matrices - Determinants – expansion– inverse of a matrix by adjoint method-solving system of equations by Cramer‘s rule and matrix inverse method.

Unit II Differential Calculus I

Definition – methods of differentiation. Geometrical and physical meaning of the derivative - Higher order derivatives - Applications of differentiation. Partial differentiation – Homogeneous functions and Euler‘s Theorem - Applications

Unit III Differential Calculus II

Increasing and decreasing function-Maxima and minima of single and several variables with and without constraints- Physical and Economic optimum- Applications in agriculture.

Unit IV Integral Calculus

Definition of integration-indefinite and definite integrals-Formulae-methods of integration - substitution, method of partial fractions-Integration by parts -Simple applications in finding the area and volume by integration.

Unit V Mathematical Models

Agricultural systems - Mathematical models - classification of mathematical models-Linear, quadratic, exponential and logistic models.

Practical

Problems in Permutation and Combination . Problems in A.P, G.P, and H.P. in biology. Problems in forming price and quantity matrix and estimation of revenue matrix.

Formation and solution (using matrix inverse and Cramer’s rule) of simultaneous equations from problems in agriculture.

Problems in differentiation- maxima and minima of single and several variables with and without constraints - physical and economic optimum-finding the fertilizer dosage for maximum yield and maximum profit. Simple problems in methods of integration computation of area, volume using definite integrals. Problems in fitting linear, quadratic, exponential and logistic models to data from agricultural experiments.

Lecture Schedule

1. Permutation and combination-meaning of nPr and nCr-simple problems

2. Arithmetic, Geometric and Harmonic progression.
3. Matrix Algebra and evaluation of determinants.
4. Inverse of a matrix by adjoint method.
5. Solution of simultaneous equations by Cramer‘s rule & inverse method.
6. Differentiation – definition – methods of differentiation- Geometrical and physical meaning of the derivative
7. Higher order derivatives- Applications of differentiation
8. Partial differentiation –Homogeneous functions and Euler‘s Theorem
9. **Mid Semester Examination.**
10. Increasing and decreasing function- Maxima and minima of single variables- Physical and Economic optimum –Applications in agriculture- finding the fertilizer dosage for maximum yield and maximum profit.
11. Maxima and minima of several variables without constraints
12. Maxima and minima of several variables with constraints
13. Integration – methods of integration and definite integrals
14. Integration by parts -Application of integration in area and volume.
15. Agricultural systems - Mathematical models - classification of mathematical models
16. Linear and Quadratic models-their applications in agriculture.
17. Exponential and Logistic models - their applications in agriculture.

Practical schedule

1. Simple problems in permutation and combination and its applications.
2. Problems Arithmetic, Geometric and Harmonic progression
3. Problems in Matrix Algebra and determinants.
4. Inverse of a matrix by adjoint method
5. Solution of simultaneous equations by Cramer‘s rule & Inverse method.
6. Problems in Differentiation – methods of differentiation.
7. Problems in Partial differentiation
8. Problems in Homogeneous functions and Euler‘s Theorem
9. Problems in Increasing and decreasing function- Maxima and minima of single variables.
10. Physical and Economic optimum-Finding the fertilizer dosage for maximum yield and maximum profit.
11. Problems in Maxima and minima of several variables without constraints
12. Problems in Maxima and minima of several variables with constraints
13. Simple problems in methods of integration and applications of definite integrals
14. Problems in integration by parts -Application of integration in area and volume.
15. Problems in fitting linear and quadratic models to data from agricultural experiments
16. Problems in fitting Exponential and Logistic models to data from agricultural experiments
17. **Final Practical Examination**

Outcome

Students will acquire knowledge in basic techniques that are applicable to agricultural sciences. Further the course will provide them good introduction to various mathematical models used in Biological sciences.

Text Books

1. Manickavasagam Pillai, T. K and Natarajan, T. 2003. Calculus, Viswanathan Publications, Madras.
2. Suyambulingom, C and Kailasam, C. 1990. Mathematics for plant sciences, Sakthi Publications, Coimbatore.

REFERENCES

1. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
2. James Stewart and Barhara Frank, Calculus, 2008, International Thomson Publishers, Singapore
3. Mehta, B. C. and G. M. K. Madnani.2006, Mathematics for Economists, Latest edition, Sultan Chand & Sons, New Delhi.
4. Veerarajan, T, 2004. Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Ranganathan.C.R. 2006, A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi
6. Elizabeth S. Allman, John A. Rhodes, 2004, Mathematical Modelling in Biology An Introduction, Cambridge University Press, New Tork.

E-Reference

www.mathworld.com
http://en.wikipedia.org/wiki/Portal:Mathematics
http://www.sosmath.com/

E-Journals http://www.math.neu.edu/~Suciu/journals.htm

16 SAC 101 PRINCIPLES OF ANALYTICAL CHEMISTRY (1+1)

Aim:

To impart knowledge on concepts and principles of analytical techniques among under graduatestudents. It also provides opportunity to develop skill among students in various analytical techniques.

Syllabus - Theory

Unit I - General principles

General principles of analytical chemistry - common analytical methods - qualitative and quantitative analysis - accuracy and precision of analytical results- Preparation of laboratory reagents

Unit II Volumetric analysis

Volumetric analysis - Calibration of apparatus- preparation of primary and secondary standards -standardization. Theory of indicators and buffers - acidimetry, alkalimetry, oxidometry, complexometry and precipitometry

Unit III Gravimetric analysis

Gravimetric analysis - principles of precipitation reactions- solubility product - common ion effect -conditions of precipitation - Choice of filters - washing solutions.

Unit IV - Instrumental methods

Instrumental analysis - principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectrometry - chromatography - Choice of analytical methods.

Unit V - Nuclear Techniques

Radioactivity - radio tracer techniques in agriculture - Stable isotopes - tracing carbon and nitrogen -mass spectroscopy - use of stable isotopes in agriculture

Syllabus - Practical

Analytical techniques and concepts - Volumetry - Gravimetry - Acidimetry - Alkalimetry -Permanganometry - Dichrometry - lodometry, Complexometry - Potentiometry - Conductometry -Colorimetry - Spectro-photometry -Turbidimetry - Flame Photometry - Atomic absorption spectrophotometry- Radioactivity-Measurement

Lecture schedule

1 General principles in analytical chemistry - common analytical methods - quantitative and qualitative analysis -Accuracy and precision of analytical results.
2 Preparation of laboratory reagents - digestion and distillation techniques
3 Volumetric analysis - Calibration of apparatus- preparation of primary and secondary

standard solutions - standardization.

4 Theory of indicators and buffers. Preparation of indicators and buffer solutions.

5 Theory of acidimetry and alkalimetry - titration curve.

6 Theory of Permanganometry, dichrometry, complexometry and precipitometry

7 Gravimetric analysis -Precipitation - solubility product - common ion effect - conditions of precipitation.

8 Gravimetric analysis - moisture - filtration of suspension - precipitation techniques

9 Midsemester examination

10 Filtration and choice of filters - washing - washing solutions and washing technique

11 Instrumental methods of analysis - Principles of potentiometry, conductometry.

12 Principles of colorimetry and spectrophotometry

13 Principles of Atomic absorption and Atomic emission spectrometry

14 Principles of chromatography - Paper chromatography and TLC

15 Principles of Gas chromatography and HPLC.

16 Introduction to radioactivity - radio tracer techniques in agriculture

17 Stable isotopes C and N - Mass spectrometer applications in agricultural research

Practical Schedule

1. Common laboratory glassware and apparatus - do's and don'ts in the laboratory
2. Principles of Gravimetry and Moisture estimation
3. Volumetric analysis - Preparation of primary, secondary standard solutions and indicators
4. Acidimetry-Standardization of acids
5. Alkalimetry - Standardization of bases
6. Permanganometry - Standardization of $KMnO_4$
7. Dichrometry - Standardization of Ferrous Sulphate
8. lodometry - Estimation of Copper
9. Complexometry - Estimation of Calcium and Magnesium
10. Potentiometry and Conductometry - Determination of pH and EC
11. Spectrophotometry - Determination of phosphorus
12. Turbidimetry - Estimation of Sulphur
13. Flame Photometry - Estimation of Potassium
14. Absorption spectrophotometry - Estimation of Fe / Zn / Mn / Cu
15. Study of components of Gas chromatography/ HPLC
16. Detection and measurement of radioactivity using Geiger Muller (GM) Counter -Visit to Radio Isotope Laboratory, Coimbatore
17. Practical Examination

Text books

1. Jeffery, G.H, J.Basset, J.Mendham, R.C. Denney (1988,) Vogel‘s e-book on Text book of Quantitative Chemical Analysis V^{th} edition Longman Scientific &Technical and John Wiley &Sons Inc., NewYork

2. Pradyot Patnaik. (2004) e-book on Dean‘s Analytical Chemistry Handbook, Second edition. McGraw –Hill Handbooks

Reference books

1. Chatwal Anand. 1999. Instrumental Methods of Chemical Analysis. Himalaya Publishing House, New Delhi.

2. Chopra, S.L. and J.S.Kanwar. 1976. Analytical Agricultural Chemistry. Kalyani Publishers, Ludhiana, New Delhi.

3. Gabb, M.H. and Latchem, W.E. 2012. A Hand Book of Laboratory Solutions. Scientific Publishers, Jodhpur, India,

4. Gary D.Christian. 2007. Analytical Chemistry. Wiley Student Edition, Singapore.

5. Gupta A.K. and Varshney ML., 1989. Practical manual for Agricultural Chemistry - Kalyani Publishers, New Delhi.

6. Hamilton I.F. and Simpson G.S.G., 1964. Quantitative Chemical Analysis - The MC Millan Co., New York.

7. Hessee, P.R. 2002. A Text book of Soil Chemical Analysis. CBS Publishers and Distributors Pvt. Ltd., New Delhi.

8. Jackson, ML. 2014. Soil Chemical Analysis. Scientific Publishers, Jodhpur, India.

9. James Holler, F. and Donald, M.West. 2008. Fundamentals of Analytical Chemistry. Cengage Learning Publishers

10. Khandpur, R.S. 2012. Hand Book of Analytical Instrumentation. Tata McGraw Hill Education Pvt. Ltd.

11. Keith A. Smith, 1983. Soil Analysis - Instrumental Techniques and Related Procedures, New York.

12. Khopkar, S.M. 1998. Basic concepts of Analytical Chemistry. New Age International Publications

13. Kreshkov A.P. and Yaroslavtsev, 1977. Course of Analytical Chemistry Vol.ll. Quantitative Analysis - Mir Publishers, Moscow.

14. Liptak, 1994. Analytical Instrumentation. Taylor and Francis. Pp. 471.

15. Piper, C.S 2014. Soil and plant analysis: Scientific Publishers, Jodhpur, India.

16. Sankaram, A. 1966. A Laboratory Manual for Agricultural Chemistry - Asia Publishing House, Bombay.

17. Valcarcel, M. 2000. Principles of Analytical Chemistry. Vol. XV. Pp.372. Springer

Publishers

18. Verma, R.M. Analytical Chemistry - Theory and Practice. 2010. CBS Publishers and Distributors Pvt. Ltd., New Delhi.

e-references

1. http://en.wikipedia.org/wiki/AnalyticaLchemistry

2. http://www.scribd.com/doc/30296831/lnstant-Notes-in-Analytical-Chemistry 3.

http://nzic.org.nz/ChemProcesses/analysis/15B.pdf

4. www.aoac.org

5. http://www.tutornext.com/ws/rock-type-chart 6.

http://www.chem.uoa.gr

7. http://www.chemguide.co.vk/analysis/paper.html.

8. http://www.ias.ac.in/initiat/scied/resources/chemistry

9. Portal.acs.org/portal/career/CTP-003375

Out come

The students will gain knowledge on concepts and principles of analytical techniques. They will also acquire skills in various analytical techniques. Further, the knowledge gained will form as building block to pursue many research works.

16 PBG 101 INTRODUCTION TO AGRICULTURAL BOTANY (1+1)

Aim: To expose the students to the basic features of botanical description, economic parts and economic importance of different field and horticultural crops

SYLLABUS FOR THEORY

Unit I: Systems of classification and general morphological description

Bentham and hooker‘s classification of plant kingdom — international code of nomenclature and its major guidelines – author citation – agricultural classification of crops; general morphology: life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; modification of roots and leaf; floral morphology: kinds of bracts, inflorescence; structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit II: Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description of Poaceae: Key botanical features of Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, *Cenchrus* and Sugarcane

Unit III: Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram, Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunnhemp,

Unit IV: Botanical description and economic uses of Pedaliaceae, Asteraceae, Oleaceae, Brassicaceae, Euphorbiaceae, Arecaceae and Malvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Pedaliaceae - Gingelly; Asteraceae - Sunflower, Safflower, Chrysanthemum; Oleaceae – Jasmine; Brassicaceae - Rapeseed and Mustard, Cabbage, Cauliflower; Euphorbiaceae: Castor; Jatropha and Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm, Sugarpalm; Malvaceae: Cotton, Mesta and Bhendi.

Unit V: Botanical description and economic uses of Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae,Cucurbitaceae, Alliaceae, Musaceae, Rubiaceae, Theaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and key botanical features of the crops given against them. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet; Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul and Acacia; Moraceae: Mulberry; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic; Musaceae: Banana, Manila hemp; Rubiaceae: Coffee; Theaceae: Tea

SYLLABUS FOR PRACTICAL

Family features - observation and description of habit, morphology of root, stem, leaves, inflorescence, flowers, floral diagram, floral formula and economic parts of Poaceae: Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, Guinea grass, Napier grass, *Cenchrus* and Sugarcane*;* Papilionaceae: Redgram, Bengal gram, Soybean, Blackgram, Greengram, Cowpea, Lab-lab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunnhemp; Pedaliaceae: Gingelly; Asteraceae: Sunflower, Safflower and Chrysanthemum; Oleaceae: Jasmine; Brassicaceae: Rape and Mustard, Cabbage, Cauliflower; Euphorbiaceae: Castor, Jatropha, Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm and Sugar palm; Malvaceae: Cotton, Mesta, Bhendi; Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet; Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul and Acacia; Moraceae: Mulberry; Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic; Musaceae: Banana, Manila hemp; Rubiaceae: Coffee; Theaceae: Tea

Theory schedule

1. Bentham and Hooker‘s classification of plant kingdom — International code of nomenclature and its major guidelines – author citation – Agricultural classification of
2. crops
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf
4. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation , types of fruits.
5. List of cultivated crops, economic parts, chromosome number and family description of Poaceae; Key botanical features of Rice and Wheat.
6. Key botanical features of sorghum, maize, pearl millet and finger millet. List of small millets
7. Key botanical features of Guinea grass, Napier grass, *Cenchrus* and sugarcane.
8. List of cultivated crops, economic parts, chromosome number and family description of (Papilionaceae) Key botanical features of Red gram, Bengal gram and Soybean
9. Key botanical features of Black gram, Green gram, Cowpea, Lab lab, Horse gram and Groundnut.
10. **Mid Semester Examination**
11. Key botanical features of Lucerne, *Stylosanthes*, Clitoria, Agathi, and Sunnhemp.
12. List of cultivated crops, economic parts, chromosome number and family description of Pedaliaceae and Asteraceae: Key botanical features of Gingelly, Sunflower, Safflower, Chrysanthemum; Oleaceae: Jasmine
13. List of cultivated crops, economic parts, chromosome number and family description of Brassicaceae and Euphorbiaceae; Key botanical features of Rapeseed and Mustard, Cabbage, Cauliflower, Castor, Jatropha and Tapioca
14. List of cultivated crops, economic parts, chromosome number and family description of Arecaceae and Malvaceae; Key botanical features of Coconut, Arecanut, Oilpalm,

Sugarpalm, Cotton, Mesta and Bhendi.

15. List of cultivated crops, economic parts, chromosome number and family description of Tiliaceae, Piperaceae and Chenopodiaceae; Key botanical features of Jute, Betelvine, Sugar beet.
16. List of cultivated crops, economic parts, chromosome number and family description of Solanaceae, Mimosae and Moraceae; Key botanical features of Tobacco, Potato, Chilli, Tomato and Brinjal, Desmanthes. Subabul, Mulberry
17. List of cultivated crops, economic parts, chromosome number and family description of Cucurbitaceae and Alliaceae; Cucurbitaceae: Key botanical features of Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic
18. List of cultivated crops, economic parts, chromosome number and family description of Musaceae, Rubiaceae and Theaceae; Key botanical features of Banana, Manila hemp, Coffee and Tea
19. **Final Theory Examination**

Practical schedule

1. Observing general morphology of roots, stems and leaves.
2. Observing general morphology of inflorescence - flowers, stamens and pistils.
3. Family characters, Botany, Economic parts, Floral diagram and Floral formula of the following crop plants:- Poaceae: Rice and Wheat
4. Poaceae: Sorghum, Maize, Pearl millet, Finger millet.
5. Poaceae: Guinea grass, Napier grass, *Cenchrus* and Sugarcane.
6. Papilionaceae: Redgram, Bengal gram and Soybean.
7. Papilionaceae: Blackgram, Greengram, Cowpea, Lab-lab, Horse gram and Groundnut.
8. Papilionaceae: Lucerne, *Stylosanthes*, Clitoria, Agathi, Sunnhemp, and Sesbania.
9. Pedaliaceae: Gingelly; Asteraceae: Sunflower, Safflower and Chrysanthemum; Oleaceae: Jasmine
10. Brassicaceae: Rapeseed and Mustard, Cabbage, Cauliflower.
11. Euphorbiaceae: Castor, Jatropha, Tapioca; Arecaceae: Coconut, Arecanut, Oilpalm and Sugar palm.
12. Malvaceae: Cotton, Mesta, Bhendi
13. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet;
14. Solanaceae: Tobacco, Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes, Subabul , Moraceae:Mulberry
15. Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic
16. Musaceae: Banana, Manila hemp; Rubiaceae: Coffee; Theaceae: Tea
17. **Final Practical Examination**

Assignment

- Collection and preparation of 25 herbarium specimens representing minimum of ten families

of the crop species studied.

- Collection of crop seeds of 10 traditional varieties.

Outcome

Botanical features and economic importance of different crop plants belonging to 20 families will be exposed.

References

1. Daniel Sundararaj, D. and G. Thulasidas, 1993. Botany of field crops. MacMillan India Ltd., New Delhi.
2. Sambamurthy, V.S. and N.S. Subramanian, 1989. Text Book of Economic Botany, Wiley Eastern, New Delhi

Further reading

1. Purse glow, 1988. Tropical Crops - Monocotyledons. The English Language book Society and Longman Co., Singapore
2. Purse glow. 1988. Tropical Crops - Dicotyledons. The English language book Society and Longman Co., Singapore.
3. Albert F. Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
4. John Joel, A., C. Vanniarajan, T.S. Raveendran, and A. Gopalan 2006. Fundamentals of Crop Botany, Directorate of ODL, Tamil Nadu Agricultural University, Coimbatore – 641 003.

Web resources

- www.nmsu.edu
- www.biology200.gsu.edu

16 AEX 101 FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY 1+1

Objective

This course will enable students to acquire knowledge on basics concepts related to rural sociology and educational psychology. Students will also learn the practical applications of important sociological and psychological concepts.

Theory

UNIT I Introduction to Sociology, Social groups and Culture

Sociology and Rural Sociology – definitions; Society – rural and urban, characteristics, differences and relationships, important characteristics of Indian rural society; Social groups – definition, classification, role of social groups in extension; Culture – concept, cultural traits, characteristics, functions, Ethnocentrism, Acculturation, Cultural lag, Cultural diffusion, Marginal man, Ethos.

UNIT II Social Structure, Social Stratification, Migration and Social Values

Structure of Rural Society – patterns of rural settlement, social institutions, social organizations, ecological entities (Region, Community, Neighbourhood, Family); Social Stratification – concept, functions, types, differences between class and caste system; Social Values – definition, values and norms, characteristics of values, functions; Migration – concept, factors influencing migration.

UNIT III Social Control, Social Customs, Leadership

Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes; Social Change – concept, factors influencing social change, indicators of social change; Leadership – definition of leader and leadership, classification, functions, characteristics, roles, selection of leaders.

UNIT IVIntroduction to Educational Psychology, Intelligence,Teaching-Learning Process

Education – Psychology – Educational Psychology – Social Psychology – definitions, importance in extension; Basic principles of Human behaviour – Sensation, Attention, Perception – meaning, characteristics; Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, measurement, factors influencing personality; Teaching–Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching; Learning – definition, meaning, principles, types of learning, learning situation.

UNIT V Motivation, Attitude

Motivation – concept, Maslow‘s hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; Attitude – concept, factors influencing the development of attitudes.

Practical

Visit to a village to study the sociological characteristics of a rural society - patterns of settlement, culture, social stratification, social values, social control, customs, social interaction processes, social change, and social problems; Study of basic social institutions and social organizations and their functions in a village setting; Exercise on selection of leaders in a village; Practice on Personality and Intelligence measurement techniques.

Theory Schedule

1. Sociology and Rural Sociology – Definitions, nature of rural sociology, importance of rural sociology in extension education.
2. Society – rural and urban, characteristics, differences and relationship, important characteristics of Indian rural society; Social Groups – definitions, classification, role of social groups in extension.
3. Culture – concept, cultural traits, characteristics, functions, Ethnocentrism, Acculturation, Cultural lag, Cultural diffusion, Marginal man, Ethos.
4. Structure of Rural Society – patterns of rural settlement, social institutions, social organizations and ecological entities - Region, Community, Neighbourhood, and Family.
5. Social Stratification – concept, functions, types, differences between class and caste system; Social Values – definition, values and norms, characteristics of values, functions.
6. Migration – concept, factors influencing migration.
7. Social Control – definition; Customs – conventions, folkways, mores, rituals, taboos; Social Interaction Process – definition, basic social processes.
8. Social Change – concept, factors influencing social change, indicators of social change.
9. **Mid semester Examination.**
10. Leadership – definition of leader and leadership, classification, functions, characteristics, roles, selection of leaders.
11. Education – Psychology – Educational Psychology – Social Psychology – definitions, importance in extension.
12. Basic principles of Human behaviour – Sensation, Attention, Perception – meaning, characteristics.
13. Intelligence – concept, types, measurement, factors affecting intelligence; Personality – concept, types, measurement, factors influencing personality.
14. Teaching–Learning Process – Teaching – definition, meaning, principles of teaching, steps in extension teaching.
15. Learning – definition, meaning, principles, types of learning, learning situation.
16. Motivation – concept, Maslow‘s hierarchy of needs (including selfless-service), intrinsic and extrinsic motivation, techniques of motivation, importance of motivation in extension.
17. Attitude – concept, factors influencing the development of attitudes.

Practical Schedule

1. Understanding the sociological characteristics of a rural society – (Brainstorming).

2. Data collection methods – survey, questionnaire, mailed questionnaire, interview schedule, observation method, case study.

3 & 4. Preparation of interview schedule to study the social characteristics of rural society – pattern of settlement, culture, social stratification, social values, social control, customs, social interaction process, social change and social problems (Group exercise).

5. Visit to a village for data collection (Group exercise).

6 & 7. Processing of data and presentation of Reports.

8 & 9. Preparation of interview schedule to study the basic social institutions and social organizations and their functions in a village setting (Group exercise). Preparatory work for selection of leaders in a village (Group exercise).

10. Visit to a village for data collection (Group exercise).

11& 12. Processing of data and presentation of reports.

13 & 14. Practicing Personality measurement techniques (Group exercise).

15 & 16. Practicing Intelligence measurement techniques (Group exercise).

17. Final Practical Examination

Suggested Readings

Textbooks

- Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi Press, Bapatla, Andhra Pradesh.
- Chatterjee, S. 2000. Advanced Educational Psychology, Books & Allied (P) Ltd., Calcutta.
- Chauhan, S.S. 2001. Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd., New Delhi.
- Chitambar, J.B.1997. Introductory Rural Sociology, New Age International (P) Ltd., Publishers, New Delhi.
- Dahama, O.P. and O.P. Bhatnagar. 2007. Education and Communication for Development, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Kundu, C.L and Tutoo, D.N. 2001. Educational Psychology, Sterling Publishers Pvt. Ltd., New Delhi.
- Lester Crow, D and Alice Crow. 1973. Educational Psychology, Eurasia Publishing House Pvt. Ltd., New Delhi.
- Madumita Gupta. 2011. Fundamentals of Sociology, Pacific Publications, New Delhi.

- Mangal, S.K. 2000. Educational Psychology, Prakash Brothers, Ludhiana.
- Shankar Rao, C.N. 2012. Sociology – Principles of Sociology with an Introduction to Social Thought, S.Chand & Co. Ltd., New Delhi.
- Sharma, R.N. 1968. Principles of Sociology, Asia Publishing House, New Delhi.
- Supe. S.V. 2012. Text book of Extension Education, Agrotech Publishing Academy, Udaipur.
- Usha Rao. 2008. Advanced Educational Psychology, Himalaya Publishing House, New Delhi.
- Vidya Bhushan and Sachdeva, D.R. 2003. An Introduction to Sociology, Kitab Mahal, Allahabad.

Journals

- Indian Journal of Social Research
- Journal of Rural Development
- Journal of Social Sciences
- Journal of Advances in Social Work
- Journal of Asian Social Sciences
- Journal of Social Sciences and Research
- Journal of Current Research in Social Psychology
- Journal of Rural Sociology
- Journal of Extension Education - Coimbatore

Web resources

- www.sociologyguide.com
- eu.wikipedia.org
- www.princeton.edu

16 ENG 101 ENGLISH FOR EFFECTIVE COMMUNICATION (0+1)

AIM

To make the students competent in
Listening – receptive skill
Speaking – productive skill
Reading - receptive skill
Writing - productive skill

UNIT I - LISTENING

Introduction - Listening vs Hearing -Basic listening modes - Types of listening - Intensive and Extensive Listening - Process of Listening - Methods of enhancing listening- Barriers of listening.

UNIT II - SPEAKING

Introduction to English Phonology – English Phonemes – Stress & Intonation - Influence of Language 1 on Language 2 - Oral Discourse skills - Principles of speech preparation - Presentation skills - Techniques of speaking.

UNIT III - READING

Introduction to Reading - Types of reading - Skimming and Scanning - Idea reading (Reading for information) - Exploratory reading - Study reading (Text reading) - Critical reading - Analytical reading - Note-making – Précis Writing.

UNIT IV - WRITING

Word formation (prefix , suffix & word coining) - Word expansion (root word & etymology) - Compound words - Single word substitutes -Abbreviations & acronyms – Sentence agreement - Sentence completion - Sentence correction - Writing definitions - Coherence and cohesion in writing - Mind mapping in writing - Paragraph writing techniques - Thesis sentence writing - Inferential sentence writing - Logical arrangement of sentences - Letter Writing - Text conversion- Interpreting charts , graphs, diagrams into text - Poster making - Essay writing (types of essays).

Unit V INTEGRATED SKILLS

Integrated skills - Group Discussion - Presentation (Seminar) - Forum discussion - Brain Storming – Debate – Writing Fan-mail – e-mail.

Practicals

1. Introduction - Listening vs Hearing - listening modes - Types of listening -Intensive and Extensive Listening
2. Process of Listening - methods of enhancing listening

3. Barriers of listening - Note–taking
4. English Phonology - Influence of Language 1 on Language 2
5. English Stress & Intonation
6. Principles of speech preparation
7. Presentation skills
8. Techniques of speaking
9. **MID SEMESTER**
10. Introduction to reading - Types - Scanning and Skimming -Idea reading (Reading for information) - Exploratory reading -Study reading (Text reading) - Critical reading - Analytical reading - Note-making-précis writing.
11. Word formation(prefix , suffix & word coining) - Word expansion (root word & etymology) -Compound words - Single word substitute -Abbreviations & Acronyms
12. Sentence agreement - Sentence completion - Sentence correction - Writing definitions
13. Writing Practice -Mind mapping - sentence writing - Logical arrangement of sentences
14. Paragraph writing - techniques - Thesis sentence writing – Inferential sentence writing – coherence and cohesion in writing
15. Letter Writing – Types of letters
16. Text conversion- Interpreting charts, graphs diagrams into text - Poster making - Essay writing (types of essays)
17. **FINAL PRACTICAL EXAMINATION**

Outcome:

The students will gain competence in skills viz.,

1. **Listening -** Understanding the kinds of listening and acquire the techniques of active listening followed by note-taking and the art of asking questions.
2. **Speaking -** Acquire the correct pronunciation and the art of speaking in a forum.
3. **Reading**: Know the types of reading, the techniques of reading, reading for comprehension and note-making.
4. **Writing** - Understand the genre of writing, mechanics of writing, article writing (essay), abstract writing (précis) and letter writing.

REFERENCES

Bernhardt, E.B., **Reading Development in a Second Language,** 1991, Norwood, N.J., Ablex Publishing Goodale, Malcolm, **Professional Presentations**, 2005, Cambridge University Gerald, J. Alred et. al, **The Professional Writer,** 1992, New York: St. Martin‘s Press

Hariharan, S., **Authentic English for Agriculture and Allied Sciences** 2003, Hyderabad, Orient Longman.

Helgesen, Mark *et al*., **Active listening**, 1997, Cambridge University

Jones Daniel, **English Pronouncing Dictionary** 2006, Cambridge University Press. Lynch, Tony and Kenneth Anderson, **Study Speaking**, 1992, Cambridge University. Martin Cutts,

Oxford Guide to Plain English, 2004, Oxford University Press.

Peregoy, S.F. and Boyle, O.F. **Reading, Writing and Learning in ESL,** 1997, New York. Longman.

Robert, A. Day **How to Publish a Scientific Article** 2001, Oxford University Sahaneya Wandy, et.al. **IELTS, Preparation and Practice**, Oxford University, 2005.

Sundararajan, N., ― Attentive Listening: How it matters ‖ University News, March 19-25, 2005.

Sweeney, Simon, **English for Business Communication**, 2003, Cambridge University. Swan, M. & Smith, B. **Learner English,** 1987, Cambridge.

Team of authors - **Read Better, Write Better** 2005, Readers Digest.

Team of authors – **Cambridge BEC Vantage,** 2005, Cambridge University. Team of authors - **Cambridge IELTS** Books 1 to 5, 2006, Cambridge University.

Team of authors - **Objective IELTS,** 2006, Intermediate and Advanced, Cambridge University.

Team of authors -**TOEFL ibt**-2007-Bar

e-references :

www.esl--lab.com www.eflweb.com

www.teachingenglish.org.uk www.essays.com www.onestopenglish.com www.tealit.com www.eltweb.com www.angelfire.com www.primesl.com www.learnbusinessEnglish.com www.bogglesworld.com

II Semester

S. No.	Course No.	Course Title	Credit Hours
1.	16 AGR 102	Fundamentals of Agricultural Meteorology	1+1
2.	16 BIC 101	Fundamentals of Biochemistry	2+1
3.	16 CRP 101	Fundamentals of Plant Physiology	2+1
4.	16 AEC 101	Principles of Economics	1+1
5.	16 SER 121	Principles and practices of sericulture	1+1
6.	16 ENS 101	Principles of Environmental Sciences	1+1
7.	16 FSN 111	Principles of Food Science and Nutrition	1+1
8.	16 FOR 121	Agro Forestry	1+ 1
9.	16 TAM 101	Tamil ilakiangalil velanmaiyum arivial tamil payanpadum	0+1
	16 ENG 103	Development Education	
		Total	10+9=19

16 AGR 102 FUNDAMENTALS OF AGRICULTURAL METEOROLOGY (1+1)

Theory:

Unit - I:

Meteorology - Agricultural Meteorology - Importance and scope in crop production - Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India.

Unit - II:

Solar radiation - Light intensity, quality, direction and duration - Air and Soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative Humidity and its importance - vapor pressure deficit and its importance - Wind and its effect on crops.

Unit - III:

Atmospheric pressure - Pressure systems - cyclones, anticyclones, tornado, hurricane and storms - Wind systems of the world - Inter Tropical Convergence Zone. Clouds - types and their classification. Precipitation - forms - monsoon - Seasons of India- rainfall variability drought, flood and their effect - Cloud seeding - Evaporation - transpiration - Evapotranspiration - PET.

Unit - IV:

Agro climatic Zones of India and Tamil Nadu - Agro climatic normals - Weather forecasting - synoptic chart - crop weather calendar - Remote sensing and crop weather modeling - Impact of climate and weather on crop production and pest and diseases.

Unit - V:

Climate change- climate variability - definition and causes of climate change - Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem

Practical:

Observatory - Site selection and layout. Acquiring skill in use of Pyranometers - Sunshine recorder - Maximum, Minimum, Grass minimum and Soil thermometers - Thermograph, Dry and wet bulb thermometers - Hygrograph - Psychrometers - Fortein‘s barometer - Barograph - Altimeter; Wind vane, Anemometer - Raingauge - Ordinary and self-recording - Dew guage; Automatic weather station - Evaporimeters - Lysimeters, Automatic weather station - Preparation of synoptic charts and crop weather calendars. Rainfall probability analysis. Mapping of Agroclimatic Zones.

Theory - Lecture Schedule:

1. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production.
2. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Meso climate - Microclimate - Definition and their importance - Different climates of India and Tamil Nadu and their characterization.
4. Solar radiation - Radiation balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production.
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries.
6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production.

Mid Semester Examination.

8. Atmospheric pressure, diurnal and seasonal variation - Pressure systems of the world - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.
9. Wind systems of the world - Inter Tropical Convergence Zones (ITCZ), wind speed in different seasons -. Clouds and their classification - Concepts of cloud seeding - present status.
10. Precipitation - Forms of precipitation - Isohyte - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production.
11. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agroclimatic zones of Tamil Nadu - Agroclimatic normals for field crops.
12. Weather forecasting - Types, importance, Agro Advisory Services - Synoptic chart - Crop weather calendar.
13. Remote sensing and its application in agriculture - Crop weather modeling and its application in agriculture - list of models available.
14. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases.
15. Climate change, climate variability - definition and causes of climate change including ENSO.
16. Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem.

Practical schedule:

1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements - Reviewing agromet registers.
2. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) - working out weekly and monthly mean for graphical representation.
3. Measurement of air and soil temperature and grass minimum thermometers and thermographs - drawing isolines.
4. Humidity measurements - use of wet and dry bulb thermometers - Psychrometers - Hygrograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) - Beaufort‘s scale.
5. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.
6. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
7. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data- Measurement of Evapotranspiration- Lysimeter.
8. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
9. Probability analysis of rainfall for crop planning.
10. Drawing Synoptic charts for understanding weather.
11. Preparation of crop weather calendars and forecast based agro advisories
12. Preparation pest weather calendar and pest forewarning.
13. Estimation of length of growing periods using weekly rainfall data.
14. Water balance studies.
15. Identification of efficient cropping zone- RYI, RSI.
16. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
17. **Practical Examination**.

References:

1. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
2. Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi.
3. Gopalaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.

E:References:

www.tawn.tnau.ac.in
www.usbr.gov/pn/agri.met
www.imd.gov.in

16 BIC 101 FUNDAMENTALS OF BIOCHEMISTRY (2+1)

OBJECTIVE

- To gain basic knowledge of the biomolecules *viz*., Carbohydrates, Proteins and Lipids - properties, structure and metabolism.
- To learn basics of enzymes

Theory

UNIT I Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, **oligosaccharides** and polysaccharides. Physical and chemical properties of carbohydrates – optical isomerism, optical activity, mutarotation, reducing property, reaction with acids and alkalies. **Glycoconjugates - Glycoproteins and Lectin - structure and significance.**

UNIT II Lipids

Lipids - occurrence and classification. Storage lipids - fatty acids, triacyl glycerol, essential fatty acids, waxes. **Structural lipids - role of lipids in biological membrane - glycolipids** and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

UNIT III Proteins and Enzymes

Amino acids - classification and structure. Essential amino acids. Properties of amino acids - amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins: primary structure, secondary structure, tertiary structure and quaternary structure - **protein folding and denaturation**. Properties and reactions of proteins. Enzymes - Properties, classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity. Enzyme inhibition - Competitive, Non-competitive and Uncompetitive inhibition; **Allosteric enzymes**. Coenzymes, cofactors and isoenzyme.

UNIT IV Metabolism

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Lipid metabolism - lipases and phospholipases. Beta-oxidation of fatty acids and bioenergetics. Biosynthesis of fatty acids and triacyl glycerol. General catabolic pathyway for amino acids - transamination, deamination and decarboxylation. Ammonia assimilating enzymes. Metabolic inter-relationship.

UNIT V Secondary metabolites

Secondary metabolites - occurrence, classification and functions of phenolics, terpenes and alkaloids.

Lecture schedule

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification R2: 1-4, 66-72.
2. Structure of monosaccharides. R2: 75-82.
3. Structure of oligosaccharides and polysaccharides. R2: 82-90.
4. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism. R2: 73-78.
5. Chemical reactions of carbohydrates. R2: 90-95.
6. Glycoproteins and lectin - structure and significance. R1: 316-321.
7. Lipids - occurrence and classification. R2: 99-100.
8. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids, waxes. R2: 101-106.
9. Structural lipids - Glycolipids and phospholipids - types and importance. R2: 107-111.
10. Sterols - basic structure and their importance. R2: 111-114.
11. Physical and chemical constants of oils. Rancidity of oils. R2: 114-119.
12. Amino acids - Classification and structure. R2: 17-21.
13. Properties of amino acids - amphoteric nature, isomerism, essential amino acids. R2: 21-26.
14. Classification of proteins based on function and solubility. R2: 26-31.
15. Structure of protein - Primary, secondary, tertiary and quaternary structure. R2: 31-41.
16. Protein folding, physical and chemical properties of proteins. R2: 41-43, R1: 52-55.
17. **MIDSEMESTER EXAMINATION**
18. Enzymes - Properties, classification and nomenclature. R2: 123-127.
19. Mechanism of enzyme action. R2: 129-131.
20. Factors affecting enzyme activity. R2: 131-136.
21. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes. R2: 136-137, R1: 224-225.
22. Coenzymes, cofactors and isoenzyme. R2: 127-129, 138.
23. Carbohydrate metabolism - breakdown of starch by amylases, Glycolysis - Reactions and bioenergetics. R2:159-164.
24. TCA cycle - Reactions and bioenergetics. R2: 164-168.
25. Pentose phosphate pathway - Reactions . R2: 174-177.
26. Respiration - electron transport chain and oxidative phosphorylation. R2: 170-173.
27. Lipid metabolism - lipases and phospholipases. R2: 205-208.
28. Beta-oxidation of fatty acids and bioenergetics. R2: 208-212.
29. Biosynthesis of fattyacids and triacylglycerol. R2: 213- 220.

30. Transamination, deamination and decarboxylation of amino acids. R2: 224-231.
31. Ammonia assimilating enzymes - GS, GOGAT and GDH. R2: 231-233.
32. Metabolic inter-relationship. R2: 287-289.
33. Secondary metabolites - occurrence, classification and functions of phenolics. R2: 274-276.
34. Occurrence, classification and functions of terpenes and alkaloids. R2: 277-280.

Practical

1. Qualitative analysis of carbohydrates
2. Estimation of starch
3. Estimation of amylose
4. Determination of reducing sugars
5. Qualitative analysis of amino acids
6. Sorenson‘s formal titration of amino acids
7. Estimation of amino acids by Ninhydrin method
8. Estimation of protein by Biuret method
9. Determination of free fatty acid of an oil
10. Determination of iodine number of an oil
11. Estimation of ascorbic acid by dye method
12. Assay of amylase
13. Estimation of total phenols
14. Extraction and estimation of lycopene and carotenoids
15. Separation of amino acids by paper chromatography
16. Separation of phenols by thin layer chromatography
17. Final Practical Examination

References

1. Berg JM, Tymoczko JL and Stryer L, (2007), Biochemistry, 7th Ed. Wiley Eastern Ltd. ISBN:0-7167-8724-5.
2. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN :81-7515-459-4.

Teaching Resources

1. Cox, MM and Nelson, DL. (2011), Principles of Biochemistry, Fourth (Indian edition) Macmillian, Worth Publishers. http://bcs.whfreeman.com/lehninger6e - Web links/ Tutorials/ Lecture companion Art
2. Harper‘s illustrated Biochemistry -https:// freemedebooks. files.wordpress.com /2014/01/harpers-illustrated-biochemistry-28th-edition.pdf
3. J M Berg, J L Tymoczko and L Stryer , Biochemistry, Sixth Edition - http://www.irb.hr/users/precali/Znanost.o.Moru/Biokemija/Literatura/Lubert%20Stryer%20-%20Biochemistry.pdf
4. Sadasivam, S and Manickam, A. (2009), Biochemical Methods, 3rd Edn, New Age International.

5. Wilson, K. and Walker, J.M. (2000), Principles and techniques of Practical Biochemistry, 5th Edn. – Cambridge University Press.
6. www.ncbi.nlm.nih.gov

16 CRP 101 FUNDAMENTALS OF PLANT PHYSIOLOGY (2+1)

Aim

To impart basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses.

Syllabus

Unit I: Plant Water Relations

Importance of Crop Physiology in Agriculture – cell organelle- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water –water potential and its components – diffusion – osmosis – imbibition - plasmolysis – Field Capacity and Permanent Wilting Point- Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast - Translocation of water – ascent of sap – mechanisms - Transpiration – significance – structure of stomatal pore- mechanisms of stomatal opening and closing – guttation – antitranspirants

Unit II: Plant Mineral Nutrition

Criteria of essentiality - classification of nutrients – macro, micro, mobile, beneficial elements and immobile – mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients – Hidden hunger- Foliar nutrition-root feeding and fertigation – sand culture, hydroponics and aeroponics

Unit III: Photosynthesis and Respiration

Light reaction – Photosystems- red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Z scheme - Photosynthetic pathways – C_3 and C_4, CAM

– difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway and its significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient

Unit IV: Growth and Development

Growth – phases of growth - Factors affecting growth – Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR‘s – Brassinosteroids and salicylic acid - Growth retardants – Commercial uses of PGR‘s- Photoperiodism - short, long and day neutral plants – Chailakhyan‘s theory of flowering-Forms of phytochrome - Pr and Pfr - regulation of flowering - Vernalisation - Theories of vernalisation – Lysenko and Chailakhyan‘s theories- Seed germination - physiological and biochemical changes - seed dormancy and breaking methods - Senescence and abscission – physiological and biochemical changes -Physiology of fruit ripening- climacteric and non-climacteric fruits -

factors affecting ripening- Manipulations

Unit V: Stress Physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties — compartmentalization – stress alleviation - Global warming – green house gases – physiological effects on crops - Carbon Sequestration

Practicals

Preparation of different types solutions -Measurement of plant water potential by different methods - Estimation of photosynthetic pigments- Chlorophylls and Carotenoids - Determination of stomatal index and stomatal frequency - Measurement of leaf area by different methods Physiological and Nutritional disorders in crops plants -Estimation of chlorophyll Stability Index - Estimation of Relative Water Content -Determination of photosynthetic efficiency in crop plants – soluble protein - Estimation of Nitrate Reductase activity -Growth Analysis - Bioassay of Cytokinin and GA - Estimation of proline - Demonstration of Practical applications of PGRs. Field visit for foliar diagnosis

Theory lecture schedule

1. Importance of Crop Physiology in Agriculture – Structure of plasma membrane, chloroplast, mitochondria, peroxisome and vacuole
2. Structure and role of water –water potential and its components – Diffusion – Osmosis – imbibition – Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast
4. Translocation of water – ascent of sap – mechanisms of xylem transport
5. Transpiration – significance – structure of stomata - mechanisms of stomatal opening and closing – guttation - antitranspirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro, mobile and immobile – mechanism of nutrient uptake
7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics
10. Light reaction – photolysis of water and photophosphorylation - Z scheme
11. Photosynthetic pathways – C_3 and C_4 cycles
12. CAM pathway – difference between three pathways - Factors affecting photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient

17. Mid Semester Examination
18. Growth – phases of growth – factors affecting growth – Hormones- classifications
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation PGR‘s
23. Growth retardants and inhibitors -commercial uses of PGR‘s
24. Photoperiodism - short, long and day neutral plants – Chailakhyan‘s theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan‘s theories
27. Seed germination - physiological and biochemical changes - seed dormancy and breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations
30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
31. High and low temperature stress – physiological changes - membrane properties - adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases –-physiological effects on crop productivity- Carbon Sequestration

Practicals schedule

1. Preparation of different types solutions
2. Measurement of plant water potential by different methods
3. Estimation of photosynthetic pigments- chlorophylls and Carotenoids
4. Determination of stomatal index and stomatal frequency
5. Measurement of leaf area by different methods
6. Physiological and Nutritional disorders in crops plants
7. Estimation of chlorophyll Stability Index
8. Estimation of Relative Water Content
9. Determination of photosynthetic efficiency in crop plants – soluble protein
10. Estimation of Nitrate Reductase activity
11. Growth Analysis - LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI
12. Bioassay of Cytokinin
13. Bioassay of GA
14. Estimation of proline
15. Demonstration of Practical applications of PGRs.
16. Field visit for foliar diagnosis
17. Final Practical Examination

Outcome

Students will come to know basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses. In addition, hands on exposure to preparation of solutions, analysis of pigment composition, estimation of growth analytical parameters, diagnosis and correction of nutrient deficiencies, enzyme assays and demonstration of plant growth regulator applications

Text books

1. P. Boominathan, R. Sivakumar, A. Senthil, and D. Vijayalakshmi. 2014. Introduction to Plant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

e- books and e-references

- **http://www.plantphys.org**
- **http://www. Biologie. Uni-hamburg. de/b-online**
- **http://4e.plantphys.net**

16 AEC 101 PRINCIPLES OF ECONOMICS (1+1)

Objective

This course aims to introduce the basic principles of economics including the problem of economic decision - making, laws of economics and macroeconomic concepts.

Theory

Unit 1: Nature and Scope of Economics

Nature and Scope of economics: Importance, Subject matter: Science Vs. art, Positive science Vs. normative science, Deductive method Vs. inductive method - Definitions of Economics: Wealth, Welfare, Scarcity and Growth - Different economic systems: merits and demerits - Divisions of Economics - Microeconomics and Macroeconomics - Agricultural Economics: Definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth and Welfare - Wants: Characteristics and classification.

Unit 2: Theory of Consumption

Utility: Definition, Measurement: Cardinal and ordinal utility, Marginal utility - Law of Diminishing Marginal Utility and Law of Equi-marginal Utility: Definition, Assumptions, Limitations and Applications - Indifference curve analysis: Definition and properties of indifference curves and budget line - Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand, Extension and Contraction of demand Vs. Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Factors influencing elasticity of demand, Importance of elasticity of demand – Standard of Living: Definition, Engel‘s Law of Family Expenditure - Consumer surplus: Definition and Importance.

Unit 3: Theory of Production

Concept of production – Factors of production – Land: Characteristics of land - Labour: Characteristics of labour, Division of labour, Malthusian and Modern theories of population – Capital: Characteristics of capital, Capital formation – Entrepreneur: Characteristics and functions of entrepreneur. Supply: definition, Law of Supply, Factors influencing supply - Elasticity of Supply – Producer surplus.

Unit 4: Exchange and Theory of Distribution

Exchange and Distribution: Definition – Pricing of factors of production - Marginal productivity theory of distribution - Rent and Quasi rent - Wages: Real wage and money wage - Interest: Pure interest and gross interest – Profit: Meaning of economic profit.

Unit 5: Macroeconomic Concepts

Macroeconomics: Definition and Subject matter – National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income – Money: Definition, Types and functions of money - Inflation: Meaning, types of inflation - Public Finance: Meaning, Principles - Public Revenue: Meaning, Classification of taxes - Canons of Taxation - Public expenditure: Principles – Welfare Economics: Meaning, Pareto‘s optimality.

Practical

Ten principles of economics - Law of Diminishing Marginal Utility - Law of Equi-Marginal Utility - Indifference Curve analysis and consumer equilibrium - Individual andmarket demand- Measurement of Arc and Point elasticities of demand - own price, income and cross price elasticities of demand – Estimation of Consumer surplus – Law of Diminishing Marginal Returns: Relationship among TPP, APP and MPP - Cost concepts and graphical derivation of cost curves - Estimation of total revenue and profit - Producer surplus - Supply elasticity – Exchange: Market Structure and Price determination – Theories of Distribution – Computation of National Income – Study of structural changes in the economy - Estimation of Growth Rate - Money: Quantity theory of money - Inflation: Causes and control measures – Estimation of price index - Measures of standard of living – Indices of human development.

Theory Schedule

1. Nature and Scope of economics: Importance, Subject matter: Science Vs. art, Positive science Vs. normative science, Deductive method Vs. inductive method -
2. Different economic systems: merits and demerits.
3. Definitions of Economics - Wealth, Welfare, Scarcity and Growth- Divisions of Economics: Micro economics and Macroeconomics - Agricultural Economics: Definition and scope.
4. Basic concepts – Goods, Services, Use value and Exchange value, Cost, Price, Wealth and Welfare - Wants: Characteristics and Classification of wants.
5. Utility: Definition, Measurement: Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility.
6. Law of Equi-marginal Utility: Definition, Assumptions, Limitations and Applications - Indifference curve analysis: Definition and properties of indifference curves and budget line.
7. Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand - Extension and contraction of demand Vs. Increase and decrease in demand.
8. Elasticity of Demand: Own price, cross price and income elasticities of demand, Degrees of price elasticity of demand, Factors influencing elasticity of demand and Importance of Elasticity of demand.
9. Standard of Living – Definition, Engel‘s Law of Family Expenditure – Consumer surplus: Definition and Importance.
10. **Mid Semester Examination.**
11. Concept of production – Factors of production – Land and its characteristics.

12. Labour: Characteristics of labour - Division of labour - Malthusian and Modern theories of population.
13. Capital: Characteristics of capital - Capital formation: Phases of capital formation - Entrepreneur: Characteristics and functions of entrepreneur.
14. Supply: Definition, Law of Supply, Factors influencing supply - Elasticity of supply - Producer surplus.
15. Exchange and Distribution: Definition – Pricing of factors of production - Theory of distribution – Marginal productivity theory of distribution - Rent and Quasi rent.
16. Wages: Real wage and money wage – Interest: Pure interest and gross interest – Profit: Meaning of economic profit.
17. Macroeconomics: Definition and Subject matter - National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income – Money: Definition, Types and functions of money - Inflation: Meaning and Types of inflation.
18. Public Finance: Meaning, Principles - Public Revenue: Meaning, Classification of taxes - Canons of taxation - Public expenditure: Principles – Welfare Economics: Meaning, Pareto‘s optimality.

Practical Schedule

1. Elucidation of 10 principles of economics.
2. Exercise on Law of Diminishing Marginal Utility - Exercise on Law of Equi-Marginal Utility.
3. Indifference Curve Analysis: Properties, budget line and consumer equilibrium.
4. Demand schedule - Graphical derivation of individual and market demand - Measurement of Arc and Point elasticities of demand.
5. Estimation of own price, income and cross price elasticities of demand - Estimation of consumer surplus.
6. Law of Diminishing Marginal Returns: Relationship among TPP, APP and MPP.
7. Cost concepts: Total cost, total fixed costs, total variable cost, average costs, marginal costs and Graphical derivation of cost curves - Estimation of total revenue and profit.
8. Supply: Estimation of supply elasticity - Estimation of producer surplus.
9. Market Structure – Characteristic features of different types of Sellers‘ markets –
10. Perfect competition, monopoly, oligopoly and monopolistic competition – Buyers‘ Market – Price determination under Perfect completion and Monopoly.
11. Rent: Theories of Rent: Ricardian and Modern theories of rent - Wages: Determination of wages: Marginal productivity theory and Demand and supply theory of wages.
12. Interest: Theories of interest: Keynesian and Modern theories of interest – Profit: Risk - bearing theory of profit.
13. Approaches to computation of National Income - Analysis of Trends in National Income - Study of structural changes in the economy.
14. Estimation of Growth Rate of Population and Food grain production.

15. Money: Quantity theory of money – Inflation: Causes and control measures
16. Consumer price index and Wholesale price index - Estimation of price indices.
17. Measures of standard of living and human development – Human Development Index – Physical Quality of Life Index – Gender Development Index.
18. **Practical Examination.**

References

1. Dewett, K. K. 2004. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Mankiw, G.N., Principles of Microeconomics, Cengage Learning. Chapter 1.
3. Samuelson, P. 2004. Economics, (18/e), Tata Mc-graw-Hill, New Delhi
4. Seth, M. L. 2005.Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi.

16 SER 121 PRINCIPLES AND PRACTICES OF SERICULTURE (1+1)

THEORY

Importance and history of sericulture – organizations involved in sericulture – silkworm types – Mulberry cultivation – varieties and management practices – pruning and harvesting – Pests, diseases and nematodes of mulberry and their management.

Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – Pure races –multivoltine and bivoltine races – cross breeds – bivoltine hybrids – Morphology and biology of silkworm – mouth parts of larva – silkworm genetics – chromosome number in wild and domesticated species –sex limited characters – Anatomy and physiology of digestive and excretory systems of larva – structure and function of silk glands.

Rearing house – types – disinfection – room and bed disinfectants – Egg incubation methods – Chawki rearing – feeding, cleaning and spacing – Rearing of late age worms – feeding, cleaning, spacing and moulting care in different stages – spinning – Mountages – harvesting – Pests and diseases of silkworm and their management – Post cocoon technology – stifling to weaving – Non –mulberry silkworms – Eri, Tasar and Muga silkworms.

PRACTICAL

Morphology of mulberry plants – Identification of popular mulberry genotypes – Nursery bed and main field preparation – planting methods – Identification of nutrient deficiency symptoms – Identification of weeds – herbicide application method – pruning and harvesting methods – Identification of pests, diseases and nematodes of mulberry.

Morphology of silkworm – Identification of races – Dissection of mouth parts and silk glands – Disinfection techniques – rearing facilities – silkworm rearing – feeding, cleaning and spacing – Identification of pests and diseases of silkworm – hyperparasitoids and mass multiplication techniques – Visit to grainage, cocoon market, sericulture farms and silk reeling centre – Non-mulberry silkworms – Eri and Tasar silkworms – food plants – rearing methods.

LECTURE SCHEDULE

THEORY

1. Importance of sericulture – History of sericulture – silk road – Organizations in sericulture industry – Types of silkworm – Mulberry – origin – species – Morphology of mulberry plant – shoot system – importance of different morphological characters influencing leaf yield.
2. Ecological requirements for mulberry cultivation – soil type – mulberry varieties – Methods of propagation – merits and demerits – selection of semi hard wood cuttings
3. Nursery preparation – Main field preparation – methods of planting – pit, row, paired row and Kolar system of planting – merits and demerits.
4. Nutritional requirements – organic, inorganic and biofertilizers – Intercropping – Water management – Types of weeds and their management.

5. Pruning methods – bottom, middle, Kolar or strip system of pruning – Methods of harvesting – preservation of leaves.
6. Pests of mulberry – foliage feeders – sucking insects – subterranean insects – management of pests.
7. Diseases of mulberry – foliar diseases – soil borne pathogens – Nematodes - management of diseases and nematodes.
8. Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids – suitability for rearing in different seasons.
9. Morphology and biology of silkworm – sexual dimorphism in immature and adult Stages – silkworm genetics – chromosome number – sex limited characters in egg and larva.
10. **Mid – Semester Examination**
11. Anatomy of digestive system – physiology of digestion and excretion – silk glands – silk synthesis – physico chemical properties of silk.
12. Rearing house – types – Hygienic rearing – Methods of disinfection – disinfectants – Egg transportation and incubation methods – black boxing.
13. Environmental requirements for different stages of silkworm – Chawki rearing – brushing – spacing – feeding cleaning – Selection of leaves for feeding – care during feeding, moulting, mounting and bed cleaning.
14. Rearing of late age worms – different methods – floor, shelf and shoot feeding – cleaning – spacing – mounting – Different mountages – merits and demerits – spinning – harvesting of cocoons.
15. Pests of silkworm – uzifly – dermestid beetle – management practices.
16. Diseases of silkworm – pebrine – flacherie – grasserie – muscardine – life cycle, pathological symptoms and management practices.
17. Post cocoon technology – selection of cocoons – methods of stifling – cooking for different races – Reeling devices – charka – cottage basin – multi end reeling machine advantages – re reeling – twisting – degumming – dyeing – weaving - By product utilization.
18. Non – mulberry silkworm – Eri, Tasar and Muga Silkworms – food plants – rearing methods.

PRACTICAL

1. Morphology of mulberry plant – description – leaf – types – distinguishing characters of promising mulberry genotypes.
2. Nursery bed preparation – care in selection of planning materials – Biofertilizer treatment in nursery – main field preparation – methods of planting.
3. Identification of nutrient deficiency symptoms – corrective measures – Identification of weeds – Herbicide application method.
4. Pruning methods – leaf harvest based on the larval instar – preservation of leaves.

5. Identification of different stages of pests of mulberry.
6. Identification of symptoms of diseases and nematodes of mulberry.
7. Morphology of silkworm – different stages – Identification of races by cocoon shape, colour and larval marking –Dissection of mouth parts and silk glands.
8. Rearing house and appliances – Methods of disinfection.
9. Incubation of eggs – methods – acid treatment of eggs – Chawki rearing – brushing – feeding.
10. Silkworm rearing – shelf and shoot rearing – skill involved in brushing – feeding-moulting care – bed cleaning – spacing — spinning and cocoon harvest.
11. Identification of pests and diseases of silkworm – Mass multiplication of hyperparasitoid.
12. Visit to grainage and cocoon market – observing the activities involved in selection of parent races – pairing – depairing - egg collection – cold storage – mother moth testing – fixing up of cocoon price – auction procedures.
13. Visit to silk reeling centre – observing various processes –stifling – cooking – reeling rereeling – winding – rewinding – bleaching – dyeing – weaving – silk grades – Working out economics of raw silk production – Byproducts from reeling units.
14. Eri silkworm – morphology – food plants – methods of rearing – methods of spinning methods of collection of cocoons – Tasar silkworm – morphology – food plants – early and late instar larval rearing.
15. Economic of silkworm rearing.
16. Visit to sericulture farms – Interaction with sericulturists.
17. Final Practical Examination.

Assignment :

1. Rearing of 50 larvae of cross breed silkworm from larva to cocoon by each student
2. Assignments on various aspects of Sericulture to twelve different group of students.

REFERENCES

1. CSB. 2003. **Seri Business Manual- Vol. III Farm & Industry Sectors**, Central Silk Board, Bangalore.
2. Dandin, S.B., J.Jayaswal and K. Giridhar.2003. **Hand book of Sericulture Technologies**. Central Silk Board, Bangalore, 287 p.
3. David, B.V.and T.Kumaraswami. 1988. **Elements of Economic Entomology**, 4th Edition. Popular Book Depot, 536 p.
4. Jolly, M.S., S.K. Sen, T.N. Sonwalkar and G.K. Prasad 1980. **Non – mulberry Silks.** FAO Agicultural Services Bulletin 29. Food and Agriculture Organisation of the United Nations, Rome,178 p.
5. Krishnaswami,S., M.N. Narasimhanna, S.K Suryanarayan and S.Kumararaj. 1978. **Seiculture Manual 2 – Silkworm Rearing** . FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organisation of the United Nations, Rome, 131 p.
6. Krishnaswami, S., N.R.Madhava Rao, S.K.Suryanarayan and T.S.Sundaramurthy. 1972z .

Seiculture Manual 3 – Silk Reeling. FAO Agricultural Services Bulletin 15/3. Food and Agriculture Organisation of the United Nations, Rome, 112 p.

7. Rangaswami, G.,M.N.Narasimhanna, K.Kasiviswanathan, C.R.Sastry and M.S.Jolly. 1978.
8. **Sericulture Manual 1 – Mulberry Cultivation**. FAO Agricultural Services Bulletin 15/1. Food and Agriculture Organization of the United Nations, Rome, 150 p.

16 ENS 101 PRINCIPLES OF ENVIRONMENTAL SCIENCES (1+1)

Unit I - Introduction to Environmental Science

Environmental Science – Interrelationship with other sciences - Scope – Concepts - Segments

- Global Environmental initiatives and perspectives – Environmental Sustainability – Ecological footprint

Unit II - Ecology and Ecosystems

Ecology – Relevance to man - Ecosystem - Components – Terrestrial - Biomes – Forest – Desert - Aquatic – Pond – River – Estuaries – Ocean - Matter cycling - Energy flow – Food Chain, Food Web and Ecological pyramids —Species interactions – Succession

Unit III- Biodiversity and conservation

Biodiversity – Types – National and Global Status – Significance – Hotspots - Threats – Conservation – *In-situ* – *Ex-situ* - Biosphere Reserve - National parks and Wildlife Sanctuaries – Botanical Garden

Unit IV- Natural Resources

Natural resources – Land – Water – Air – Forest – Minerals – Energy Resources – Renewable

- Non-renewable - Status – Degradation – Sustainable Management and Conservations- Resource Extraction

Unit V- Environmental problems and Protection

Environmental pollution - Introduction to soil, water and air pollution - Green House Gases- Global warming - Climate change - Impact on agriculture and other natural resources.
Environmental protection-Global treaties - Conventions – National and state level organizations: TNPCB, CPCB — Environmental Laws and Acts – Environmental Education

Practical

Environmental Sampling and Preservation - Biodiversity Assessment in natural and agroecosystems – Water and Effluent quality analysis: Colour, Temperature, Turbidity, pH, EC, TDS, Acidity, Alkalinity, Hardness, DO, BOD, COD and *E. Coli*. – Impact of wastewater irrigation: germination test – Biogas production from wastes – Suspended Particulate Matter (SPM) assessment in the ambient air – Field Visit to Wind / Solar / Hydro power generation units, contaminated site and Pollution Control Board Lab

Lecture Schedule

1. Introduction to Environmental Science, Interrelationship with other sciences, Scope, Concepts and Segments
2. Global Environmental initiatives and perspectives, Environmental Sustainability and

Ecological footprint

3. Ecology, its Relevance to man, Ecosystem and its components
4. Biomes: Terrestrial (Forest, Desert, etc..) and Aquatic (Pond, River, Estuaries and Ocean)
5. Energy flow, Food Chain, Food Web and Ecological pyramids
6. Species interactions, adaptations and Succession
7. Biogeochemical cycles
8. Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
9. **Mid Semester Examination**
10. Conservation of Biodiversity: *In-situ and Ex-situ* - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
11. Natural and Energy resources: Land, Water, Air, Forest, Minerals, Perpetual, Renewable and Non-renewable
12. Present Status of Natural and Energy resources, Resource Extraction, Degradation and Sustainable Management and Conservation.
13. Environmental pollution-Introduction to soil, water and air pollution -impact on agriculture and environment
14. Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources
15. Global treaties and Conventions for Environmental Protection
16. National and state level organizations: CPCB, TNPCB, etc..
17. Environmental Education, Environmental Laws and Acts

Practical Schedule

1. Environmental sampling and preservation
2. Biodiversity assessment in organic and conventional farming
3. Floral and faunal diversity assessment in forest ecosystem
4. Water quality analysis: Colour, temperature and turbidity
5. Water quality analysis: pH, EC and TDS
6. Estimation of Acidity, Alkalinity
7. Estimation of water hardness
8. Estimation of DO and BOD in water samples
9. Estimation of COD in water samples
10. Effect of wastewater on plants: Germination test
11. Enumeration of *E.coli* in water sample
12. Energy: Biogas production from organic wastes
13. Assessment of Suspended Particulate Matter (SPM)

14. Visit to wind mill / hydro power / solar power generation units
15. Visit to Contaminated site and Common Effluent Treatment system
16. Visit to Pollution Control Board
17. **Practical examination**

References

1. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions).* Brooks/cole, Cengage learning publication, Belmont, USA
2. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India

16 FOR 121 Agroforestry (1+1)

Aim

To impart knowledge about the basic facts of Forestry as well as agroforestry and familiarize the students with important trees suitable for agroforestry and various agroforestry systems.

Theory

Unit I –Introduction to Forestry

Forests and Forestry - Definition, scope, classification of Indian Forests - Role of forests – Tangible and intangible benefits - Forest types of Tamil Nadu – Forest cover of India - Silvics and Silviculture – definition and objectives – relation with other branches of forestry.

Unit II – Agroforestry concept and systems

Agroforestry – definition, scope and history - Agroforestry components – benefits and limitations – Agroforestry systems in different agro climatic zones of Tamil Nadu - Classification of agroforestry systems – structural, functional, ecological and socio-economic basis.

Unit III – Agroforestry tree species

Important farm grown trees - Silvicultural characters – Regeneration techniques – Tending – Rotation – Yield and Uses of *Tectona grandis, Santalum album, Casuarina equisetifolia, Eucalyptus hybrid, Azadirachta indica, Melia dubia, Ailanthus excelsa, Dalbergia sissoo, and Pterocarpus santalinus*

Unit IV – Agroforestry practices

Agroforestry practices for arid and semi arid regions, salt affected soils, waterlogged areas, fuelwood and fodder production, soil and water conservation, wasteland development – Carbon sequestration through agroforestry approaches – Forest Mensuration – definition, objectives – Diameter, girth and height measurement methods–standard rules governing breast height measurement – Volume estimation in standing and felled trees - measurement of weight and biomass - Timber transit rules for farm grown trees - National Agroforestry policy, 2014

Unit V Forests and people

Social forestry – Definition, history, objectives – Components – Farm forestry, Extension forestry, Community forestry, Recreation forestry, Urban forestry – Benefits of social forestry - Important social forestry schemes implemented in India - Definition, origin and evolution of JFM in India – Salient features of JFM – Organisational structure in JFM-Benefit sharing mechanism

Practical

Identification of major farm grown tree species – Design and Layout of permanent forest nursery - Nursery technology of *Tectona grandis*, *Casuarina equisetifolia*, *Eucalyptus hybrid*, *Azadirachta indica*, *Ailanthus excelsa*, *Melia dubia*, *Dalbergia sissoo*, *Gmelina arborea*, *Santalum album* and *Pterocarpus santalinus* – Visit to agroforestry models – Agrisilviculture –

Silvipasture – Integrated Farming System - Windbreaks and shelterbelts – Industrial wood plantations and contract tree farming - Estimation of volume – Estimation of biomass – Economics of agroforestry – Preparation of two agroforestry models for the region**.**

Lecture Schedule

1. Forests and Forestry - Definition, scope and classification of Indian forests
2. Role of Forests – Tangible and Intangible benefits - Forest types of Tamil Nadu – Forest cover of India
3. Silvics and Silviculture – definition and objectives – relation with other branches of forestry
4. Agroforestry – definition, scope and history
5. Agroforestry components – benefits and limitations – Agroforestry systems in different agro climatic zones of Tamil Nadu
6. Classification of agroforestry systems – structural, functional, ecological and socio-economic basis
7. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of *Tectona grandis, Santalum album* and *Pterocarpus santalinus*
8. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of *Casuarina equisetifolia, Eucalyptus hybrid* and *Ailanthus excelsa*
9. Mid semester examination
10. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of *Azadirachta indica, Melia dubia* and *Dalbergia sissoo*
11. Agroforestry practices for arid, semi-arid, salt affected and waterlogged soils
12. Carbon sequestration through agroforestry approaches
13. Definition, objectives, scope of Forest Mensuration - Diameter, girth and height measurement methods
14. Standard rules governing breast height measurement – volume estimation of standing and felled trees – measurement of weight and biomass
15. Timber transit rules for farm grown trees – National Agroforestry policy, 2014
16. Definition, history and objectives of social forestry – Components and benefits of social forestry – Important social forestry schemes implemented in India
17. Joint Forest Management – definition, origin, evolution, salient features and organizational structure- benefit sharing mechanism

Practical schedule

1. Identification of major farm grown tree species
2. Design and Layout of permanent Forest Nursery
3. Nursery technology of *Tectona grandis* and *Santalum album*
4. Nursery technology of *Casuarina equisetifolia* and *Eucalyptus hybrid*
5. Nursery technology of *Azadirachta indica* and *Melia dubia*
6. Nursery technology of *Ailanthus excelsa* and Red *Pterocarpus santalinus*
7. Nursery technology of *Dalbergia sissoo* and *Acacia spe.*

8. Visit to agrisilviculture and silvipasture models
9. Visit to Integrated Farming System
10. Design and establishment of windbreaks and shelterbelts
11. Visit to pulpwood / plywood plantations
12. Studies on contract tree farming practices in Tamil Nadu
13. Estimation of volume of standing and felled trees
14. Estimation of tree biomass through various methods
15. Economics of agroforestry
16. Preparation of two agroforestry models for the region
17. Final practical examination

Text Books

1. Divya, M.P., K.T.Parthiban, K.Srinivasan, K.Vanangamudi and M.Govinda Rao. 2008. A text book on Social Forestry and Agroforestry. Satish Publishers, Delhi
2. Dwivedi, A.P. 1992. Agroforestry Principles and Practices. oxford & IBH publishing Co., New Delhi

For further reading

1. Sunil Puri and Pankaj Panwar. 2007. Agroforestry Systems and Practices. New India Publishing Agency, New Delhi
2. Antony Joseph Raj and S.B.Lal, 2014. Agroforestry – Theory and Practices. Scientific Publishers (India), Jodhpur
3. Pathak, P.S. and Ram Newaj. 2003. Agroforestry – Potentials and Opportunities. Agrobios (India)
4. Nair, P.K.R. 1993. An introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht

Websites

www.worldagroforestry.orgn
www.global-saf.com
www.agroforestry.net.au
www.nac.unl.edu/documents/insideagroforestry/vol16issue2.pdf

Outcome

The students will gain knowledge on concepts of forestry, agroforestry and the important agroforestry systems. The students will learn about the silviculture and nursery technology of important agroforestry tree species.

16 FSN 111 PRINCIPLES OF FOOD SCIENCE AND NUTRITION (1+1)

Theory

Unit I: Principles of Food Science and Nutrition

Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of nutrition – relation of nutrition to health.

Unit -II: Carbohydrate, Protein and Fat

Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA). Energy value of foods – determination. Protein – classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention. Deficiency states of protein, carbohydrate and fat nutrition – signs and symptoms.

Unit III: Vitamin and Mineral Nutrition

Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency. Water soluble vitamins – thiamine , riboflavin , niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements. Importance of water – maintenance of electrolyte balance. Dietary fibre - importance, health benefits, sources and requirements.

Unit IV: Food Preservation and Processing

Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.

Unit V: Food Quality and Safety

Food packaging materials – requirements – methods – nutrition labeling. Food adulterants and their detection methods. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCP and Codex Alimentarius Commission.

Practical

Determination of energy value of Foods, cooking quality tests – cereals and pulses. Estimation of moisture, protein and fat. Processing of jam, jelly, squash, ready to serve beverages (RTS).

Preparation of flaked, puffed and extruded products. Visit to food industries and quality control laboratory.

Theory Schedule

1. Food Science – definition, scope and classification, food pyramid.
2. Methods, merits and demerits of moist heat, dry heat and microwave cooking of foods.
3. Importance and scope of nutrition and the relation of nutrition to health.
4. Carbohydrate – classification, functions, digestion and absorption, deficiency symptoms, sources and requirements.
5. Protein – classification, functions, digestion and absorption, deficiency symptoms, sources and requirements. Protein quality – supplementary value of protein.
6. Fat - classification, functions, digestion and absorption, deficiency symptoms, sources and requirements. Rancidity – types. Determination of energy value of foods.
7. Fat soluble vitamins – A, D, E and K – functions, deficiency symptoms, sources and requirements.
8. Water soluble vitamins - thiamine, riboflavin, niacin, pyridoxine, folic acid, cyanacobalamin, biotin, pantothenic acid, ascorbic acid – functions, deficiency symptoms, sources and requirements.
9. **Mid Semester Examination**
10. Minerals – calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, requirements and deficiency diseases.
11. Importance of water and maintenance of electrolyte balance. Health benefits of fibre.
12. Preservation of food by low and high temperature and food irradiation.
13. Processing of puffed, flaked and extruded products
14. Preservation by using sugar (jam, jelly, squash and marmalade), preservation by using salt (brining and pickling) and use of preservatives in food preservation.
15. Food packaging – importance, types of packaging materials and nutrition labeling.
16. Common food adulterants and their detection.
17. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCP and Codex Alimentarius Commission.

Practical Schedule

1. Cooking tests for cereals and pulses
2. Determination of energy value of food
3. Estimation of moisture
4. Estimation of protein
5. Estimation of fat
6. Estimation of ascorbic acid
7. Estimation of iron
8. Estimation of crude fibre
9. Processing of jam and jelly

10. Processing of squash and RTS
11. Puffing of pulses
12. Extrusion of cereals and millets
13. Canning of fruits and vegetables
14. Processing of dehydrated fruits and vegetables
15. Identification of common food adulterants
16. Visit to food processing unit and quality control lab
17. Final Practical Examination

TEXT BOOKS

1. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.
2. Srivastava, R.P., and Sanjeevkumar. S. 2013. Fruit and Vegetable preservation. International Book Distributing Co. Lucknow.
3. Srilakshmi .B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi.

JOURNALS

1. The Indian Journal of Nutrition and Dietetics
2. Journal of Food Science and Technology
3. Critical Reviews of Food Science and Nutrition

WEB RESOURCES

1. www.cellinteractive.com
2. www.nutrition.org.uk
3. www.fnic.nal.usda.gov
4. www.myfooddiary.com

16 TAM 101 இலக்கிய“களில் வெளாண்மையஜம் அறிவியல் தமிர்ப் பயனாக்கமும் (0,1)

நொக்கம்

இளநிலை வெளாண்மை பயிலும் மாணவர்களுக்கு தமிர் இலக்கிய“கள் வரி வெளாண்மை மற்றும் வெளாண்மை சார்ந்த டிதாரில்நுட்ப“களையஜம் டிசய்திகளையஜம் அறியச் டிசய்தல்- தற்கால வெளாண் டிதாரில்நுட்ப“களொடு டிபாருத்திப் பார்த்தல் - வெளாண்மை தவிர தொட்டக்கலை – வனவியல்- வெளாண்டிபாறியியல் - மனையியல் சார்ந்த கருத்துக்களை டிவளிக்டிகாணர்தல் - வெளாண்துறைக்கு இன்றியமையாத கலைச்டிசாற்கள் - டிமாரிப்டிபயர்ப்பஜ - பாரம்பரிய டிதாரில்நுட்ப“களை அறியச்டிசய்தல் - மாணவர்களின் எதிர்காலத் தெவைக்கு அழப்படையான பெச்சுப்பயிர்ச்சி – நெர்காணலை எதிர்டிகாள்ளும் வகையில் டிமன்திறன்களான தலைமைப்பண்பஜ - ஆளுமைப்பண்பஜ - காலமெலாண்மை ஆகியவற்றில் திறம்டிபறச்டிசய்தல் - மாணவர்களின் ஆய்வஜக்கட்டுரை திறனை வளர்த்தல் - வெளாண்மை இதர்கள்.'. நூல்கள் குறித்து விரிப்பஜணர்வை வர்“குதல் - கணினி வரி தமிரில் வெளாண் டிசய்திகளை பதிவெற்றம்.'. பதிவிறக்கம் டிசய்யஜம் முறைகளை அறியச்டிசய்தல் ஆகியவற்றை நொக்கமாக டிகாண்டு பாடத்திட்டத்தை வரையறை டிசய்தல்.

பாடத்திட்டம்

டிதால்காப்பியம் காட்டும் முதற்டிபாருள்.'. கருப்டிபாருள் - ச“க இலக்கியத்தில் வொளாண் டிதாரில் நுட்ப“கள் - பதிடினண் கீர்க்கணக்கு நூல்களில் வெளாண்மைஅறிவியல் - பள்ளு இலக்கிய“கள்.'. ஏடிரபுபது.'. இலக்கியத்தில் வெளாண் டிபாறியியல் - தொட்டவியல் - வனவியல் மனையியல் - ரேலியல் வெளாண்மைப் பர்டிமாரிகள் - இலக்கியம் காட்டும் வார்வியல் டிநறிமுறைகள் - இக்கால இலக்கிய“களில் வெளாண்மைச் சிந்தனைகள் - பிரர்யின்றிளபுதும் முறைகள் - பாரம்பரியத் டிதாரில்நுட்“கள் - இலக்கியத்தில் டிமன்திறன்கள் - அறிவியல் தமிர் வளர்ச்சிநிலைகள் - கலைச்டிசால்லாக்கம் - டிமாரிடிபயர்ப்பஜ - கட்டுரைச் சுருக்கம் எபுதுதல் - கணினிஉலகில் தமிர்

டிசய்முறைப் பயிற்சிகள்

1. டிதால்காப்பியம் காட்டும் முதற்டிபாருள்.'. கருப்டிபாருள்.'. தாவரவியல் அறிவஜ.'. வெளாண் மாந்தர் குறித்த டிசய்திகளை அறிதல்

2. ச“க இலக்கியத்தில் வெளாண் டிதாரில் நுட்ப“கள் - (எட்டுத்டிதாகை.'. பத்துப்பாட்டு)

3. பதிடினண் கீர்க்கணக்கு நூல்களில் வெளாண்மைஅறிவியல்

4. பள்ளு இலக்கிய“கள்.. ஏடிரபுபது–உர்வர் வார்வியல் டிநறிமுறைகளும் வெளாண்மைத் டிதாரில் நுட்ப“களும்

5. இலக்கியத்தில் வெளாண் டிபாறியியல் - தொட்டவியல் - வனவியல் - மனையியல் - ரேலியல்

6. வெளாண்மைப் பர்டிமாரிகள் - உர்வஜ விதைஅறிவியல் - பருவம் - மரை - நாற்றுநடுதல் - எரு இடுதல் - நீர்ப்பாசனம் - களைமெலாண்மை–பயிர்பாதுகாப்பஜ - அறுவடை–உர்வர் சமுதாயம்

7. இலக்கியம் காட்டும் வார்வியல் டிநறிமுறைகள்

8. இக்கால இலக்கிய“களில் வெளாண்மைச் சிந்தனைகள் - பாரதி.. பாரதிதாசன் படைப்பஜகள் - பஜதுக்கவிதை

9. இடைநிலைப் பருவத்தெர்வஜ

10. பிரர்யின்றிளபுதும் முறைகள் - எபுத்துப் பிரைகள் - டிசாற்பிரைகள் - டிசாற் பிரிப்பஜப்பிரை–வாக்கியப்பிரை–டிமய்ப்பஜத் திருத்தம்

11. பாரம்பரிய வெளாண்மைத் டிதாரில்நுட்ப“கள்

12. இலக்கியத்தில் டிமன்திறன்கள் - தலைமைப்பண்பஜ - காலமெலாண்மை

13. ஆளுமைப்பண்பஜ மெம்பாடு–மனித உறவஜத்திறன்கள் வளர்த்தல்

14. அறிவியல் தமிர் வளர்ச்சிநிலைகள்.. வெளாண் நூல்கள்.. வெளாண் இதர்கள் - அலுவலகக் கழதம்

15. கலைச்டிசால்லாக்கம் - வெளாண் கலைச் டிசாற்களைஉருவாக்கும் முறை–தரப்படுத்துதல் - இலக்கியவெளாண் கலைச்டிசாற்கள்.. வட்டாரவெளாண்மைவர்க்குச் டிசாற்கள் - அகராதியியல்

16. டிமாரிடிபயர்ப்பஜ - முக்கியவிதிகள் - பழநிலைகள் - டிமாரிடிபயர்பாளரின் இன்றியமையாப் பண்பஜகள் - வெளாண் டிசய்திகளைடிமாரிடிபயர்த்தல் - கட்டுரைச் சுருக்கம் எபுதுதல்

17. கணினிஉலகில் தமிர் - விக்கிபீழயா–வெளாண் டிசய்திகளைப் பதிவெற்றம் டிசய்தல் - வெளாண் டிசய்திகளை இணையதளவரிஅறிதல்

மெற்பார்வை நூல்கள்

- கந்தசாமி.இல.டிச.வெளாண்மையஜம் பண்பாடும்.'. தமிர்நாடுவெளாண்மைப் பல்கலைக்கர்கம்.'. கொயம்பஜத்தூர்.'. 1974
- கந்தசாமி. இல.டிச.இலக்கியத்தில் வெளாண்மை.'. தமிர்நாடுவெளாண்மைப்பல்கலைக்கர்கம்.'. கொயம்பஜத்தூர் 1981.
- கந்தசாமி. இல.டிச. வெளாண்மைபர்டிமாரிகள்.'. கலைச்டிசல்வம் பதிப்பகம்.'. கொயம்பஜத்தூர் 1983.
- குர்ந்தைசாமி.வா.டிச.அறிவியல் தமிர்.'. பாரதிபதிப்பகம்.'. டிசன்னை
- மீனாட்சிசுந்தரம். மா. மற்றும் ஏ.இல.விசயலட்சுமி..'. தகவல் டிதாடர்பில் தமிர் டிமாரிப்பயன்பாடு.'. கெ.ஆர்.எ.ஆப்டிசட் பிரிண்டர்.'. கொவை– 2002
- மணிமெகலை.ம.தமிர் டிமாரித் தடத்தில் வெளாண் அறிவியலின் சுவடுகள்.'. தெவிபதிப்பகம்.'. திருச்சிராப்பள்ளி.'. 2002
- இலக்கியமும் வெளாண்மையஜம்.'. அனைத்திந்தியஅறிவியல் தமிர்க் கர்கம்.'. த"சாவர்.'. 2006
- தமிர்ரின் மரபஜச்டிசல்வ"கள்.'. உலகத் தமிர்ராய்ச்சிநிறுவனம்.'. டிசன்னை
- சந்திரசெகரன்.'. இரா.'. டிமாரிப்பாடம் - படைப்பாக்கத்திறன் வளர்த்தல்
- வெளாண்கலைச்டிசால் பெரகராதி.'. தமிர் நாடுவெளாண்மைப் பல்கலைக்கர்கம்.'. கொயம்பஜத்தூர்.'. 2008.
- பாவெந்தன்.'. இரா.'. தமிரில் அறிவியல் இதர்கள்.'. சாமுவெல்.'. ;பிசூ கிறி! பதிப்பகம்.'. கொயம்பஜத்தூர்
- டாக்டர் இராதாடிசல்லப்பன்.'. கலைச்டிசால்லாக்கம்.'. தமிர்ப் பல்கலைக்கர்கம்.'. த"சாவர்

16 ENG 103 DEVELOPMENT EDUCATION (0+1)

(Alternate course for non-Tamil students)

Aim:

- Basic principles of learning
- Taxonomy of educational
- Career development and entrepreneurship
- Communication skills

Lecture Schedule

1. Basic principles of learning. Binary terms viz – growth and development, education – for
   - life and life – long education, motivation and morale –
2. Occupation and profession, training and education, lateral thinking and convergent thinking, teaching and learning – discussion.
3. Bloom‘s classification of educational objectives – Cognitive, Affective, Psychomotor domain(s)
4. Career development – opportunity for graduates of agriculture and allied sciences – discussion
5. Success story of a farmer / entrepreneur – factors involved – role – play
6. Brainstorming – Demonstration
7. Simulation – Educational Simulation-Interactive Teaching - Business Simulation –
8. Company‘s annual report for analysis
9. Interpersonal communication – Transactional communication – ice breaker
10. **MID SEMESTER EXAMINATION**
11. The conduct of a symposium
12. Conferencing – the concept and presentation of a paper
13. Scientific Article Writing and Editing
14. Popular Article Writing, Editing and Blogging
15. Project proposal
16. Project Report – writing
17. Entrepreneur – intrapreneur – Managing an intrapreneur – motivation and entrepreneurship development – planning, monitoring and evaluation.
18. **FINAL PRACTICAL EXAMINATION**

Text book:

Sudarsanam.R 1985. ―Development Education‖ Chapter 1,2

Outcome:

- Understand the concepts of learning,
- The necessity for Lifelong education,
- Communication skills in terms of career development

References

1. Bloom,B.S.Hastings J.T. and Maduas J.F. 1971. Handbook on Formative and Summative Evaluation of Student Learning Mc Graw Hill Pub, New York.
2. Day, A Robert 1993. ―How to Write and Publish a Scientific Paper‖ CUP.

3. Hariharan.S. 1995. ―Brainstorming and Interactive Learning‖ Research Quarterly, ADU,
4. Coimbatore.
5. Krishna Mohan and Meera Banerji, 1990. ―Developing Communication Skills‖,
6. Macmillan Pub. Co., Ch.6,9,10,13 and 15.
7. Mathew.M. Monipally. 1997. ―The craft of Business Letter Writing‖. Tata McGraw Hill
8. Pup., Ch. 10 & Appendix – I.
9. Seely John. 1988. ―Communicating in Everyday Life‖. The Oxford Guide to Writing and
10. Speaking, OUP. P.1-79.
11. Sudarsanam.R 1985. ―Development Education‖ Chapter 1,2.
12. Taneja.R.P. 1991. Dictionary of Education, Anmol Pub., New Delhi, India.
13. Wallace, L.Michael 1998. ―Study Skills in English‖ CUP Unit.4.

III Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 201	Weed Management	1+1
2.	16 AEN 201	Fundamentals of Entomology	2+1
3.	16 AGR 202	Irrigation Management	1+1
4.	16 PAT 201	Fundamentals of Plant Pathology	2+1
5.	16 SAC 201	Fundamentals of Soil Science	2+1
6.	16 AMP 201	Livestock and Poultry Production Management	2+1
7.	16 AGM 201	Fundamentals of Microbiology	2+1
8.	16 AEX 201	Dimensions of Agricultural Extension	1+1
9.	16 FMP 211	Farm Power and Machinery	1+1
10.	16 AEC 201	Production Economics and Farm Management	1+1
		Total	**15+10=25**

16 AGR 201 WEED MANAGEMENT (1+1)

Theory:

Unit - I:

Weeds: Introduction, Definitions; harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy.

Unit - II:

Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical, biological and biotechnological methods. Integrated weed management.

Unit - III:

Herbicides - Classification, characteristics, formulations, methods of application; advantages and limitation of herbicide usage in India - adjuvants - herbicide mixture.

Unit - IV:

Herbicides - selectivity of herbicides; Herbicide absorption and translocation; Compatibility of herbicides and other agro inputs - Herbicide residue management - Herbicide resistant weeds and their management - Herbicide resistant crops.

Unit - V:

Weed management in major field and horticultural crops - weed shift - weed control in non cropped areas - aquatic and problematic weeds and their control.

Practical:

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices ; Visiting problematic / parasitic weed infestation areas.

Theory - Lecture Schedule:

1. Weeds - Definition, classification and characteristics, harmful and beneficial effect of weeds.
2. Weed biology and ecological adaptation to different agro ecosystems.
3. Classification and characteristics of weeds of different agro ecosystems-lowland weeds, irrigated upland and rainfed land weeds.
4. Classification and characteristics of weeds - Aquatic, parasitic and obnoxious weeds.
5. Life cycle of weeds, weed migration, weed seed distribution, dormancy, germination, establishment and perennation of weeds in different ecosystems.
6. Crop weed interactions - Critical crop weed competition, competitive and allelopathic effects of weeds and crops.
7. Principles and methods of weed management: Preventive, cultural, mechanical.
8. **Mid semester examination.**
9. Principles and methods of weed management: chemical, biological and alternate methods.
10. Classification and characteristics of herbicides and herbicide formulations - History and

Development.

11. Herbicide Use Efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India - Interaction with moisture, fertilizer and other agrochemicals.
12. Mode of action of herbicides and their selectivity - Mechanism of action of herbicides and their selectivity.
13. Herbicide persistence and degradation in plants and soils-Herbicide residue and management.
14. Herbicide resistant weeds and their impact on weed management.
15. Success of Herbicide Resistant Crops (HRC) in Indian and World agriculture.
16. IWM in crops and cropping systems-Agricultural Crops, Horticultural Crops.
17. Weed shift: Causes and management options for weed shift in crop production.

Practical Schedule:

1. Identification, classification and characterization of terrestrial weeds.
2. Identification, classification and characterization of aquatic weeds.
3. Identification, classification and characterization of problem and parasitic weeds.
4. Weed survey and weed vegetation analysis - density, frequency, SDR and IVI.
5. Study on biology of nut sedge, bermuda grass, parthenium and celosia.
6. Practicing skill development on cultural and non chemical weed management.
7. Identification, classification and characterization of herbicides.
8. Practicing skill development on herbicide application techniques.
9. Practicing Skill development on spray equipment‘s and spray fluid calibration.
10. Practicing Skill development on herbicide weed management in lowland, upland and rainfed ecosystems.
11. Calculation of herbicide quantity and recommendation for different eco systems.
12. Study on phytotoxicity symptoms of herbicides in different crops.
13. Visit to Problem and parasitic weed infestation areas/ herbicide industries.
14. Herbicide residue determination by bioassay techniques.
15. Herbicide residue determination by volumetric, spectro-photometric methods and chromatographic methods.
16. Economic analysis of different weed management methods in crops and cropping systems.
17. **Practical Examination.**

References:

1. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
2. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.
3. Jaganathan R., and R.Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.

E-References:

www.tnau.ac.in www.fao.org

www.tnau.ac.in/agriportal

16 AEN 201 FUNDAMENTALS OF ENTOMOLOGY (2+1)

Aim:

To acquaint the students with external morphology of the insect, basic aspects of anatomy of different systems and identification of insects up to family level with hands-on experience.

Theory

Unit I: History and importance

History of Entomology in India; Position of insects in the animal kingdom and their relationship with other classes of Arthropoda; Reasons for insect dominance.

Unit II: Morphology

General organisation of insect body wall - structure and function, cuticular appendages, moulting; Body regions - insect head, thorax and abdomen, their structure and appendages.

Unit III: Anatomy and physiology

Digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects, sense organs and their functions, exocrine and endocrine glands; Embryonic and post embryonic development.

Unit IV: Taxonomy of Apterygota and Exopterygota

Insect systematics; Distinguishing characters of agriculturally important orders and families of Hexapoda. Apterygota (Thysanura, Diplura, Protura and Collembola); Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Thysanoptera and Siphunculata).

Unit V: Taxonomy of Endopterygota

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera.

Practical

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation – Preparation of Riker mount. Types of insect head, antenna, mouth parts – Structure of thorax. Types of insect legs, wings and their modifications – wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects – immature stages in insects. Study of digestive and reproductive systems of grasshopper / coackroach – Observing the characters of agriculturally important orders and families.

Theory lecture schedule:

1. History of Entomology in India; Position of insects in the animal kingdom - relationship with other members of Arthropoda
2. Structural, morphological and physiological factors responsible for dominance
3. Insect body wall - its structure and function; cuticular appendages

4. Moulting process in insects
5. Structure of insect head and its appendages
6. Structure of insect thorax and its appendages
7. Structure of insect abdomen and its appendages
8. Structure of alimentary canal and its modifications; Digestive enzymes, digestion and absorption of nutrients
9. Malpighian tubules - accessory excretory organs and physiology of excretion
10. Structure of trachea - tracheoles - types of respiratory system - types of spiracles - respiration in aquatic and endoparasitic insects.
11. Haemocoel and dorsal vessel - circulation of blood -composition of haemolymph - haemocytes and their functions
12. Structure of neuron – types of nervous systems.
13. Axonic and synaptic transmissions
14. Male and female reproductive systems in insects – structure and modifications Spermatogenesis and Oogenesis
15. Oviparous, viviparous, paedogenesis, polyembryony ovoviporous and parthenogenesis
16. Embryogenesis; Types of metamorphosis – Immature stages of insects
17. Mid-semester examination
18. Structure of sense organs - types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects — Sound and light production
21. Systematics - principles and procedures of classification and nomenclature of insects
22. Distinguishing characters of insect orders — Apterygota (Thysanura, Diplura, Protura and Collembola), Exopterygota — (Ephemeroptera, Odonata and Phasmida)
23. Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Dictyoptera, Dermaptera and Embioptera
24. Isoptera — social life in termites
25. Thysanoptera, Pscoptera, Mallophaga and Siphunculata.
26. Hemiptera – Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae)
26. Hemiptera - Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
27. Endopterygota — Classification of Lepidoptera – suborders; butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperiidae)
29. Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
28. Classification of Coleoptera – suborders; Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae)
29. Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae,

Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)

30. Diptera – Suborders; Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombylidae,), Cyclorrapha (Syrphidae, Drosophillidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
31. Hymenoptera–Suborders; Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethylidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
32. Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae); Siphonaptera and Strepsiptera

Practical schedule:

1. Observations on external features of grasshopper / cockroach and other members of phylum Arthropoda
2. Methods of insect collection, preservation, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, house fly, moths and butterflies
5. Structure of thorax and abdomen and their appendages —modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Types of immature stages of insects
7. Study of digestive system.
8. Study of male and female reproductive systems
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota -Odonata and Ephemeroptera and Phasmida
10. Observing the characters of Dictyoptera, Dermaptera, Embioptera, Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Mallophaga and Siphunculata
11. Observing the characters of Exopterygota —Isoptera and Hemiptera — Homoptera Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
12. Observing the characters of orders Thysanoptera and Diptera- Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombylidae,), Cyclorrapha (Syrphidae, Drosophillidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
13. Observing the characters of Hymenoptera-Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethylidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
14. Observing the characters of Coleoptera - Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae) Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae,

Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)

15. Observing the characters of Lepidoptera - Butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperiidae), Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
16. Observing the characters of Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family
17. Final Practical examination

Assignment

1. Collection and submission of 50 insects
2. Preparation and submission of one riker mount

Outcome/Deliverables:

The students gain knowledge on external morphology of the insect i.e., head, thorax and abdomen, their appendages and functions. Moreover, this course imparts knowledge on basic aspects of anatomy of different systems, physiology, classification and identification of insects up to family level with hands-on experience.

References:

A. Text Book:

1.Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}

B. Reference Books:

1. Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}
2. Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.
3. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
4. Srivastava, P. D. and R. P. Singh. 1997. An Introduction to Entomology. Concept Publishing Company, New Delhi.

C. Supplementary references:

1. Borror, D.J., D.M. Delong and C.A. Triple Horn. 1976. *An introduction to the study of insects* (IV Edition). Holt McDougal, New York. 864p. {ISBN 978-0030884061}
2. Cedric Gillott. 2005. *Entomology* (Third Edition). Springer, Netherlands.832p. {ISBN 978-1402031823}
3. Nayar. K.K., T.N. Ananthakrishnan and B.V. David 1976. *General and Applied Entomology.* Tata Mc-Graw Hill publishing Company Ltd, New Delhi.
4. Paulson, G.S. 2005. *Hand book to the Construction and Use of Insect Collection and Rearing Devices.* Springer, New York.121p. {ISBN 1402029748}

D. Web resources:

1. http://www.itis.usda.gov/it is/
2. www.zin.ru/animalia
3. https://courses.cit.cornell.edu/ent201/content/*anatomy*2.pdf
4. www.*insects*explained.com/03*external*.htm
5. www.earthlife.net/*insects*/anatomy.html
6. www.*insect*identification.org/*orders_insect*.asp

16 AGR 202 IRRIGATION MANAGEMENT (1+1)

Theory:

Unit - I:

Role of water in plant growth - Importance of irrigation - Water resources and irrigation potential of India and Tamil Nadu - History and development of irrigation in India - Irrigation systems of India and Tamil Nadu.

Unit - II:

Soil - water - plant relationship - Soil Plant Atmospheric Continuum (SPAC) - Hydrological cycle - Soil water movement - soil moisture constants - Moisture extraction pattern - Absorption of water - Evapotranspiration - Plant water stress and its effect and methods to overcome stress.

Unit - III:

Crop water requirement - Potential evapotranspiration (PET) and consumptive use - Definition and estimation - Factors affecting water requirement - Effective rainfall - Critical stages for irrigation - water requirement of crops.

Unit - IV:

Scheduling of irrigation - Different approaches - Methods of irrigation: surface, sub-surface sprinkler and drip irrigation - Micro irrigation: layout, suitability, merits and scope - Fertigation - Water use efficiency - Methods to improve WUE - Conjunctive use of surface and ground water - Water management for major field crops of Tamil Nadu.

Unit - V:

Irrigation management under limited water supply, Quality of irrigation water - Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation - tank irrigation, canal irrigation, well irrigation - Drainage, importance and methods.

Practical:

Estimation of soil moisture - Measurement of irrigation water through water measuring devices (flumes, weirs and water meter) - Calculation of irrigation water requirement (problems) - Acquiring skill in land shaping for different surface irrigation methods - Operation and economics of drip and sprinkler irrigation systems - Estimation of crop water requirement - Scheduling of irrigation based on different approaches - Irrigation efficiency (problems) - Irrigation water quality (lab analysis) - On-farm irrigation structures - Visit to irrigation command area (Reservoirs and tanks) and water management institutes - Methods of drainage and observation of drainage structures.

Theory - Lecture Schedule:

1. Role of water in plants - Importance of irrigation - water resources of India and Tamil Nadu - History and development of irrigation in India - Irrigation systems of India and Tamil Nadu.
2. Soil - Plant -water relationship - Soil-plant-atmospheric continuum - Hydrologic cycle - absorption of water and evapotranspiration.
3. Plant water stress - causes - plant response and adaptations - method to overcome plant water stress.
4. Soil water movement - saturated and unsaturated flow and vapour movement - soil moisture constants and their importance in irrigation.

5. Available soil moisture - definition and importance - moisture extraction pattern - soil physical characteristics (texture, structure, porosity, bulk density and particle density) in influencing irrigation - soil moisture estimation methods.
6. Crop water requirement - factors affecting crop water requirement - effective rainfall - potential evapotranspiration (PET), consumptive use (CU) - definition and estimation.
7. Factors affecting crop water requirement (contd...)- Critical stages for irrigation - water requirement for different field crops.
8. **Mid-Semester Examination.**
9. Methods of irrigation - surface (flooding, beds and channels, border strip, ridges and furrows, broad bed and furrows, surge irrigation) and sub-surface methods.
10. Micro irrigation system (drip and sprinkler irrigation) - suitability, components, layout, operation, advantage and disadvantage.
11. Scheduling of irrigation - criteria based on plant, soil moisture - different approaches - climatological approach, empirical methods, crop co-efficient.
12. Water use efficiency - definition and concept - methods to improve WUE - conjunctive use of water- water budgeting.
13. Water management for cereals, pulses and oilseeds.
14. Water management for commercial crops (cotton, sugarcane, sugar beet, tobacco).
15. Quality of irrigation water - irrigation management under limited water supply - Agronomic practices for use of poor quality water (saline, effluent and sewage water).
16. Tank irrigation, well irrigation - on farm development - command area development.
17. Agricultural drainage - importance of drainage and different methods of drainage.

Practical Schedule:

1. Estimation of soil moisture by gravimetric method and tensiometer.
2. Estimation of soil moisture by resistance blocks and neutron probe and other improved devices.
3. Measurement of irrigation water with flumes and weirs.
4. Calculation of irrigation water based on source, water flow, soil moisture status and depth of irrigation.
5. Land leveling and land shaping - Beds and channels - ridges and furrows.
6. Land leveling and land shaping for border strips - broad bed furrow method of irrigation.
7. Layout, operation and maintenance of drip and sprinkler irrigation systems.
8. Estimation of crop water requirement by direct and indirect methods.
9. Scheduling of irrigation based on indicator plants, soil-sand mini plot technique.
10. Scheduling of irrigation based on depletion of available soil moisture and IW/CPE ratio.
11. Calculations on irrigation efficiency parameters.
12. Assessment of irrigation water quality parameters.
13. Observation of irrigation structures in wetlands and irrigated drylands.
14. Visit to irrigation command area and study of command area development.
15. Observation on drainage structures during on / off campus field visit.
16. Visit to water management and training institute.
17. **Practical Examination.**

References:

1. Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers.
2. Sankara Reddy, G.H. and T. Yellamanda Reddy. 1997. Efficient use of irrigation water. Kalyani Publishers.

e-References:

www.irri.org

www.wcc.nrcs.usda.gov/nrcsirrig

www.wcc.nrcs.sda.gov/irrig.info.html

www.croinfo.net/irrigschedule.htm

16 PAT 201 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Theory

Unit I: Plant pathogenic organisms

Introduction – Definition – Plant Pathology – History of Plant Pathology- causes of plant diseases- biotic and abiotic- Losses due to plant diseases – Plant Pathogenic organisms – Protozoa ,chromista, Fungi, Bacteria, *Candidatus Phytoplasma,* Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites

Unit II: Pathogenesis

Pathogenesis - Mode of infection – pre-penetration, penetration and post penetration – - Effect of pathogen on physiological functions of the plants - Role of enzymes and toxins on disease development – Plant defense mechanisms

Unit III: General characters and molecular phylogeny of fungi

General characters of fungi – somatic structures, types of fungal mycelia - Modification of mycelia – reproduction in fungi (Vegetative, asexual and sexual) –nutrition in fungi- Disease cycle –Symptoms of fungal diseases - Classification based on molecular phylogeny. **I Kingdom: Protozoa,** Phylum: Plasmodiophoromycota, Class: Plasmodiophoromycetes (Plasmodiophorales) **II. Kingdom**: **Chromista,** Phylum: Oomycota, Class: Oomycetes (Pythiales and Peronosporales). **III. Kingdom: Fungi. Phylum: Chytridiomycota**, Class: Chytridiomycetes (Chytridiales, Spizellomycetales); **Phylum: Blastocladiomycota,** Class: Blastocladiomycetes (Physodermaceae); **Phylum: Zygomycota,** Subphylum: Mucoromycotina (Mucorales).

Unit IV: Phylum Ascomycota and Basidiomycota

Phylum: **Ascomycota**, Classes: Taphrinomycetes (Taphrinales), Dothideomycetes (Dothidiales, Capnodiales, Pleosporales,) Eurotiomycetes (Euriotiales), Leotiomycetes (Erysiphales and Helotiales),Sordariomycetes (Hypocreales, Phyllochorales, Glomerales, Diaporthales,) and mitosporic ascomycetes; **Phylum: Basidiomycota**, Classes: Agaricomycetes (Agaricales, Corticiales, Cantharellales and Polyporales), Pucciniomycetes (Pucciniales) and Ustilaginomycetes (Ustilaginales, Urocystidales) Exobasidiomycetes (Exobasidales and Tilletiales)

Unit V: Bacteria, Phytoplasma, virus viroid, Algae, Phanerogams and abiotic disorders

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria -general characters and symptoms of *Candidatus Phytoplasma*, Spiroplasma, Fastidious vascular bacteria, viruses ,viroids, algae –Abiotic disorders.

Practical

Study of important taxonomic characters and symptoms produced by *Plasmodiophora, Pythium Phytophthora, Albugo, Sclerospora, Peronospora, Peronosclerospora, Pseudoperonospora,* and *Plasmopara, Mucor, Rhizopus, Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Botryodiplodia* (*Botryosphaeria*), *Curvularia, Drechslera* (*Helminthosporium), Alternaria, Venturia, Erysiphe, Phyllactinia, Uncinula, Leveillula* and *Claviceps, Fusarium* (*Gibberella ,Nectria*), *Verticillium ,Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria), Pyricularia*(*Magnoporthe*) *Sarocladium, Macrophomina, , Puccinia, Uromyces , Hemileia, Ustilago Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Exobasidium, Sclerotium, Rhizoctonia* (*Thanatephorus*) *Ganoderma Agaricus, Pleurotus, Volvariella* and *Calocybe.* Symptoms of bacterial diseases,

Candidatus Phytoplasma, Fastidious vascular bacteria, algal parasite, phanerogamic parasites and non-parasitic diseases.

Note: Students should submit 50 well-preserved Herbariums

Theory schedule

1. Definition of Plant Pathology – History of Plant Pathology
2. Losses caused by plant diseases
3. Causes of Plant diseases – Protozoa , Chromista, , fungi, Bacteria, Fastidious vascular bacteria, Spiroplasma, *Candidatus Phytoplasma,*
4. Causes of Plant diseases -Virus, viroid, algal, phanerogamic parasites and abiotic disorders
5. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and post penetration
6. Role of enzymes in disease development
7. Role of toxins in disease development
8. Effect of pathogen on physiological functions of the plants- Effect on Photosynthesis- Transpiration- Respiration- translocation of water and nutrients
9. General characters of fungi- Mycelia – vegetative resting structures
10. Asexual reproduction in fungi
11. Sexual reproduction in fungi
12. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, facultative saprophyte- Mode of nutrition in fungi- biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
13. Classification of Kingdom Protozoa - important taxonomic characters , symptoms and life cycle of *Plasmodiophora brassicae* and symptoms of Protozoan diseases
14. Classification of Kingdom Chromista- General characters of Oomycetes- Symptoms and life cycle of *Pythium,Phytophthora* and *Albugo*
15. Symptoms and life cycle of *Peronosclerospora, Sclerospora. Perenospora, Pseudoperenospora and Plasmopara*
16. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Synchtrium* and *Rhizopus* and *Mucor*
17. **Mid Semester Examination**
18. Classification of Kingdom– Ascomycota- important characters
19. Symptoms and life cycles of *Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium), Alternaria* and *Venturia and Macrophomina*
20. Symptoms and life cycles of *Eurotium, Talaromyces, Erysiphe, Leveillula, Phyllactinia, Uncinula , Podosphaera and Sphaerotheca*
21. Symptoms and important characters of *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillim*
22. Symptoms and important characters of *Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria), Pyricularia*(*Magnoporthe*) and *Sarocladium*
23. Classification of Kingdom - Basidiomycota- important characters
24. Symptoms and life cycles of *Puccinia ,Uromyces, Hemileia*
25. Symptoms and life cycles of *Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Tilletia and Exobasidium*
26. Symptoms and life cycles of *Athelium, Thanetephorus* and *Ganoderma*
27. Important taxonomic characters of *Agaricus, Pleurotus , Volvariella* and *Calocybe*

28. Classification and general characters of phytopathogenic bacteria
29. Symptoms and characters of *Xanthomonas, Ralstonia, Erwinia, Pantoea, Pectobactrium Agrobacterium (Rhizobium), Corynebacterium* (*Clavibacter*,) and *Streptomyces*
30. Important characters and symptoms of *Candidatus Phytoplasma* diseases – Phyllody, little leaf, yellow dwarf and sandal spike, Fastidious vascular bacteria and Spiroplasma
31. Virus - definition, nature and properties of plant virus, Single stranded, Double stranded RNA and DNA viruses and Transmission of plant viruses
32. Common symptoms of virus diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis , ring spot, vein clearing, leaf crinkle, rosette and bunchy top
33. Important characters and symptoms of Viroid, Algal and Phanerogamic parasites
34. Symptoms and characters of non-parasitic diseases

Practical schedule

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies.
2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora, Pythium* and *Phytophthora*.
3. Study of important taxonomic characters and symptoms produced by *Sclerospora, Peronospora, Peronosclerospora Pseudoperonospora* and *Plasmopara*
4. Study of important taxonomic characters and symptoms produced by *Albugo and Rhizopus.*
5. Study of important taxonomic characters and symptoms produced by *Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium)* and *Alternaria*
6. Study of important taxonomic characters and symptoms produced by *Eurotium, Talaromyces, Erysiphe, Leveillula, Phyllactinia, Uncinula , Podosphaera and Sphaerotheca*
7. Study of important taxonomic characters and symptoms produced by *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillim*
8. Study of important taxonomic characters and symptoms produced by *Colletotrichum (Glomerella), Pestalotia (Pestalosphaeria), Pyricularia* (*Magnoporthe*), *Sarocladium* and *Macrophomina.*
9. Study of important taxonomic characters and symptoms produced by *Puccinia, Uromyces and Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces),and Exobasidium*
11. Study of important taxonomic characters of *Agaricus, Pleurotus, Calocybe, Volvariella* and symptoms produced by *Athelium, Thanetephorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
13. Symptoms of *Candidatus Phytoplasma* and Algae
14. Symptoms and vectors of viral diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis , ring spot, vein clearing, leaf crinkle, rosette and bunchy top
15. Phanerogamic parasites and non-parasitic diseases
16. Field visit
17. **Final Practical Examination.**

Note: Students should submit 50 well-preserved disease specimens.

References

1. Agrios, G.N. 2005. Plant Pathology – (5^{th} Edition). Academic Press, New York.
2. Alexopoulos,C.J., Mims,C.W. and Blackwell, M.2010 Introductory Mycology. John Wiley and Sons Ltd., N.York.
3. Alice D, and Jeyalakshmi C 2014. Plant Pathology. A.E Publications ,Coimbatore
4. Dube, H.C.2009. A textbook of Fungi, Bacteria and Viruses, Vikas Publishing House P. Ltd, New Delhi.
5. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E.Ltd. New Delhi.
6. Singh, R.S.1982. Plant Pathogens – The Fungi. Oxford and IBH Publishing Co., New Delhi.
7. Vidyasekaran, P. 1993. Principles of Plant Pathology –. CBS Publishers & Distributors, New Delhi.

E-books

1. Agrios, G.N. 2005. Plant Pathology – (5^{th} Edition). Academic Press, New York.
2. Janse,J.D. 2006. Phytobacteriology- Principles and practice, CABI Publishing, UK
3. Phyllis G. Weintraub and Phil Jones ,2010. Phytoplasma- Genomes,plant host and vectors

Web resources

1. www.mycobank.org
2. www.mycology.net
3. www.bspp.org.uk
4. www.ictv.org
5. www.bibo.library.cornel.edu

16 SAC 201 FUNDAMENTALS OF SOIL SCIENCE (2 + 1)

Aim:

To impart knowledge about soils, their formation, pedological and edaphological approaches and physical, chemical and biological properties of soils.

Syllabus - Theory

Unit l-Earth, Rocks and Minerals

Soil - Pedological and edaphological concepts - Origin of the Earth - Composition of Earth's crust -Rocks and minerals - primary and secondary minerals.

Unit II - Soil Formation

Weathering of rocks & minerals - Physical, chemical and biological weathering - Soil formation - factors-active & passive. - Soil forming processes - Simenson's and specific - Soil profile.

Unit III- Physical Properties

Soil physical properties and their significance - Soil texture and textural classes - Soil structure and classification - Soil consistence. Bulk density, particle density and porosity - Soil colour - significance -causes and measurement. Soil temperature - Soil air - Soil water-Measurement - Soil water potentials -Soil moisture constants - Movement of soil water - saturated and unsaturated flow - infiltration, hydraulic conductivity, percolation, permeability and drainage**.**

Unit IV-Chemical Properties

Soil colloids - Properties, types and significance - Layer silicate clays - their genesis and sources of charges - Ion exchange - CEC, AEC and Base saturation - Factors influencing Ion exchange -significance. Soil reaction, Buffering capacity and EC.

Unit V-Organic matter and Humus

Soil organic matter - Composition - decomposition and mineralization, C : N ratio, Carbon cycle -Fractions of soil organic matter - Humus formation. Soil organisms - Beneficial and harmful effects.-Soil enzymes**.**

Syllabus-Practical

Identification of rocks and minerals - Study of soil profile - collection and processing of soil samples -Determination of bulk density, particle density and porosity - Particle size analysis - Feel method -International pipette method - Soil colour - Munsell colour chart. Soil moisture determination -Gravimetric method, gypsum block, tensiometer, TDR and neutron probe moisture meter. Determination of infiltration rate and hydraulic conductivity - Soil temperature. Soil pH and EC - Organic carbon -Chemical constituents of soil - Field study of different soil types.

Lecture Schedule

1. Soil definition – soil as a three dimensional narural body – Pedalogical and edaphological concepts.
2. Origin of Earth – theories – planetesimal and nebular hypothesis – Composition of Earth‘s crust
3. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks
4. Brief description of important rocks – mineralogical composition
5. Minerals – definition, occurrence, classification of important soil forming primary minerals – silicate and non silicate minerals, ferro and non-ferro magnesium minerals

6. Formation of secondary minerals – clay minerals and amorphous minerals
7. Weathering of rocks and minerals – Physical, chemical and biological
8. Soil profile description – Master horizons – pedon and poly pedon
9. Factors of soil formation – Passive soil forming factors
10. Factors of soil formation – Active soil forming factors
11. Fundamental soil forming process – Simenson‘s four fold soil forming process – eluviation, illuviation, translocation and humification.
12. Specific Soil forming processes – podzolization, laterization, salinization, alkalization, calcification, decalcification and pedoturbation.
13. Soil texture – particle size distribution – textural classes – textural triangular diagram
    – significance of soil texture
14. Soil structure – classification – genesis – factors influencing structural stability – significance of soil structure
15. Soil consistence – cohesion, adhesion, plasticity, Atterberg‘s constants – upper and lower plastic limits, plasticity number – significance of soil consistence
16. Soil bulk density,particle density and porosity – factors influencing – significance
17. Mid semester Examination
18. Soil colour – causes and measurement – Munsell colour chart – factors influencing soil colour – significance
19. Soil temperature – measurement , soil air – composition – aeration, measurement – significance of soil temperature and soil air
20. Soil water – forms of water, units of expression and pF scale
21. Measurement of soil moisture – Gravimetric, Tensiometer, Gypsum Block, TDR, Neutron probe and Theta probe
22. Soil water potentials – gravitational, matric, osmotic –soil moisture constants
23. Movement of soil water – Saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage.
24. Soils colloids – types, properties – inorganic colloids and organic colloids
25. Layer silicate clays – genesis and classification – 1:1, 2:1 expanding and non expanding – 2:2 clay minerals, amorphous minerals.
26. Sources of charges in expanding and non expanding crystalline lattice clays, amorphous minerals and organic colloids
27. Ion exchange reactions – cation exchange, anion exchange and base saturation – significance
28. Soil reaction (pH) – definition, pH scale, factors affecting soil pH, buffering capacity
    – Significance
29. Soil Electrical Conductivity – factors affecting EC – Significance
30. Soil organic matter – composition, decomposition, mineralization and immobilization Carbon cycle, C:N ratio, biomass carbon and nitrogen.
31. Fractions of soil organic matter – humus formation and stabilization
32. Soil organisms – soil flora and fauna formation and stailization
33. Soil organisms – soil flora and fauna – beneficial and harmful roles – earth worms – micro – organisms and their influence on soil properties – Soil enzymes – Dehydrogenase, catalase and phosphatise
34. Importance of soil properties on crop growth.

Practical Schedule

1. Identification of common rocks and minerals
2. Methods of soil sample collection
3. Visit to soils of different terrains and study of soil profiles
4. Determination of bulk density, particle density and porosity - cylinder, wax coating and core methods.
5. Soil textural analysis - feel method, International pipette method (part 1)
6. International pipette method (part 2)
7. International pipette method (part 3)
8. Determination of soil colour and temperature.
9. Determination of soil moisture- Gravimetry and moisture probes
10. Determination of available soil moisture - Pressure Plate Apparatus
11. Determination of Infiltration rate - Double Ring Infiltrometer
12. Determination of hydraulic conductivity - Constant head Hydraulic Conductivity unit
13. Determination of soil pH and EC
14. Estimation of soil organic carbon
15. Colloquium 1. - Chemical constituents of soil - Total elemental composition - relevance in soil properties and behaviour
16. Colloquium 2. - Preparation of interpretative reports of soil analysis and assignments
17. Final Practical Examination

Text Books

1. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14th Edition). Pearson Education, Inc. Publishing as Prentice Hall.
2. Sehgal, J. 2005. Pedology concepts and applications, Kalyani Publishers, New Delhi.

References

1. Arun Kumar Saha and Anuradha Saha. 2012. Text book of Soil Physics. Kalyani Publishers. New Delhi.
2. Bear, Firman.E. 2012. Soil Science. Vol. 8. Scientific Publishers, Jodhpur, India.
3. Bear,Firman.E.2014. Chemistry of the soil. 2nd Edition. ScientificPublishers,Jodhpur,India.
4. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science-Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5. Black, C.A. 1965. Agronomy Monograph. Methods of Soil Analysis. Part1. Physical & Mineralogical properties including Statistics of Measurement and Sampling. Wiley, NewYork.
6. Brady, N.C. and Raymond, C.Weil. 2013. The Nature and Properties of Soils (14th Edition). Pearson Education, Inc. Publishing as Prentice Hall.
7. Daji A.J. 1970. A Text Book of Soil Science - Asia Publishing House, Madras.
8. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, New Delhi
9. Fanning, D.S. and C.B.Fanning. 1989. Soil: Morphology, Genesis and Classification. John Wiley and Sons, New York.
10. Fundamentals of Soil Science. 2009. ISSS Publication, New Delhi.
11. Garrison Sposito. 2008. The Chemistry of Soils. Amazon Publishers, India.
12. Ghildyal, B.P. and Tripathi, R.P. 2001. Soil Physics. New Age International Publications.
13. Hillel, D. 1998. Environmental Soil Physics. Academic Press: Orlando, Fl.
14. Helmut Kohnke and D.P.Franzmeier. 2013. Soil Science Simplified. Amazon

Publishers, India
15. Henry D.Foth. 1990. Fundamentals of Soil Science. Amazon Publishers, India.
16. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGraw-Hill Book Company INC. NewYork.
17. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersy.
18. Kim H.Tan. 2003. Principles of Soil Chemistry. Third Edition. Scientific Publishers, Jodhpur, India.
19. Kohnke, H. and D.R.Franzmeier. 2013. Soil Science Simplified. Amazon Publishers.
20. Michael J.Singer and Donald N. Munns. 2005. Soils : an introduction (6th Edition). Amazon Publishers.
21. Sahai, V.N. 2008. Fundamentals of Soils. Kalyani Publishers, New Delhi.
22. Schaetzl, R. and S.Anderson. 2005. Soils - Genesis and geomorphology. Cambridge University Press, Cambridge.
23. Soil Science Society of America. 2001. Glossary of Soil Science Terms 1996. Soil Science Society of America, Madison, Wis.
24. Michael J.Singer and Donald N.Munns. 2005. Soils : An Introduction (6th Edition) Amazon Publishers.
25. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers.
26. William A.Jury and Robert Horton. 2004. Soil Physics. Amazon Publishers.

e-references

1. http://www.sciencedirect.com/science/books
2. http://202.200.144.17/sykc/hjx/content/ckzl/6/2.pdf
3. http://www.pedosphere.com/volume01/pdf/Section._01.pdf
4. http://waterquality.montana.edu/docs/homeowners/Septic_Drainfield_Soil_Suitability, Presentations /6_Soil Texture and__Structure.pdf
5. http://wfrec.ifas.ufl.edu/landscape_horticulture/PDFdocuments/SoilProp.pdf
6. http://www.rootsofpeace.org/assets/Soil%Testinq%Manual%20V6%20(Feb%208).pdf
7. http://www.soils.wisc.edu/courses/SS325/morphology.htm
8. http://www.google.co.in/#hlBase+saturation+%E2%80%93+Factors+influencing +ion+exchange+significance.+Soil+reaction%2C+Buffering+capacity+and+EC+ +&btnG
9. ftp: / / ftp- fc. sc. egov. usda. qov/ NSSC/ Lab Methods Manual/ SSIR42 2004 print, pdf
10. www.scribd.com/.../15751720-Soil-Survev-lab-Methods-Manual-2004-USDA
11. www.asssi.asn.au/.../Understanding_Soils_and_Their_lnteractions_with_La nd Management_2005.pdf
12. http://www.soils.wis.edu/courses/SS325/morphology.htm
13. http://landresources.montana.edu/
14. http://ftp.wcc.nrcs.usda.goV/H....soilOther/soil-USDA-textural-class.pd

Outcome:

This course will give a comprehensive knowledge on rocks and minerals, their composition and the types of soils formed from different parent materials. It will enrich the students on the role of soil forming factors and processes in soil formation. The students will understand the various soil physical, chemical and biological properties and their impact on plant growth. The knowledge gained in this course will be useful in understanding the behaviour of soils in crop production and management

16 AMP 201 LIVESTOCK AND POULTRY PRODUCTION MANAGEMENT 2+1

Theory

Unit I: Introduction to Livestock Management

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu-Various systems of livestock production-extensive – semi intensive - intensive- mixed-Integrated and specialized farms.

Unit II: Dairy Cattle Management

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle –Culling - Estrus Cycle – Artificial Insemination – Introduction to Embryo transfer – Housing – Space requirement calf and adult stock – System and types of housing - Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder –Total Mixed Ration **–** composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

Unit III: Sheep and Goat Management

Breeds - Sheep and goat classification — Economic traits - system of rearing - Housing Management – Floor space requirement - Care and Management of young and adult stock – Nutrition – Feed and fodders of Small ruminants – Flushing - Common diseases – prevention and control.

Unit IV: Management of Swine

Classification of breeds – Economic traits - Housing - Nutrition – creep feeding - Care and Management of Adult and Young Stock - Common disease- prevention and control.

Unit V: Poultry Management

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers - Nutrition of Chick, grower, Layer and broiler – Incubation and Hatching of Eggs - Common Diseases - Control and prevention.

Practical

Study of external parts of Livestock - Identification of livestock and poultry-Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) Dehorning-Different methods of castration- Dentition-Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk- Demonstration of cream separation, - Identification of feeds and fodder-Economics Dairy, Goat and Swine farming - Study of external parts of Fowl - Preparation of Brooder House - Brooder management-Identification of layer and non layer- Debeaking, delousing and deworming of poultry-Vaccination schedule for broiler and layer-Dressing of broiler chicken - Economics of Broiler and Layer Farming - Visit to a modern Dairy and commercial layer and broiler farms - Demonstration of incubator and setter.

Lecture schedule

S. No	Lecture Unit	Reference Book & Page No
1	Significance of livestock and poultry in Indian economy- livestock and poultry census. Different livestock development programmes of Government of India and Tamil Nadu	www.indiastat.com, Livestock census 2012 is , Dairying in Tamil Nadu 2014 by NDDB
2	Various systems of livestock production-extensive – semi intensive, intensive- mixed- integrated and specialized farms.	357- 396 Handbook of Animal Husbandry - ICAR
3	Definition of breed-classification of indigenous white and black cattle-breed characteristics of Tamil Nadu cattle and Indian breeds -Sindhi, Gir and breeds Sahiwal.	Handbook of Animal 1-53- Husbandry - ICAR
4	Breed-characteristics of exotic cattle -Jersey and Holstein Friesian – Indian Buffaloes- Murrah, Surti and Toda.	Handbook of Animal 1-53- Husbandry - ICAR
5	Breeding-cross breeding-upgrading-economic traits of cattle-culling importance and methods	1-53- Handbook of Animal Husbandry - ICAR
6	Estrous cycle – signs of estrous - artificial insemination-merits and demerits-Principles and outline of embryo transfer	722-723 Handbook of Animal Husbandry - ICAR
7	Housing management-farm site selection and floor space requirement for calves, heifer, milch animal and work bullock.	364-379 Handbook of Animal Husbandry - ICAR
8	Systems of housing-single row system-double row system- head to head and tail to tail-merits and demerits - Type design of house.	364-379 Handbook of Animal Husbandry - ICAR
9	Care and management of new born calf and heifers	358-362 Handbook of Animal Husbandry - ICAR
10	Care and management of pregnant animal and lactating animals .	Handbook of 362-363 Animal Husbandry - ICAR
11	Care and management of dry cows and work bullock.	756-757 Handbook of Animal Husbandry - ICAR
12	Nutrition-definition-ration-balanced ration-desirable characteristics of a ration. Classification of feed stuffs-concentrate and roughage-comparison, Total Mixed Ration	395-447 Handbook of Animal Husbandry - ICAR
13	Model composition of concentrate mixture of young and	395-447 - Handbook of

	adult stock-age wise feed and fodder requirement- Importance of green fodder.	Animal Husbandry - ICAR
14	Milking methods-clean milk production-factors affecting	363 Handbook of animal

	milk yield and composition	Husbandry – ICAR
15	Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.	448-551 Handbook of Animal Husbandry - ICAR
16	Viral diseases-foot and mouth disease, bacterial diseases, anthrax, hemorrhagic septicemia- black quarter - metabolic- tympanites, acidosis, ketosis and milk fever	448-551 Handbook of Animal Husbandry - ICAR
17	**Mid semester examination**	
18	Sheep and goat farming-classification of breeds of Indian and exotic origin – economic traits.	54-120 Handbook of Animal Husbandry - ICAR
19	Systems of rearing-housing management - type design-floor diagram-space requirement for adult and young stock.	10 1 Handbook of Animal Husbandry - ICAR
20	Care and management of ram, ewe and lamb-nutrition-feeds and fodder for small ruminants.	99-101 Handbook of Animal Husbandry - ICAR
21	Care and management of buck, doe and kid- nutrition-flushin g.	10 2 Handbook of Animal Husbandry - ICAR
22	Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue- PPR- enterotoxaemia- Ecto and endo parasite s.	448-551 Handbook of Animal Husbandry - ICAR
23	Swine husbandry –Common breeds of exotic origin- Large White Yorkshire, Landrace and Duroc -economic traits- housing of Swine.	256-271Handbook of Animal Husbandry – ICAR
24	Care and management of sow, boar and piglets-nutrition-creep feeding.	256-271Handbook of Animal Husbandry - ICAR
25	Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.	448-551 Handbook of Animal Husbandry - ICAR
26	Classification of breeds - commercial strains of layer and broiler.	206-255 Handbook of Animal Husbandry - ICAR
27	Care and management of Chicks-brooder management.	206-255 Handbook of Animal Husbandry - ICAR
28	Systems of housing- deep litter and cage system- floor space requirement- common material- litter management-merits and demerits.	206-255 Handbook of Animal Husbandry - ICAR
29	Care and management of Grower and Layers-	206-255 Handbook of Animal

	vaccination schedule.	Husbandry - ICAR
30	Care and management of broilers-vaccination schedule.	206-255 Handbook of Animal Husbandry - ICAR
31	Incubation and hatching of eggs.	206-255 Handbook of Animal Husbandry - ICAR
32	Nutrition-feed formulation-composition of chick, grower, layer broiler- starter and Finisher mashes-Feed Conversion Ratio/dozen egg or / kg of meat production.	206-255 Handbook of Animal Husbandry - ICAR
33	Classification of disease –viral – bacterial - protozoan-	448-551 Handbook of Animal
	causative organisms, symptoms and prevention – viral diseases- Ranikhet – IBD-avian flu	Husbandry - ICAR
34	Bacterial disease-E.coli-coryza-salmonellosis-protozoan–coccidiosis-casuative organism, symptoms and preventive measures. Management of dead birds and manure	448-551 Handbook of Animal Husbandry - ICAR

Practical:

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, Dehorning, Castration and Dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat %, total solids, solids not fat
8. Demonstration of cream separation
9. Identification of feed &fodder
10. Economics of dairy, goat and swine Farming
11. Study of external parts of fowl. Preparation of brooder house
12. Identification of layer and non- layer
13. Debeaking, delousing, deworming of poultry Vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler. Economics of layer and broiler farming
15. Visit to a modern dairy and commercial layer and broiler farms
16. Demonstration of incubator and setter
17. **Practical examination**

Reference books:

ICAR (2002) Hand of Animal Husbandry, ICAR, New Delhi.

E- reference:

http://www.elearnvet.net/
http://agridr.in/expert_system/cattlebuffalo/Breeding%20management%20of%20cattle%20and%20buffaloes-2.html

16 AGM 201 FUNDAMENTALS OF MICROBIOLOGY (2+1)

Aim

1. To enable better understanding of students about the microscopic world around them
2. To acquaint students with the basic laboratory techniques and tools of microbiology
3. To introduce the fundamental characteristics of various microorganisms
4. To develop experimental skills, including the collection and analysis of data, the ability to draw valid conclusions and apply these conclusions within a larger framework

Theory

Unit I. History of Microbiology

Definition and scope of microbiology – microbes for human welfare and environment. Historical roots of microbiology; biogenesis and abiogenesis theory; germ theory of diseases and fermentation. Contributions of Antonie Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Alexander Fleming and Waksman.

Unit II. Microbiological Techniques

General principles of light microscopy - magnification, resolving power and numerical aperture. Different types of light and electron microscopes; three dimensional imaging - Atomic force and Confocal scanning laser microscopy. Staining techniques - principle and types of stains; simple, negative, differential and structural staining. Sterilization and disinfection techniques; principles and methods of sterilization - physical methods – heat, filters and radiation; chemical methods. Isolation, enrichment and purification techniques of bacteria, yeast, moulds and actinobacteria. Preservation of microbial cultures.

Unit III. Position of Microbes in the living World and their Structure

Evolutionary relationship among the living organisms. Whittaker‘s Five Kingdom concept of living organism and Carl Woese systems. Three domains of life – similarities and differences; Modern approach to the bacterial systematics; Differentiation of bacteria, archaea and eukaryotes; Systematic bacteriology; prokaryotic diversity - Bergey‘s Manual of Systematic Bacteriology. Cell biology - bacterial size, shape and arrangement; cell structure and components of bacteria. Morphology of fungi and algae.

Unit IV. Growth, Nutrition and Metabolism

Bacterial growth- population growth- growth cycles of population - measurement of growth ; environment on growth – temperature, oxygen, pH and salts; energetics in bacteria; oxidation – reduction , electron carrier – overview of aerobic and anaerobic respiration and fermentation in bacteria.

Unit V. Viruses, Bacterial Genetics and Immunology

General properties of viruses: different types; overview of bacteriophages; morphology of bacteriophages: Lytic and lysogenic cycles; lytic and temperate phages. Genetic elements of bacteria; bacterial chromosomal DNA and plasmid; gene arrangements. Mutation - types and mutagens. Genetic recombinations: Transformation, transduction and conjugation. Genetic engineering – an introduction. Basic concepts of immunology – antigen – antibody reactions and vaccines.

Practical

Safety in Microbiology laboratory. Microscopes – Micrometry – Sterilization techniques and equipment – Growth media preparation – bacteria, fungi and actinobacteria. Isolation, purification and preservation of bacteria yeast and moulds. Staining techniques: Simple and differential staining - spore staining - Measurement of bacterial growth. Identification of microorganisms: cultural, physiological and biochemical tests for bacteria and actinobacteria. Morphological identification of yeasts, moulds and algae. Molecular identification of bacteria (16s rDNA). Isolation of bacteriophages. Isolation of mutants employing physical or chemical mutagens.

Theory schedule

1. Definition and scope of microbiology – Development of microbiology as science
2. Biogenesis and a biogenesis theory.Contributions by Antonie Van Leeuwenhoek, Louis Pasteur
3. Contributions of John Tyndall, Joseph Lister, Edward Jenner, Robert Koch, Alexander Fleming and Waksman. Germ theory of fermentation and disease
4. Microscopy; principles – resolving power and magnification. Light microscopy
5. Different types of microscopes - UV, Dark Field, Phase Contrast, Fluorescence and Electron Microscopes; Atomic and Confocal Scanning Laser Microscopy
6. Staining techniques - principle and types of stains - staining techniques- simple, negative, differential and structural staining methods
7. Sterilization – principle – physical agents and chemical methods
8. Isolation and enrichment culture techniques; preservation techniques
9. Evolutionary relationship - Position of microbes in living world – concepts and developments in classification of microorganisms
10. Groups of microorganisms - prokaryotes and eukaryotes
11. Archaea – ecology; differences among archaea, eubacteria and eukaryotes
12. Systematic bacteriology - Bergey‘s manual of systematic bacteriology – outline only
13. Cell biology; size, shape, structure and arrangement of cells
14. External structures in bacteria and their functionality
15. Functional anatomy and reproduction in bacteria
16. Morphology of fungi – economic importance
17. Morphology of algae – economic importance
18. **Mid Semester Examination**
19. Bacterial growth- population growth and growth cycle – continuous culture -chemostat and turbidostat; synchronous culture
20. Conditions for growth - temperature requirements - aerobes and anaerobes – factors influencing growth and methods of assessment of growth
21. Nutritional types of bacteria; energetics in bacteria. Metabolic diversity/ pathways specific to bacteria
22. Microbial metabolism- Energy generation by substrate level phosphorylation, oxidative and photo phosphorylation
23. Aerobic respiration and anaerobic respiration
24. Fermentative mode of respiration
25. Viruses and their properties; bacteriophages – lytic and lysogenic and temperate phages
26. Genetic elements in bacteria – structure and functions of bacterial chromosome and plasmid

27. Mutation in bacteria – principles and types
28. Mutagens – physical, chemical and biological
29. Genetic recombination – competency - transformation
30. Genetic recombination by Conjugation – concept of Hfr
31. Genetic recombination by Transduction – generalized and specialized
32. Microorganisms as tools in genetic engineering
33. Immunology – principles – specific and non-specific defense
34. Antigen – antibody reactions – vaccines - applications

Practical schedule

1. Safety in Microbiology laboratory. Microscopes – handling light microscope
2. Micrometry-measurement of microorganisms
3. Aseptic techniques – working with equipment and apparatus
4. Preparation of growth media for bacteria, yeast moulds and actinobacteria
5. Isolation of microorganisms by serial dilution and plating technique
6. Purification and preservation of bacteria and actinobacteria
7. Purification and preservation of yeasts and moulds
8. Staining techniques - positive and negative staining
9. Differential staining - Gram and spore staining
10. Turbidometric assessment of growth of bacteria
11. Morphological and physiological characteristics of bacteria and actinobacteria
12. Biochemical characteristics of bacteria and actinobacteria
13. Identification of yeasts moulds and algae - morphological characterization
14. Molecular identification of bacteria by 16s r DNA sequencing
15. Isolation of bacteriophages
16. Isolation bacterial mutants by UV irradiation / chemical mutagenesis
17. **Practical Examination**

Outcome

1. Skill development in the safe handling, culturing and staining of microorganisms
2. Learning the laboratory procedures needed to identify a bacterial culture
3. Understanding the structural, reproductive and metabolic characteristics of bacteria and morphology of eukaryotic microorganisms
4. Acquiring knowledge about the factors that influence microbial growth and how it can be controlled
5. Exposure to the mechanisms of genetic recombination in bacteria and describe the practical applications of these methods

Text Books

1. Prescott, Harley and Klein, 2013. Microbiology, 9 th edition, McGraw Hill Publishing
2. Michael J. Pelczar,JR., E.C.S. Chan, Noel R.Krieg, 2005. Microbiology
3. ebook: LuisM.de la Maza, Marie T. Pezzlo and Ellen Jo Baron 1997. Color Atlas of diagnostic Microbiology, Published by Mosby- Year Book Inc.
4. ebook: Michael J. Leboffee and Burton E.Pierce 2011. A photographic Atlas for the Microbiology Laboratory 4th edition, Marton Publishing Company

Reference Books

1. Hans G. Schlegel, 2012. General Microbiology, 7 th edition
2. Ronald M. Atlas, 1997. Principles of Microbiology, Second edition
3. Tortora, G.J., B.R.Funke and C.L. Case, 2009. Microbiology- An Introduction, 9 th edition

4. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

Web pages

http://www.microbes.info

http://aem.asm.org

http://microbelibrary.com

http://www.rapidmicrobiology.com

16 AEX 201 DIMENSION OF AGRICULTURAL EXTENSION (1+1)

OBJECTIVE

The course intends to expose students to the fundamentals of extension education, extension systems in India, programme planning and rural development efforts. The course will also provide an opportunity to students to visit different organizations involved in extension activities and rural development work.

Theory

UNIT I

Introduction to Extension Education

Extension Education – meaning, definition, scope, objectives, philosophy, principles; Extension Education Process; Differences among formal, informal and non-formal education; Extension education as a science – relationship with other social sciences.

UNIT II

Early Rural Development attempts, Extension in USA, Extension approaches in India

Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon Experiment, Sriniketan, Sevagram, Marthandam project, India Village Service, Firka development scheme, Etawah pilot project, Nilokheri Experiment; Extension in USA – origin, Cooperative Extension Service, organization of extension work, 4-H club; Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Farming System Research Extension(FSRE) , Agricultural Technology Management Agency (ATMA); Firstline Extension System – KVK, IVLP, ATIC, Frontline demonstrations.

UNIT III

Major Rural Development Programmes

Rural Development – meaning, definition, concept, importance; Rural Development in India - Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup – Community Development Programme (CDP), National Extension Service (NES), IADP, IAAP, HYVP, IVLP, WDP, NATP, ITDP, IRDP, SFDA, MFAL, NREP, RLEGP, DPAP, CADP, FFW, JRY, EAS, IAY, SGSY, PMEY, SJSRY, PMGSY, SGRY, MGNREGA, PURA, NAIP, NADP (RKVY) - the strengths and weaknesses of the above programmes.

UNIT IV

Women and Youth Development Programmes

Women Development Programmes – DWCRA, RMK, ICDS, MSY, TANWA; Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), ARYA - the strengths and weaknesses of the above programmes.

UNIT V

Extension Programme Planning

Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

Practical

Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes; Visit to Panchayat Union office to learn their functions; Exposure to Grama Panchayat activities; Study of the functions of JDA / ADA and to learn about ATMA and other schemes; Interaction with a Self-Help Group to study its activities; Exposure to a Non-Governmental Organization (NGO) to study its role in rural development; Study of the activities of State Department of Horticulture to learn their extension activities; Visit to Krishi Vigyan Kendra (KVK) to learn their roles and activities; Visit to Social Welfare Department to study the women development programmes; Exercise to assess the awareness and participation of village people in rural development programmes in a rural setting.

Theory Schedule

1. Extension Education – meaning, definition, scope, objectives, philosophy, principles.
2. Extension Education Process, Differences among formal, informal and non-formal education.
3. Extension education as a science – relationship with other social sciences.
4. Historical development of extension in India – Famine Commission, Royal Commission, Scheme of Rural Reconstruction, Economic Conference of Mysore, Gurgaon experiment, Sriniketan.
5. Sevagram attempt, Marthandam Project, Indian Village Service, Firka Development Scheme, Etawah Pilot project, Nilokheri Experiment.
6. Extension in USA – origin, Cooperative Extension Service, organization of extension work, 4-H clubs.
7. Extension programmes of Ministry of Agriculture – Training and Visit (T&V) System, Broad Based Extension System (BBES), Farming System Research Extension (FSRE), Agricultural Technology Management Agency (ATMA).
8. Firstline Extension System – Krishi Vigyan Kendra (KVK), Institution Village Linkage Programme (IVLP), Agricultural Technology Information Centre (ATIC), Frontline demonstrations.
9. **Mid Semester Examination**
10. Rural Development – meaning, definition, concept and importance. Rural Development in India. Democratic Decentralization –Meaning of Democratic Decentralization and Panchayat Raj – Three tiers of Panchayat Raj system – Powers, Functions and Organizational setup.
11. Community Development Programme (CDP), National Extension Service (NES), Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP) - their strengths and weaknesses.
12. High Yielding Variety Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), Integrated Rural Development Programme (IRDP) - their strengths and weaknesses.
13. National Agricultural Technology Project (NATP), Integrated Tribal Development Agency (ITDA), Small Farmers Development Agency (SFDA), Marginal Farmers and Agricultural Labourers Development Agency (MFAL) - their strengths and weaknesses.
14. National Rural Employment Programme (NREP), Rural landless Employment Guarantee Programme (RLEGP), Drought Prone Area Programme (DPAP), Command Area Development Programme (CADP), Food for Work Programme (FFW), Jawahar Rozgar

Yojana (JRY), Employment Assurance Scheme (EAS), Indira Awaas Yojana (IAY), Swarnajayanthi Gram Swarozgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY), Swarna Jayanthi Shahari Rozgar Yojana (SJSRY), Pradhan Mantri Gram Sadak Yojana (PMGSY) - their strengths and weaknesses.

15. Sampoorna Grameen Rozgar Yojana (SGRY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Providing Urban Amenities to Rural Areas (PURA), National Agricultural Innovation Project (NAIP), NADP (RKVY) - their strengths and weaknesses.
16. Women Development Programmes – Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS), Mahila Samridhi Yojana (MSY), Tamil Nadu Women in Agriculture (TANWA), Youth Development Programmes – TRYSEM, Nehru Yuva Kendra (NYK), Attracting Rural Youth towards Agriculture (ARYA) - their strengths and weaknesses.
17. Extension Programme Planning – definition, principles; meaning of project, plan, calendar of work, plan of work; steps in programme planning.

Practical Schedule

1. Visit to District Rural Development Agency (DRDA) to study the organizational set up and rural development programmes.
2. Visit to a Panchayat Union Office to learn about its functions.
3. Exposure to the activities of a Grama Panchayat.
4. Study of the functions of JDA / ADA and to understand the reorganized extension system, organizational setup, functions, ATMA scheme and other schemes.
5. Interaction with a SHG to study its activities.
6. Exposure to an NGO to study their role in rural development activities.
7. Study of the extension activities of the State Department of Horticulture.
8. Visit to a nearby KVK to study its role and activities.
9. Visit to the Social Welfare Department to study the social welfare and women development programmes.

10 &11. Construction of interview schedule to study the awareness and participation of people in rural development programmes implemented in a village (Group exercise)

12 &13. Visit to a village to collect data (Group exercise).

14 &15. Preparation of report.

16. Presentation of report.

17. **Final Practical Examination**

Suggested Readings (Textbooks, Reviews, Journals)

- Dipak de, Basavaprabhu Jirli. 2010. A Handbook of Extension Education, Agrobios, India.
- Pandey, B.K. 2005. Rural Development, ISHA Books, New Delhi.
- Puran, Chandra. 2005. NGOs in India. A. Kansha Publishing, New Delhi.
- Ray, G.L. 1999. Extension Communication and Management, Noya Prakash, Kolkatta, West Bengal.
- Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra

Pradesh.

- Sagar Mondal and Ray, G.L. 2007. Text book of Rural Development, Kalyani Publishers, New Delhi.
- Sanjay Prakash Sharma. 2006. Panchayat Raj, Vista International Publishing House, New Delhi.
- Singh, A.K. 2012. Agricultural Extension, Agrobios, New Delhi.
- Van den Ban, A.W and H.S. Hawkins. 2002. Agricultural Extension, CBS Publishers & Distributors, New Delhi.
- Viswanathan Maithili. 1994. Women in Agriculture and Rural Development, Printwell, Jaipur.

Journals

- International Journal of Extension Education
- Indian Journal of Extension Education
- Journal of Extension Education – Coimbatore
- Journal of Extension Education – Bhubaneshwar
- Rajasthan Journal of Extension Education
- The Journal of Agricultural Education and Extension
- Journal of Agricultural Extension Management
- Journal of Agricultural Education and Extension
- Indian Journal of Gender Studies
- Indian Research Journal of Extension Education
- Journal of Community Mobilization and Sustainable Development

Web resources

- rural.nic.in
- www.panchayat .gov.in
- wcd.nic.in
- moud.nic.in
- mhupa.gov.in

16 FMP 211 FARM POWER AND MACHINERY 1+1

Aim: To equip the students with sufficient theoretical knowledge and practical skills about farm power and tractor power, implement resources used in agriculture, their cost of operation and selection

Theory:

UNIT I – Farm Power & Tractors

Farm power in India- sources, IC engines- working principles, two stroke and four stroke engines, IC engine terminology, different systems of IC engine. Tractors- types and utilities.

UNIT II – Tillage and Tillage Machinery

Tillage – ploughing methods - primary tillage implements – mould board, disc ploughs and chisel plough – secondary tillage implements – cultivators, harrows and rotovators – wetland equipment - puddlers, tramplers and cage wheels.

UNIT III – Sowing, Planting and Intercultural Equipment

Sowing methods - seed drills, seed cum fertilizer drills - Paddy transplanters - nursery requirements - implements for intercultural operations - wet land, dry land and garden land intercultural tools.

UNIT IV – Plant Protection Gadgets, Harvesting Machinery and Horticulture Tools

Plant protection equipment - harvesting tools and equipment - reapers and combine - harvesting machinery for groundnut, tuber crops and sugarcane - tools for horticultural crops

UNIT V – Equipment for Land Development and Farm Machinery Selection

Equipment for land development and soil conservation – Cost of operation of farm machinery - Tractor and implement selection.

Practical:

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertiliser drills, their mechanisms. Operation of tractor and implements - operation and maintenance of power tiller – Study of different inter-cultivation equipments - Sprayers and dusters – their operation, repairs and adjustment - Paddy transplanting and allied machines. Harvester for paddy, sugarcane, groundnut – horticultural tools – land development and soil conservation machines – Field capacity and cost economic analysis

Lecture Schedule:

1.	Farm power in India - human, animal, mechanical and electrical energy sources and their use in agriculture	**TB1: 1-11** **TB2: 1-16**
2.	Two stroke and Four stroke engines, working principles, applications - types, power and efficiency	**TB1: 27-39** **TB2: 32-39 52-55**
3	Different systems of IC engine – cooling, lubricating, fuel injection systems	**TB1: 18-26** **TB2: 39-46**
4	Tractors- types and utilities	**TB1:12-18**

		TB2:135-137
5.	Tillage, objectives, types - ploughing methods. Field capacity and field efficiency	**TB1:40-52 TB2:224-226 234-235 244-247**
6	Primary tillage, objectives, mould board ,disc plough, chisel plough and subsoiler, components and functions, types, advantages and disadvantages.	**TB1:53-71 TB2:226-244**
7	Secondary tillage equipment – harrows, land forming equipment – rotaravators – wet land equipment – puddlers, manure tramplers and cage wheels	**TB1:72-91 TB2:254-274**
8	Sowing methods - seed drills, seed cum fertilizer drills - components and functions	**TB1:92-106 TB2:277-294**

9. Mid semeter examination

10. Paddy transplanters, types, working principle, field and nursery requirements **TB1:106-119**

11. Implements for intercultural operations – cultivators, sweep, junior hoe, manual weeders and power operated weeders for wet land and garden land **TB1:121-129**

12. Sprayers and their functions, classification, manually operated sprayers, power sprayers - dusters, types and uses **TB1:130-143 TB2:326-337**

13. Harvesting tools and equipment- sickles, paddy reapers and combine - Harvesting machinery for groundnut, tuber crops and sugarcane **TB1:144-167 TB2:340-347**

14. Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery **TB1:168-190**

15. Equipment for land development and soil conservation - dozers, levelers, chisel plough, sub soil plough, blade harrow and bund former **TB1:191-198**

16	Cost of operation of farm machinery – problem solving	**TB1:212-217**
17	Tractor and implement selection for different agricultural operations	**TB1:199-211**

Practical Schedule:

1 Study of working of two and four stroke IC engines

2 Study of MB plough and disc plough, measurement of plough size, different parts, horizontal and vertical suction,

3 Study of disc harrows, bund former, leveller and rotavator

4 Study of seed-cum-fertiliser drills- furrow opener, metering mechanismand calibration

5 Study of tractors – their operation and maintenance

6 Learning to drive and operate the tractor

7 Learning to operate tractor with mounted implement

8 Study of power tiller - their operation and maintenance

9 Study of different inter-cultivation equipments in terms of efficiency, field capacity

10 Study of plant protection equipment – power sprayers, knapsack sprayers, dusters – minor repairs and adjustment of sprayers

11 Study of paddy transplanters – allied machinery for raising mat nursery

12 Study of paddy reaper and paddy combine – Registration and alignment of cutter bars

13 Study of sugarcane, turmeric and groundnut harvesters.

14 Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery

15 Study of land development and soil conservation machinery - dozers, levelers, chisel plough, blade harrow, bund former and trenchers

16 Problems on field capacity and cost of operation of farm machinery

17 Final practical examination

Text Books:

1. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. **A Text Book of Farm Machinery**, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305
2. Jagadishwar Sahay, 2010. **Elements of Agricultural Engineering**. Standard Publishers Distributors, Delhi. ISBN: 978-8180140440

Reference Books:

1. Ojha, T.P and A.M.Michael 2005. **Principles of Agricultural Engineering Vol-I**. Jain Brothers, New Delhi. ISBN: 978-8186321638
2. Nakra C.P 1970. **Farm Machinery and Equipment**,: Dhanpat Rai Publishing Company Ltd, New Delhi ISBN: 978-8187433231
3. Srivastava, A.C., 1991. **Elements of Farm Machinery**. Oxford & IBH Publishing Co Pvt Ltd, New Delhi. ISBN: 978-8120405134

WEB RESOURCES:

www.agricoop.nic.in/dacdivision/Machinery1/directory.htm
www.farmmachineryshow.org

Outcome:

Students will be equipped with sufficient theoretical knowledge with practical skills on farm power sources, the availability of tractors and handling of tractors, power tillers and various implements used in land preparation, sowing, inter cultivation, plant protection and harvesting operations

16 AEC PRODUCTION ECONOMICS AND FARM MANAGEMENT (1+1)

Objectives

This course aims at imparting knowledge on principles of farm management. This course also would help the Under Graduate students in using different methods and tools for decision making in farm management, which would facilitate profit maximization through optimizing farm resource use.

Theory

Unit 1: Production Economics and Farm Management - Nature and Scope

Production Economics: Meaning, Definition and Nature and Scope – Farm Management: Definition and Objectives of farm management – Production Economics Vs. Farm Management – Farm Management Decisions: Decision making process – Scope of farm management – Types and Systems of farming: Types – Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

Unit 2: Factor – Product Relationship

Factor – Product relationship: Meaning – Agricultural Production Function: Meaning, Definition – Laws of Returns: Increasing, Constant and Decreasing Returns – Classical production function and Three stages of production – Elasticity of production –Types / Forms of Production functions – Linear, Cobb–Douglas and Quadratic – Cost Concepts and Cost curves: Total, Average and Marginal Costs – Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.

Unit 3: Factor – Factor Relationship

Factor – Factor relationship: Meaning - Isoquant: Definition and Types, Isoquant map – Marginal Rate of Technical Substitution – Factor Intensity – Isocline – Ridge Line – Returns to Scale – Elasticity of Factor Substitution – Isocost line – Principle of Factor Substitution and Least Cost Combination of inputs – Expansion Path – Effect of input price changes on the least cost combination.

Unit 4: Product – Product Relationship

Product – Product relationship: Meaning – Production Possibility Curve – Marginal Rate of Product Transformation – Enterprise relationship: Joint Products, Complementary, Supplementary and Competitive Products – Isorevenue line – Optimum Combination of Products – Principle of Equi–Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle.

Unit 5: Farm Planning and Budgeting

Farm Planning: Importance – Characteristics of good Farm Plan – Farm planning procedure – Budgeting: Definition and Types: Partial budgeting, Enterprise budgeting, Complete budgeting and Cash flow budgeting – Limitations of budgeting – Linear Programming: Assumptions – Linear Programming Model: Definition, Graphical solution, Advantages and Limitations – Risk and Uncertainty: Definition – Types of Risk and Uncertainty – Safeguards against Risk and Uncertainty.

Practical

Problems on Factor – Product relationship – Determination of Least Cost Combination – Determination of Optimum Product Combination – Computation of cost concepts – Cost of

cultivation and Cost of production of agricultural crops, horticultural and livestock products – Depreciation: Methods of calculation of depreciation – Farm records and accounts: Analysis of farm records and accounts – Farm inventory analysis – Cash Flow statement - Net Worth statement – Profit and Loss statement – Break – even analysis – Preparation of Complete and Partial budgets – Preparation of farm plan – Graphical solution to Linear Programming problem.

Theory Schedule

1. Production Economics: Meaning, Definition, Nature and Scope – Farm Management: Definition and Objectives of Farm Management – Production Economics Vs. Farm Management.
2. Farm Management Decisions: Decision making process – Scope of farm management.
3. Types and Systems of farming, Types of farming: Specialized, Diversified and Mixed – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co–operative Farming.
4. Factor – Product relationship: Meaning – Agricultural Production Function: Meaning and Definition – Laws of Returns: Increasing, Constant and Decreasing Returns.
5. Classical Production Function and Three stages of production – Elasticity of Production.
6. Types / Forms of Production Functions – Linear, Cobb–Douglas and Quadratic Functions.
7. Cost concepts and Cost curves: Total, Average and Marginal Cost Concepts and Curves - Economies of Size and Minimum Loss principle.
8. Determination of Optimum Input and Output: Input Approach and Output Approach – Physical and Economic Optimum.
9. **Mid Semester Examination**
10. Factor – Factor relationship: Meaning – Isoquant: Definition and Types – Isoquant map – Marginal Rate of Technical Substitution – Factor Intensity – Isoclines – Ridge Line.
11. Returns to Scale and Economies of Scale – Elasticity of Factor Substitution– Isocost line - Principle of Factor Substitution and Least Cost Combination of Inputs – Expansion Path - Effect of input price changes on the least cost combination.
12. Product – Product relationship: Meaning – Production Possibility Curve – Marginal Rate of Product Transformation – Enterprise relationship and Types of Products: Joint Products, Complementary, Supplementary and Competitive Products – Isorevenue line – Optimum Combination of Products.
13. Principle of Equi–Marginal Returns – Principle of Opportunity Cost.
14. Farm Planning: Importance – Characteristics of good Farm Plan – farm planning procedure
15. Budgeting: Definition and Types – Partial budgeting, Enterprise budgeting, Complete budgeting and Cash flow budgeting – Limitations of budgeting.
16. Linear Programming: Assumptions – Linear Programming Model: Definition – Advantages and Limitations.
17. Risk and Uncertainty: Definition – Types of Risk and Uncertainty – Safe guards against Risk and Uncertainty.

Practical Schedule

1. Estimation of Optimum Input – Output combination.
2. Determination of Least–Cost Combination.

3. Determination of Optimum Product combination.
4. Cost of Cultivation and Cost of production of agricultural crops.
5. Cost of Cultivation and Cost of production of perennial crops / horticultural crops.
6. Cost of production of livestock products.
7. Farm Records and Accounts: Usefulness, types of farm records: farm production records and farm financial records.
8. Visit to a private agricultural farm to collect information on farm business.
9. Depreciation: Methods of calculating depreciation.
10. Computation of Cost concepts – Farm inventory analysis: Valuation of assets by different methods.
11. Preparation of Cash flow statement.
12. Preparation and Analysis of Net worth Statement and Profit and Loss statement.
13. Estimation of Break–even analysis.
14. Preparation of Complete Budget and Partial Budgets.
15. Preparation of Farm Plan.
16. Graphical solution to Linear Programming problem.
17. **Final Practical Examination.**

References

1. Sankayan, P.L. 1983. Introduction to Farm Management. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Johl, S.S & Kapoor, T.R. 1973. Fundamentals of Farm Business Management. Kalyani Publishers. Ludhiana.
3. Kahlon, A.S and Singh K. 1992. Economics of Farm Management in India. Allied Publishers. New Delhi.
4. Doll, J.P. and F. Orazem. 1983. Theory of Production Economics with Applications to Agriculture. John Wiley, New York.
5. Debertin, D.L. 1986. Agricultural Production Economics. Macmillan. New York.
6. Heady, E.O. and H.R. Jensen. 1954. Farm Management Economics. Prentice – Hall. Englewood Cliffs.
7. Kay, Ronald D., and William M. Edwards, and Patricia Duffy. 2004. Farm Management, Fifth Edition, McGraw–Hill, Inc. New York.
8. Panda, S.C. 2007. Farm Management and Agricultural Marketing. Kalyani Publishers. Ludhiana. India.

IV Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 203	Agronomy of field Crops- I	1+1
2.	16 HOR 211	Production Technology of Fruits and Plantation Crops	2+1
3.	16 SST 201	Principles and Practices of Seed Production	1+1
4.	16 SWE 211	Fundamentals of Soil and Water Conservation Engineering	2+1
5.	16 STA 211	Applied Statistics	1+1
6.	16 ERG 211	Renewable Energy	1+0
7.	16 AGR 204	Study Tour (10 days)	0+1
8.	16 AEN 202	Economic Entomology and Principles of Pest Management	2+1
9.	16 PBG 201	Principles of Genetics and Cytogenetics	2+1
10.	16 SAC 202	Soil Resource Inventory and Problem Soils	1+1
11.	16 ANM 201	Introductory Nematology	1+1
		Total	**14+10=24**

16 AGR 203 AGRONOMY OF FIELD CROPS – I 1+1

Theory

Unit - I: Cereals

Rice, Maize, Wheat, Oat, Barley, Rye and Triticale - Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield.

Unit - II: Millets

Sorghum, Pearl millet, Small millets - Finger millet, Foxtail millet, little millet, Kodo millet, Barnyard millet and Proso millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit - III: Pulses

Redgram, Blackgram, Greengram, Bengalgram, Horsegram, Cowpea, Soybean and Lentil - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit - IV: Oilseeds -I (Kharif)

Groundnut, sesame, sunflower, castor, Origin, and geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit - V: Oilseeds -I (Rabi)

Rape seed and mustard, safflower, Linseed, Niger - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Cereals	Rice, maize, wheat, barley, oats, rye and triticale
Millets	Sorghum, pearl millet, finger millet and minor millets
Pulses	Pigeonpea, green gram, black gram, cowpea, Chickpea, lentil and horse gram
Oilseeds	Groundnut, sesame, soybean, sunflower and castor Rapeseed and mustard, safflower and linseed

Practical:

Identification of sugar, fibre, forage - nursery preparation and management for sugarcane and tobacco - main field preparation; Seed treatment techniques - Sowing and manuring – Seeding equipment‘s - Estimation of population - After cultivation practices - Study of growth and yield parameters and yield estimation, harvesting of above crops; Fodder preservation techniques - Silage and hay making, Cost and returns - Visit to institutes and industries - Farmers‘ fields.

Theory - Lecture Schedule:

1. Importance and area, production and productivity of major cereals and millets of India and Tamil Nadu.
2. Importance and area, production and productivity of pulses and oilseeds crops of India and Tamil Nadu.
3. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement.
4. Rice - cultural practices - yield - economic benefits - Special type of Rice cultivation -

Rajarajan 1000 (SRI), Transgenic Rice - Hybrid rice.

5. Maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
6. Wheat and Barley - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
7. Oats, Rye and Triticale - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
8. **Mid semester Examination.**
9. Sorghum and Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
10. Finger millet and Minor millets - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
11. Pigeonpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
12. Greengram, Blackgram and Cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Agronomy of rice fallow pulses.
13. Chickpea, Lentil and Horse gram - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
14. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield and economics.
15. Sunflower - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
16. Sesame and Castor - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. Rapeseed, Mustard, Safflower, Niger and linseed - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

Practical:

1. Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria.
2. Practicing various nursery types and main field preparation for rice crop.
3. Nursery and main field preparation for important millets, pulses and oilseeds.
4. Acquiring skill in different seed treatment techniques in important field crops.
5. Estimation of plant population per unit area for important field crops.
6. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets.
7. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds.
8. Acquiring skill in using seed drill for sowing operations.
9. Acquiring skill in foliar nutrition for important field crops.

10. Observations on growth parameters of cereals and millets.
11. Observations on growth parameters of pulses and oilseeds.
12. Study of yield parameters and estimation of yield in cereals and millets.
13. Study of yield parameters and estimation of yield in pulses and oilseeds.
14. Working out cost and returns of important cereals, millets, pulses and oilseeds crops.
15. Visit to farmers field / research stations to study the cultivation techniques of cereal, millets, pulses and oilseeds.
16. Visit to nearby Agricultural Research Station / Farmer‘s field.
17. **Practical Examination.**

References:

1. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama publishing House, Meerut.
2. Chidda Singh. 1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Singh. S.S. 1997. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi.

E-References:

www.crida.org
www.cgiar.org
www.tnau.ac.in/agriportal

16 HOR 211 PRODUCTION TECHNOLOGY OF FRUITS AND PLANTATION CROPS (2+1)

Aim

To impart knowledge on the principles of horticulture, propagation and production techniques of tropical, sub tropical, temperate fruit and plantation crops.

Theory

Unit I: **Fundamentals and propagation techniques of fruit crops**

Horticulture – Origin, definitions – role of fruit crops in national economy - pollination mechanism – fruitfulness and causes of unfruitfulness. Propagation – definition – methods - merits and demerits – propagation through seeds - dormancy and methods of overcoming dormancy – vegetative propagation – merits and demerits – cutting, layering, grafting and budding – rootstock influence – stock / scion relationship– micro propagation.

Unit II: Production status and crop production techniques in tropical fruit crops

Scope and importance of fruit crops- classification of fruit crops – area, production, productivity and export potential.

Climate and soil requirements – varieties – propagation - planting density and systems of planting -cropping systems - after care - training and pruning - water, nutrient and weed management –fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management.

Crops: Mango, Banana, Grapes, Citrus (sweet orange, mandarin, acid lime), Papaya, Indian goose berry (Aonla)

Unit III: Crop production techniques in subtropical and temperate fruit crops

Climate and soil requirements – varieties – propagation - planting density and systems of planting -cropping systems - after care - training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management.

Crops: Sapota, pomegranate,Guava, Pineapple, Jack, Apple, Pear, Plum.

Unit IV: Status of production, principles of crop production and production technologies in plantation crops

Scope and Importance of plantation crops - area and production- export potential- classification of plantation crops- planting and cropping systems - principles of canopy management and growth regulation.

Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning- water, nutrient and weed management- shade management-intercropping -mulching-cover cropping - harvest- post harvest management and processing

Crops: Tea, coffee, rubber

Unit V: Crop production technologies in plantation crops

Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning- water, nutrient and weed management- shade management-intercropping – multi-tier cropping system-mulching-top working and other special horticultural practices- maturity indices and harvest- post harvest management and processing

Crops: cocoa, cashew, coconut, arecanut, oil palm and palmyrah

Practical

Features of an orchard – Tools, implements and machineries used for horticultural operations - preparation and application of PGR‘s for propagation and crop regulation - micropropagation, protocol for mass multiplication and hardening. Propagation techniques, selection of planting material, varieties, important intercultural practices for the fruit crops: mango, banana, grapes, papaya, sapota, guava, Indian goose berry and plantation crops :Tea-Coffee -Rubber -Cocoa and Coconut – Areca nut. Visit to commercial fruit and plantations industries.

Theory schedule

1. Horticulture - Origin, definitions – role of fruit crops in national economy.
2. Flowering, pollination, fruit set in fruit crops - Fruitfulness and causes of unfruitfulness.
3. Propagation – sexual and asexual propagation - Seed propagation – dormancy and measures to overcome seed dormancy.
4. Vegetative propagation – merits and demerits – cutting, layering.
5. Vegetative propagation - Grafting and budding.
6. Rootstock influence – stock / scion relationship in fruit crops.
7. Micro propagation in fruit crops.
8. Scope and importance of fruit crops cultivation - Area, production, productivity and export potential of fruit crops.
9. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning- top working - water, nutrient and weed management of **Mango**
10. Special horticultural techniques - plant growth regulation-GAP - important disorders – maturity indices and harvest - post harvest management of **Mango**
11. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- water and nutrient management – fertigation technique – weed control of **Banana**
12. Special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management of **Banana**
13. Climate and soil – varieties - propagation methods - planting and cropping systems-after care – systems of training and pruning and bud forecasting - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of **Grapes**
14. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation – nutrient deficiencies and important disorders – maturity indices and harvest- post harvest management of **Citrus (Sweet orange)**
15. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation – nutrient deficiencies and important disorders – techniques to rectify – maturity indices and harvest - post harvest management of **Mandarin and Acid Lime**
16. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - special horticultural techniques - plant growth regulation- important disorders – maturity indices and harvest - post harvest management of **Papaya**
17. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - training and pruning - water, nutrient and weed management - special

horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of **Sapota and pomegranate**

18. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of **Guava**
19. Climate and soil – varieties - propagation methods - planting and cropping systems - after care - water, nutrient and weed management - special horticultural techniques - plant growth regulation- important disorders – maturity indices and harvest – techniques of round the year production of pineapple - post harvest management of **Pineapple and Jack** .
20. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management of **Apple.**
21. Climate and soil – varieties - propagation methods - planting and cropping systems - after care- training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest - post harvest management of **Pear and Plum**
22. Value addition technologies for fruit crops.
23. Scope and Importance of plantation crops - area and production- export potential- classification of plantation crops- planting and cropping systems - principles of canopy management and growth regulation.
24. Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning of tea
25. Water, nutrient and weed management- shade management and harvest- processing of tea
26. Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning of coffee.
27. Water, nutrient and weed management- shade management-maturity indices and harvest-processing of coffee.
28. Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- water, nutrient and weed management -intercropping – tapping system and processing of rubber
29. Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems including multitier system - after care- training and pruning- water, nutrient and weed management- shade management– mulching- maturity indices, harvest and processing of cocoa
30. Climate and soil requirements- varieties- propagation- nursery management- planting- high density and systems of planting- cropping systems- after care- water, nutrient and weed management –intercropping- mulching -top working- maturity indices and harvest and processing of cashew
31. Climate and soil requirements- varieties- propagation- nursery management- planting systems- after care- water, nutrient and weed management- intercropping at various ages of plantation – multi-tier cropping system- harvest and post-harvest handling of

coconut

32. Climate and soil requirements- varieties- propagation- nursery management- planting- after care- water, nutrient and weed management- intercropping- harvest and post-harvest handling of arecanut
33. Climate and soil requirements- varieties- propagation- nursery management- planting- after care- water, nutrient and weed management- tapping and harvesting of palmyrah.
34. Climate and soil requirements- propagation - planting- water, nutrient and weed management and harvest of oil palm.
35. Value addition in plantation crops.

Practical schedule

1. Features of an orchard – Tools, implements and machineries used for horticultural operations
2. Preparation and application of PGR‘s for propagation.
3. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
4. Propagation techniques, selection of planting material, varieties, important cultural practices for **Mango**
5. Propagation techniques, selection of planting material, varieties, important cultural practices for **Banana**
6. Propagation techniques, selection of planting material, varieties, important cultural practices for **Grapes**
7. Propagation techniques, selection of planting material, varieties, important cultural practices for **Papaya**
8. Propagation techniques, selection of planting material, varieties, important cultural practices for **Sapota** and **Guava**
9. Crop regulation in fruit crops – Training and Pruning practices, top working and rejuvenation of old trees.
10. Tea- identification of species, nursery practices, training and pruning – processing
11. Coffee - identification of species, nursery practices, training and pruning – processing
12. Rubber - identification of clones, bud wood nursery practices - processing
13. Cocoa - identification of types, clonal nursery practices, training and pruning – processing; Cashew- identification of varieties, propagation techniques, top working- processing
14. Coconut - identification of varieties, mother palm and seed nut selection, nursery practices- management of nutrient deficiencies - processing
15. Arecanut- identification of varieties, mother palm and seed nut selection, nursery practices- management of nutrient deficiencies - processing
16. Visit to commercial fruit and plantation industries.
17. Practical examination

Outcome

- Students will gain knowledge on the fundamentals of horticulture and propagation
- Students will be imparted with wide knowledge on major tropical, a few sub tropical and temperate fruit and plantation crops
- Hands on training on various propagation methods and important cultural practices for major fruit and plantation crops will be provided (Practical)

Reference text books

1. Kumar, N. 2014. Introduction to Horticulture. Oxford & IBH Publishing co. Pvt. Ltd.
2. Chadha, K.L and Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. IIIV. Malhotra Publ. House
3. Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops, IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Alice Kurian and Peter, K.V. 2007. Horticulture science series Vol. 08, New India Publishing Agency, New Delhi.
5. Veeeraragavathatham, D and et al.,2004. Scientific fruit culture, Sun Associates, Coimbatore.

E-References

http://www.jhortscib.com
http://journal.ashspublications.org
http://www.actahort.org/
http://www.aphorticulture.com/crops.htm
http://cpcri.nic.in/
http://indiancoffee.org

16 SST 201 Principles and practices of seed production (1+1)

Aim:

To make the students understand the importance of seed quality and principles involved in seed production.

Theory

Unit I - Introduction to seed and seed quality

Seed - definition - Seed structure - Seed development and maturation - Germination - phases of seed germination - Dormancy - types of seed dormancy - Seed senescence - causes of seed senescence - Seed quality characteristics - significance - Classes of seed - Generation system of seed multiplication in seed supply chain .

Unit II - Principles of seed production

Seed replacement rate and varietal replacement - Seed Multiplication Ratio - Seed renewal period - Causes of varietal deterioration and maintenance - Genetic and agronomic principles of seed production - Factors affecting quality seed production - Methods of seed production of varieties and hybrids.

Unit III - Seed production techniques of agricultural crops

Floral biology and pollination behavior - seed production techniques of rice, maize, sorghum and bajra varieties and hybrids - redgram varieties and hybrids - blackgam and greengram varieties - groundnut and sesame varieties - sunflower, castor and cotton varieties and hybrids – Bt cotton.

Unit IV - Seed production techniques of vegetable crops

Floral biology and pollination behavior - seed production techniques of tomato, chillies, brinjal, bhendi, onion, snakegourd, bittergourd, pumpkin, ashgourd, ribbedgourd and bottlegourd varieties and hybrids.

Unit V - Post harvest seed handling techniques

Threshing - methods - Drying - methods of seed drying - advantages and disadvantages -Seed processing – definition - importance - Seed cleaning and grading - upgrading - equipments - working principles - Seed treatment - importance - types - Seed invigouration techniques - seed hardening - seed fortification - seed priming - Seed enhancement techniques - seed coating - seed pelleting.

Practical

Study of seed structure of agricultural and horticultural crops - Seed dormancy - breaking methods - Seed invigouration techniques - hardening and priming - Seed enhancement techniques - seed coating and pelleting - Seed upgradation technique in rice-Acid delinting in cotton - Hybrid seed production techniques - Detasseling in maize - emasculation and dusting in cotton and vegetables - supplementary pollination in rice and sunflower – Practicing pregerminative techniques, enhancing floral ratio and improving seed set in cucurbits - Visit to seed production plot - Identification of physical and genetic contaminants, pollen shedders, partials, shedding tassels, selfed bolls and fruits - Physiological and harvestable maturity

indices - Fruit grading - Seed extraction methods in vegetables - tomato, brinjal, chillies, bhendi and cucurbits - Seed cleaning and grading techniques - Detection of seed mechanical injury - Visit to seed processing plant - Seed production planning - Cost benefit ratio of hybrids and vegetables seed production.

Theory Schedule

1. Seed - definition - seed structure - Seed development and maturation
2. Germination - phases of seed germination - Dormancy - types of seed dormancy
3. Seed senescence - causes of seed senescence - seed quality characteristics - significance
4. Classes of seed - Generation system of seed multiplication in supply chain - Seed replacement rate and varietal replacement - Seed Multiplication Ratio - Seed renewal period
5. Causes of varietal deterioration and maintenance - Genetic and agronomic principles of seed production - Factors affecting quality seed production - Methods of seed production of varieties and hybrids
6. Floral biology and pollination behavior - seed production techniques of rice varieties and hybrids.
7. Floral biology and pollination behavior - seed production techniques in maize varieties and hybrids.
8. Floral biology and pollination behavior - seed production techniques of sorghum and bajra varieties and hybrids.
9. Mid semester examination.
10. Floral biology and pollination behavior - seed production techniques of red gram varieties and hybrids - blackgam and greengram varieties - groundnut and sesame varieties.
11. Floral biology and pollination behavior-seed production techniques of sunflower, castor varieties and hybrids.
12. Floral biology and pollination behavior - seed production techniques of cotton varieties and hybrids - Bt cotton - seed production techniques of varieties and hybrids of tomato, brinjal and chillies.
13. Floral biology and pollination behavior - seed production techniques of bhendi and onion varieties and hybrids.
14. Floral biology and pollination behavior - seed production techniques of snakegourd, bittergourd, pumpkin, ashgourd, ribbedgourd and bottlegourd varieties and hybrids.
15. Post harvest handling of seeds - Threshing - methods - Drying - methods of seed drying - advantages and disadvantages.
16. Seed processing - definition - importance - sequence - seed cleaning and grading - equipments (cleaner cum grader) upgrading - equipments (colour sorter, Indented cylinder separator, specific gravity separator, spiral separator, magnetic separator - needle separator -working principles - Seed treatment - importance - types.
17. Seed invigouration techniques - seed hardening - seed fortification - seed priming - Seed enhancement techniques - seed coating - seed pelleting.

Practical schedule

1. Study of seed structure of agricultural and horticultural crops.

2. Seed dormancy breaking methods.
3. Practicing seed invigouration techniques - seed hardening.
4. Practicing seed invigouration techniques - seed priming.
5. Practicing seed enhancement techniques - seed coating and seed pelleting.
6. Seed upgradation technique in rice- Acid delinting in cotton.
7. Detasseling techniques for hybrid seed production in maize.
8. Emasculation and dusting techniques for hybrid seed production in cotton and vegetables.
9. Hybrid seed production techniques - supplementary pollination in rice and sunflower.
10. Practicing pre-germinative techniques , enhancing floral ratio and improving seed set in cucurbits
11. Visit to seed production plot - identification of physical and genetic contaminants, pollen shedders and partials, shedding tassels, selfed bolls and fruits.
12. Determination of physiological and harvestable maturity indices.
13. Fruit grading and seed extraction methods in vegetables - tomato, brinjal, chillies, bhendi and cucurbits.
14. Seed cleaning and grading techniques and detection of seed mechanical injury.
15. Visit to seed processing unit.
16. Seed production planning and determination of cost benefit ratio of hybrids and vegetables seed production.
17. Final practical examination.

Out come

The students will gain knowledge about the various techniques of quality seed production, processing and seed quality enhancement.

References

Standard text books

1. Agrawal, R.L. 1996. Seed Technology, Oxford & IBH Publishing Co., New Delhi.
2. Bhaskaran, M. *et al.*, 2004. Principles of seed production. Scientific Publishers, Ludhiana.

Online references

1. www.fao.org
2. www.seednet.gov.in
3. www.agricoop.nic.in
4. www.online library.willey.com
5. www.sciencedirect.com

e-journals

1. Seed Science Research (www.jgateplus.com)
2. Seed Science and Technology (www.jgateplus.com)
3. ―Seeds‖, Baskin, Carol. Academic Press. (Elsevier e-books) (ISBN No. 9780124166776).
4. *" Seeds" Derek Bewley, Kent. (Springer e- books) (www-link-springer.com) (ISBN NO. 978-1-4614-4693-4)*

16 SW211 FUNDAMENTALS OF SOIL AND WATER CONSERVATION ENGINEERING (2+1)

Scope

To gain knowledge and skills on measurement of land, surveying and leveling, different irrigation methods, pumping of water, soil and water engineering concepts

Objective

To impart the basics of soil and water conservation engineering to the undergraduate students

Theory

Unit I Surveying

Surveying and levelling – chain, compass and plane table survey – levelling – land measurement and computation of area – Simpson‘s rule and Trapezoidal rule.

Unit II Soil erosion

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion - water erosion - causes - erosivity and erodibility - mechanics of water erosion - splash, sheet, rill and gully erosion - ravines - land slides – wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep

Unit III Soil conservation and watershed management

Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping – cropping systems – vegetative barriers - windbreaks and shelterbelts - shifting cultivation - mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting – insitu soil moisture conservation – Runoff Computation - runoff water harvesting — Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge. Gully control structures -Check dams – Temporary and permanent. Watershed concept – Integrated approach and management

Unit IV Irrigation and drainage

Irrigation - measurement of flow in open channels - velocity area method - rectangular weir - Cippoletti weir - V notch - orifices - Parshall flume - duty of water - irrigation efficiencies - conveyance of irrigation water - canal lining - underground pipe line system - surface irrigation methods - borders, furrows and check basins - drip and sprinkler irrigation– agricultural drainage - surface drainage systems – sub-surface drainage systems - drainage coefficient-design of open ditches.

Unit V Wells and Pumps

Groundwater occurrence – aquifers – types of wells and sizes – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps – selection of pumps – operation and their maintenance.

Practical

Study of survey instruments - chains and cross staff surveying - linear measurement - plotting and finding areas. Compass survey - observation of bearings - computation of angles-radiation, intersection. Levelling – fly levels – determination of difference in elevation.– Computation of area and volume - Contouring. Design of contour bund and graded bund. Visit to CSWCRTI, Ooty. Drip systems and Sprinkler irrigation systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement - agricultural drainage. Study of different types of wells and its selection. Study of pumps and its selection.

Lecture schedule

1. Introduction - land surveying - uses in agriculture.
2. Chain cross staff and compass surveying - computation of angles.
3. Radiation, intersection and traversing.
4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.
5. Computation of area and volume – Simpson‘s rule and Trapezoidal rule.
6. Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - ravines - land slides
9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep
10. Effects of water and wind erosion
11. Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping - Cropping systems – vegetative barriers - Windbreaks and shelterbelts - shifting cultivation
12. Mechanical measures – contour bund – graded bund - Broad beds and furrows – basin listing – random tie ridging
13. Mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall
14. Rain water harvesting – insitu soil moisture conservation – Runoff Computation - runoff water harvesting
15. Farm ponds and percolation ponds - storage and its use for domestic and ground water recharge
16. Gully control structures -Check dams – Temporary and permanent
17. Watershed concept – Integrated approach and management
18. Mid semester examination.
19. Irrigation - measurement of flow in open channels - velocity area method
20. Rectangular weir - Cippoletti weir - V notch
21. Orifices - Parshall flume
22. Duty of water - irrigation efficiencies
23. Conveyance of irrigation water - canal lining
24. Underground pipe line system
25. Surface irrigation methods - borders, furrows and check basins
26. Components of drip and sprinkler irrigation system
27. Agricultural drainage – need - surface drainage systems
28. Surface drainage systems - drainage coefficient
29. Groundwater occurrence – aquifers types
30. Types of wells and sizes
31. Pump types – reciprocating pumps – centrifugal pumps
32. Turbine pumps – submersible pumps
33. Jet pumps – Airlift pumps
34. Selection of pumps – operation and their maintenance.

Practical schedule

1. Study of survey instruments - chains - compass - plane table - dumpy level.
2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - radiation, intersection.
5. Levelling – fly levels – determination of difference in elevation.
6. Computation of area
7. Computation of volume - Contouring
8. Design of contour bund and graded bund.
9. Visit to CSWRTI, Ooty.
10. Drip Irrigation systems.
11. Sprinkler irrigation system
12. Problems on water measurement.
13. Problems on duty of water, irrigation efficiencies.
14. Problems on water requirement - agricultural drainage.
15. Study of different types of wells and its selection.
16. Study of pumps and Selection of pumps.
17. Practical examination.

Text books

1. Basak, N.N. 2008. Surveying and Levelling. 25th reprint. Tata Mc-Graw Hill Publishing Company Ltd
2. Michael, A.M. and Ojha, T.P. 2008. Irrigation Theory and Practice. Second Edition. Vikas Publication House, New Delhi

e- References

- http://nptel.ac.in/courses/105107122/13

http://soilwater.okstate.edu/courses/lectures-powerpoin

16 STA 211 APPLIED STATISTICS (1+1)

SCOPE OF THE COURSE

Students will acquire knowledge in basis techniques that are applicable to agricultural sciences. Further the course will provide them good introduction to various statistical analysis used in biological sciences.

OBJECTIVE

To understand and apply fundamental concept of statistical applications in biology and to acquire about theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

THEORY

Unit I: Descriptive Statistics

Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode –Merits and demerits. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis – Merits and demerits.

Unit II: Sampling Theory and Probability Distributions

Sampling theory – population – sample – parameter and statistic – sampling distribution - sampling vs complete enumeration –Types of sampling - simple random sampling – selection using random numbers – Stratified - Systematic sampling.

Probability distributions – Discrete distributions: Bernoulli, Binomial and Poisson. Continuous distribution: Normal distribution – definitions and properties.

Unit III: Testing of hypothesis

Null and alternative hypothesis – types of errors - critical region and tests of significance. Large sample test – single mean and difference between two means – single proportion and difference between two proportions.

Small sample tests – F-test - t-test for testing the significance of single mean – independent and paired t test – chi square test for testing the association of r x c contingency table.

Unit IV: Correlation and Regression

Correlation – Scatter diagram - Karl Pearson‘s correlation coefficient – Spearman‘s rank correlation - computation and properties.

Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient.

Unit V: Analysis of Variance and Experimental Designs

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

Text Books

1. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi.
2. Dhamu. K. P and K. Ramamoorthy. 2007. Statistical Methods. Agrobios (India), Jodhpur.

References

1. Gupta.S.C and V.K.Kapoor. 1977. Fundamentals of Applied Statistics. Sultan Chand & Sons, New Delhi.
2. Gupta S.P, Statistical Methods, 2004, Sultan Chand & Sons, New Delhi.
3. S.C. Gupta & V.K. Kapoor. 2003. Fundamentals of Mathematical Statistics. Sultan Chand & Sons, New Delhi.
4. Panse. V. G and P.V. Sukhatme. 1954. Statistical methods for agricultural workers. ICAR, New Delhi.
5. Dhamu. K. P and K. Ramamoorthy. 2009. Fundamentals of Agricultural Statistics. Scientific Publishers (India), Jodhpur.
6. Kailasam. G and R.Gangaiselvi. 2010. Applied Statistics. Kalyani Publishers. New Delhi.

Theory Schedule

1. Introduction – Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode –Merits and demerits. TBI 1-5, TBI 25 - 35
2. Measures of dispersion: Range, Quartile deviation, Mean deviation, standard deviation, and coefficient of variation - Skewness and kurtosis. TBII 41 – 48
3. Sampling theory – population – sample – parameter and statistic – sampling distribution - sampling vs complete enumeration –Types of sampling - simple random sampling – selection using random numbers Stratified - Systematic sampling. TBII 316 - 321
4. Probability distributions – Discrete distributions: Bernoulli TBI 55 - 57
5. Binomial and Poisson distribution TBI 58 - 61
6. Continuous distribution: Normal distribution TBI 55 - 57
7. Null and alternative hypothesis – types of errors - critical region and tests of significance. TBII.16-17
8. Large sample test – single mean and difference between two means. Single proportion and difference between two proportions. TBII 20-24
9. **Mid Semester Examination**
10. Small sample tests–F-test - t-test for testing the significance of single mean TBII 26- 28
11. Independent and paired t test TBII 29-38
12. Chi square test for testing the association of r x c contingency table. TBII 43-45
13. Correlation – Scatter diagram - Karl Pearson‘s correlation coefficient – Spearman‘s rank correlation - computation and properties. TBI 142 – 145
14. Regression – simple linear regression – fitting of simple linear regression equation – properties of regression coefficient. 157 - 165
15. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs. TBI 227 - 231
16. Completely Randomized Design (CRD) – Randomized Block Design (RBD). TBI 269 -

17. Latin Square Design (LSD). TBI 315 - 320

Practical schedule

1. Computation of arithmetic mean, geometric mean, harmonic mean, median and mode
2. Computation of range, standard deviation, variance, coefficient of variance
3. Selection of sample using simple random sampling method
4. Simple problems in Bernoulli distribution
5. Simple problems in Binomial distribution and Poisson distribution
6. Simple problems in Normal distribution
7. Large sample test – test for single proportion and difference between two proportions
8. Large sample test – test for single mean and difference between two means
9. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
10. Paired t-test
11. Chi square test
12. Computation of Karl Pearson‘s correlation coefficient
13. Fitting of simple linear regression equation y on x – correlation and regression using MS Excel functions
14. Analysis of Completely Randomised Design (CRD) – for equal replications only
15. Analysis of Randomised Block Design (RBD)
16. Analysis of Latin Square Design (LSD) – analysis of CRD, RBD and LSD
17. **Final Practical Examination**

Web resources

1. http://www.statistics.com/resources/glo.ssary/
2. www.statsoft.com
3. http://www.iasri.res.in/ebook/EB_SMAR/index.htm
4. www.stats.gla.ac.uk/steps/glossary/index.html
5. http://davidmlane.com/hyperstat/
6. http://www.stattrek.com/
7. http://www.businessbookmall.com/Statistics Internet Library.htm
8. http://www.stat-help.com/
9. www.statsci.org/jourlist.html

16 ERG 211 RENEWABLE ENERGY (1+0)

Unit I- Biochemical Energy Conversion

Energy crisis – Renewable energy sources – significance – potential - achievements in India – Biomass – methods of energy conversion -Biogas technology – classification - types - factors affecting biogas plants- alternate feedstocks – applications - biodigested slurry and enrichment.

Unit II – Thermochemical Energy Conversion

Briquetting –methods- advantages and disadvantages -combustion –definition-Improved chulhas – single pot – double pot – conventional chulha – biomass gas stove. Pyrolysis – methods for charcoal production- biochar production- comparion of slow and fast pyrolysis. Gasification – chemistry – types – updraft gasifier -downdraft gasifier – working principles.

Unit III – Solar Energy Conversion

Solar Energy – characteristics - types of radiation – solar constant-solar thermal devices – solar water heater – solar cooker – evacuated tube collector – working principles and applications-solar PV systems – principle – solar lantern - water pumping -solar driers – natural and forced convection types – solar tunnel drier – working principles and operation.

Unit IV- Wind and other Alternate Energy Sources

Wind mills – types – horizontal and vertical axis – components – working principles – applications .Energy from ocean-waves-tides.Geothermal energy sources – principles and operation-drying of agricultural products. Biofuels – importance – Biodiesel production method – flowchart – by products utilization

Theory Schedule

1. Energy crisis – renewable energy sources – significance – potential and achievements in India – energy requirements of agricultural and horticultural crops.
2. Biomass – methods of energy conversion – biochemical conversion methods – thermochemical conversion methods.
3. Biogas technology – classification - types of biogas plants – KVIC and Deenabandhu model biogas plants – factors affecting biogas plants.
4. Alternate feedstocks for biogas production – applications of biogas cooking, lighting and engine operations - biodigested slurry and enrichment.
5. Briquetting – MED – VED – methods – need for briquetting - benefits of biomass briquettes.
6. Combustion – improved chulha – single pot – double pot – conventional chulha – biomass gas stove – constructional features – principles and applications.
7. Pyrolysis – methods for charcoal production –biochar production– comparison between slow and fast pyrolysis.
8. Gasification – chemistry types – updraft gasifier – working principles operations application
9. Mid semester examination
10. Downdraft gasifier – working principles – operation and applications.
11. Solar energy – characteristics of solar radiation - types of radiation – solar constant
12. Solar thermal devices – solar water heater – solar cooker – evacuated tube collector – working principles and applications.
13. Solar PV systems – principle – solar lantern - water pumping applications.

14. Solar driers – natural and forced convection types – solar tunnel drier – working principles and operation.
15. Wind mills – types – horizontal and vertical axis – components – working principles – applications.
16. Energy from ocean, waves, tides. Geothermal energy sources – principles and operation.
17. Biofuels – importance – biodiesel production method – flowchart – by products utilization

16 AGR 204 SHORT TOUR (0+1)

The students will undertake the short tour during fourth semester for ten days covering all important KVK's, TNAU campuses, TNAU Research stations and ICAR institutes in Tamil Nadu. The study tour will provide an exposure to the students to know about the soil, climatic conditions and cropping patterns in the respective agro-climatic zones. The students will also have first-hand information on latest technologies on various crops and allied activities.

16 AEN 202 ECONOMIC ENTOMOLOGY AND PRINCIPLES OF INSECT PEST MANAGEMENT (2+1)

Aim: To impart knowledge on the economically important insects and principles of insect pest management, including concept and components of IPM

Theory

Unit I: Economically important insects

Classification of insects based on economic importance - Apiculture - Bee species – comparison- castes of bees, bee behaviour and bee dance; Apiary management practices – bee pasturage, foraging, seasonal variations; Bee products – properties and uses; Effect of agricultural inputs on bee activity – pesticide poisoning; Lac insect- biology-strains-natural enemies of lac insect and lac products; Weed killers, pollinators, scavengers and soil builders - Household pests, human pests, cattle and poultry pests

Unit II: Insect Ecology

Balance of life in nature – population dynamics – role of abiotic and biotic factors. Bioresources in ecosystem. Life table – interspecific and intraspecific relationships – pests – definition and categories – pest outbreak – factors governing pest outbreak– pest monitoring, surveillance and forecasting. Economic Threshold Level – Economic Injury Level.

Unit III: Components of pest management

Principles of Pest Management- Cultural, Physical, Mechanical, Ecological engineering methods, Resistant varieties in pest management, parasitoids, predators and microbial agents in pest management and biological control of weeds. Bio safety of introduced parasitoids, predators and entomopathogens. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation. Pesticides – insecticides – history, classification. Semiochemicals – allomones – kairomones – pheromones- semiochemicals in pest management. Sterile male technique – chemosterilants, insect growth regulators – moult inhibitors – Juvenile Hormone mimics – antifeedants and repellents. Pesticide application technology. Impact of pesticides in agro-ecosystem, compatibility, safety and hazards in the use of pesticides – pesticide poisoning. Impact of global warming on pests. Natural pesticides. Biotechnology in pest management. Bio safety of transgenic plants.

Unit IV: Integrated Pest Management

Integrated Pest Management – Issues and options – Ecofriendly Integrated Pest Management – Indigenous/Traditional technologies

Practical

Identification, morphology and structural adaptations in honey bees. Bee keeping appliances, bee enemies and diseases. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products. Study of house hold, human, cattle and poultry pests. Study of useful insects- Pollinators, weed killers, scavengers and soil builders. Symptoms and types of damage caused by insect pests. Assessment of insect population and their damage in field crops. Cultural, mechanical and physical control of insects. Identification and mass culturing of different types of parasitoids, predators and entomopathogens. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others. Pesticide formulations and toxicity parameters. Pesticide application techniques. Preparation of spray fluids and botanicals for field application. Plant protection appliances.

Theory lecture schedule:

1. Economic classification of insects
2. Bee species – comparison – castes of bees – bee behaviour and bee dance
3. Apiary management practices – bee pasturage – foraging – seasonal variations.
4. Bee products – their properties and uses
5. Effect of agricultural inputs on bee activity – pesticide poisoning
6. Lac insect- biology-strains-Natural enemies of lac insect and lac products
7. Weed killers, pollinators, scavengers and soil builders
8. Household, human, cattle and poultry pests
9. Insect ecology – definition – balance of life in nature – reproductive potential and environmental resistance
10. Population dynamics – role of biotic factors – competition – parasitoids and predatots. Life table – Interspecific and intraspecific relationship
11. Abiotic factors – physical, nutritional and host plant associated factors on insect population. Bioresources in ecosystems
12. Pests – definition, categories and causes for outbreak of pests. Losses caused by pests
13. Pest monitoring – pest surveillance and forecasting – objectives, survey, sampling techniques and decision making. Economic Threshold Level and Economic Injury Level. Factors influencing Economic Injury Level and Economic Threshold Level
14. Pest Management – definition – need – objectives, requirements for successful pest management programme. Components of pest management
15. Cultural methods – definition – characteristics, requisites – farm level practices and community level practices, advantages and disadvantages- Ecological Engineering in pest management
16. Physical methods – definition – use of heat, moisture, light, electromagnetic energy and sound energy – Mechanical methods – definition – mechanical destruction and exclusion – merits and demerits
17. Midsemester examination
18. Host plant resistance – types and mechanisms of resistance and role of host plant resistance in pest management
19. Biological control – definition, parasitoids and predators and their role in pest management
20. Microbial control – viruses, bacteria, fungi, protozoa and nematodes and their role in pest management, Biological control of weeds, Bio safety of introduced parasitoids, predators

and entomopathogens

21. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate - pest legislation
22. Chemical control – definition – history of insecticide development – toxicity parameters - ideal qualities of an insecticide
23. Classification of insecticides based on mode of entry, mode of action and chemical nature
24. Mode of action of organophosphates, carbamates, synthetic pyrethroids, neonicotinoids, diamides and avermectins
25. Insecticides Act 1968 – insecticide residues and waiting periods, role of pesticides in pest management, insecticide resistance management
26. Semiochemicals – definition – intraspecific semiochemicals – allomone, kairomone, synomone and apneumone
27. Interspecific semiochemicals – pheromone, sex pheromone, alarm and trail marking pheromone. Pheromones in Integrated Pest Management
28. Sterility methods – definition – principles – methods – requirements and limitaitons.
29. Insect growth regulators – moult inhibitors – Juvenile Hormone mimics – mode of action and uses. Insect antifeedants and repellents – mode of action, groups and uses
30. Botanicals and Biotechnological approaches in pest management – bio safety of transgenic plants
31. Pesticide application technology – principles and methods
32. Pesticide compatibility, safety and hazards – antidotes – safe handling – impact of pesticides on agroecosystems. Impact of global warming on pests
33. Integrated Pest Management – history, principles and strategies – relationship between different components and economics
34. Integrated Pest Management : Issues and options. Eco friendly Integrated Pest Management – Indigenous/traditional technologies in Integrated Pest Management

Practical schedule:

1. Identification, morphology and structural adaptations in honey bees
2. Bee keeping appliances, bee enemies and diseases
3. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products
4. Study of house hold, human, cattle and poultry pests
5. Study of useful insects-Pollinators, weed killers, scavengers and soil builders
6. Symptoms and types of damage caused by insect pests
7. Assessment of insect population and their damage in rice, cotton and brinjal
8. Cultural, mechanical and physical control of insects
9. Identification and mass culturing of different types of parasitoids
10. Identification and mass culturing of different types of predators
11. Identification and mass production of entomopathogens
12. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others
13. Pesticide formulations and toxicity parameters
14. Pesticide application techniques
15. Preparation of spray fluids and botanicals for field application
16. Plant protection appliances
17. Final Practical examination

Assignment

Collection and submission of 25 herbaria of symptom of insect damage

Outcome/Deliverables:

The students gain knowledge on productive and harmful insects as well as the principles of insect pest management, including concept and components of IPM

References:

A.Text Book:

1. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}

B.Reference Books:

1. Pedigo, L.P. and M.E.Rice.1996. *Entomology and Pest Management.* Prentice-Hall of Idia Pvt Ltd, New Delhi. 812p. {ISBN-978-8120338869}
2. Dhaliwal, G.S. and R.Arora. 2001. *Integrated Pest Management – Concepts and approaches*. Kalyani publishers, New Delhi. 427p. {ISBN: 81-7663-904-4}

C. Supplementary references:

1. Dhaliwal, G.S. and Ramesh Arora. 1998. *Principles of Insect Pest Management.*
2. Kalyani Publishers, New Delhi.
3. Metcalf, C.K. and W.P. Flint. 1970. *Destructive and Useful Insects - Their Habits and Control.* Tata McGraw Hill Pub. Co., New Delhi
4. Srivastava, K.P. 2003. *A text book of Applied Entomology. Vol. I & II*. Kalyani Publishers.
5. Dhaliwal, G.S. and B.Singh. 1998. *Pesticides – The Ecological Impact in Developing Countries.* Commonwealth Publishers, New Delhi.
6. Yazdani G.S. and M.L. Agarwal. 1979. *Elements of Insect Ecology.* Naroji Publishing House, New Delhi.

D. Web resources

1. http://www.sristi.org/hbnew
2. http://www.ncipm.org.in/recent-publications.htm
3. http://www.ipmnet.org

16 PBG 201 PRINCIPLES OF GENETICS AND CYTOGENETICS
(2+1)

Aim

The fundamental concepts of Genetics and Cytogenetics will be exposed to the students quoting classical examples

SYLLABUS FOR THEORY

Unit I: Cytology

Brief history of developments in genetics and cytogenetics; Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes. Cell division – mitosis, meiosis and their significance, cell cycle - zygote formation and embryo development - identical and fraternal twins. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram – chromosome banding; Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - polytene, lampbrush, Other types of chromosomes - B, ring and isochromosomes; Chromosomal aberration: Variation in chromosome structure – deletion, duplication, inversion and translocation – genetic and cytological implications; Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and euthenics; Polyploid - auto and allopolyploids, their characters; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit II: Mendelian laws and modifications of Mendelian laws

Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory,

Preformation theory, Lamarck‘s theory, Darwin‘s theory, Germplasm theory and Mutation theory. Mendel‘s experiments and laws of inheritance. Rediscovery of Mendel‘s work.

Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid. Chromosomal theory of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett‘s experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1) iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi). Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.

Unit III: Quantitative inheritance, Linkage and Crossing over

Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Linkage - coupling and repulsion; Experiment on Bateson and Punnet – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over – significance of crossing over; cytological proof for crossing over - Stern‘s experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.

Unit IV: Sex determination, sex linkage and cytoplasmic inheritance

Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – *Melandrium*, papaya, maize. Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal in chicken. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappa particles of paramecium - plasmid and episomic inheritance.

Unit V: Modern concept of genetics and mutation

DNA, the genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment. Structure of DNA – Watson and Crick model – Central dogma of life. Proof for semi conservative method of DNA replication; Models of DNA replication; RNA types - mRNA, tRNA, rRNA; Genetic code, protein synthesis; Regulation of gene expression

– operon model of Jacob and Monad; Structural genes and regulator genes. Cistron, muton and recon; Complementation test; exons, introns – split genes –Transposable genetic elements- Ac - Ds system in maize. Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics. Mutation – characteristics of mutation – micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

SYLLABUS FOR PRACTICAL

Study of microscopes – Preparation of fixatives and stains – pre treatment of materials for mitosis and meiosis – study of mitosis and meiosis. Study of genetic ratios of – monohybrid, dihybrid – incomplete dominance. Gene interaction - multiple alleles and multiple factors. Study of linkage, estimation of strength of linkage and recombination frequency in two point and three point test cross data and F_2 data – Drawing of genetic map – interference and coincidence

Theory schedule

1. Definition of genetics, heredity, inheritance, cytology, cytogenetics; Brief history of developments in genetics and cytogenetics.
2. Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes.
3. Cell division – mitosis, meiosis and their significance, cell cycle; zygote formation and embryo development - identical and fraternal twins.
4. Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram - chromosome banding.
5. Types of chromosomes based on position of centromere, based on structure and function: normal and special chromosomes - polytene, lampbrush, based on the role in sex determination: autosomes and allosomes, Other types of chromosomes - B, ring and isochromosomes.
6. Chromosomal aberration: Variation in chromosome structure – deletion, duplication, inversion and translocation – genetic and cytological implications.

7. Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Nondisjunction - Klinefelter syndrome and Turner syndrome; Definition of eugenics and euthenics.
8. Polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, *Brassica*
9. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck‘s theory, Darwin‘s theory, Germplasm theory and Mutation theory.
10. Mendel‘s experiments and laws of inheritance. Rediscovery of Mendel‘s work
11. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, trihybrid, polyhybrid.
12. Chromosomal theory of inheritance. Allelic interactions – Dominance vs recessive, complete dominance, codominance, incomplete dominance, over dominance.
13. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett‘s experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1)
14. ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1).
    iv.) Duplicate dominant epistasis (15:1)
15. v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Summary of epistatic ratios (i) to (vi).
16. Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.
17. **Mid Semester Examination**
18. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour.
19. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits.
20. Linkage - coupling and repulsion; Experiment on Bateson and Punnet – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group.
21. Crossing over – significance of crossing over; cytological proof for crossing over - Stern‘s experiment; Factors controlling crossing over.
22. Strength of linkage and recombination; Two point and three point test cross.
23. Double cross over, interference and coincidence; genetic map, physical map.
24. Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination- different types – sex determination in human, fowl, butterfly, grasshopper, honey bee, fumea; Sex determination in plants – *Melandrium*, papaya, maize.
25. Genic balance theory of Bridges, quantitative theory, hormonal theory, barr bodies, metabolic differentiation theory; Gynandromorphs – sex reversal in chicken
26. Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex limited inheritance.
27. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappa particles of paramecium - plasmid and episomic inheritance.
28. DNA, the genetic material – Griffith‘s experiment, experiment of Avery, McCleod

and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment.

29. Structure of DNA – Watson and Crick model – Central dogma of life
30. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.
31. RNA types - mRNA, tRNA, rRNA; genetic code, protein synthesis - transcription. Translation
32. Regulation of gene expression – operon model of Jacob and Monad; Structural genes and regulator genes. Cistron, muton and recon;
33. Complementation test; exons, introns – split genes – Transposable genetic elements - Ac - Ds system in maize - Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics
34. Mutation – characteristics of mutation – micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Practical Schedule

1. Use of microscopes
2. Principles of killing and fixing; preparation of stains and preservatives.
3. Study of behavior of chromosomes in mitosis.
4. Study of the mitotic phases in root tips of onion / *Aloe sp*.
5. Procedure for fixing and observing different meiotic phases in the inflorescence of rice/maize.
6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/ sorghum/ /horticultural crop/forest tree.
7. Repetition of meiotic studies in maize/ sorghum/ pearl millet/ forest tree and making temporary and permanent slides.
8. Observation of bivalents, trivalents, quadrivalents and chromosome banding.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross.
10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F_2 and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.
17. **Final Practical examination.**

Outcome

- Basic principles of inheritance and modern concepts of genetics will be exposed to students

References

- Gupta P.K., 1997. Cytogenetics. Rastogi Publications, Meerut
- Verma,P.S. and V.K.Agarwal. 2007. Genetics. S.Chand and Company Ltd./ New Delhi.
- Stansfield, W.D.1990. Theory and problems of genetics. Mc-Graw Hill Book Co.,New York
- Pundhan singh. 2014. Elements of Genetics. Kalyani Publishers

Further reading

- Benjamin Lewin. 2005. Genes IX Oxford University Press, Oxford.
- Russel, P.J. 2000. Fundamentals of genetics. Addition Wesley Longman Publishers, USA
- Daniel Sundararaj, G. Thulasidas and M.Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai –15.
- Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
- Singh, B.D. 2004. Fundamentals of Genetics, Kalyani Publishers, Chennai.

Web resources :

- www.nmsu.edu,
- www.biology200.gsu.edu

16 SA202 SOIL RESOURCE INVENTORY AND PROBLEM SOILS 1+1

Aim:

To impart proficiency to the students in exploring the problems and potentials of soil and water so as to decide the most appropriate land and water use.

Syllabus - Theory

Unit-I - Concepts of soil survey

Soil resource inventory - Early and modern concepts - Standard soil survey - Scope and objectives - Soil systematics - Soil mapping units - Methods and types of soil survey - Soil maps.

Unit-II - Soil taxonomy

Soil Classification - Earlier and genetic systems - Modern Soil Taxonomy - USDA System - Salient features, structure - Diagnostic horizons - Differentiating characteristics - Soil orders - Characteristics and distribution - Soils of India and Tamil Nadu.

Unit-III - Soil Survey Interpretations and Land Use Planning

Soil survey reports - Soil Survey Interpretations - Land Capability Classification - Soil and Land Irrigability Classification - Storie's Index Rating - Productivity potential - Fertility Capability Classification- Land suitability for field crops, horticultural crops and forest trees - Land Use Planning concepts and objectives.

Unit-IV- Soil constraints

Problem soils - physical and chemical constraints - Slow permeable, Excessively permeable, surface crusting, sub surface hard pan and fluffy paddy soils - Acid soils, Acid sulphate soils, ill drained and Aeolian soils and salt affected soils - Genesis, characteristics, effects on plant growth and management - Reclamation of problem soils .Polluted soils and their management.

Unit-V- Irrigation water quality and use

Quality of irrigation water - Criteria used for assessing the quality of irrigation water - Water quality appraisal - Effect of poor quality water on soil and crop growth.

Practical

Morphological study of soil profile - Study of base maps, aerial photographs and satellite imagery -Interpretation of soil survey data and maps. Nomenclature of soils-Estimation of CEC, exchangeable cations and ESP. Analysis of problem soils - Lime requirement of acid soil — Gypsum requirement of sodic soils. Analysis of irrigation waters - pH, EC, TSS , anions and cations - Quality appraisal of irrigation waters and computation of salts. Field visit to problem soil area.

Lecture Schedule

1. Early and modern concepts of soil resource inventory, Concepts of Standard Soil Survey, its scope and objectives

2. Soil systematics - Characteristics of genetic horizons, subordinate distinctions, pedon, polypedon and control section, Soil mapping units - Soil series, soil association, soil complex, variants, inclusions and miscellaneous land types.
3. Method and types of soil survey - Free and grid survey, Reconnaissance, Detailed, Semi detailed, Exploratory and Rapid reconnaissance survey
4. Soil classification - Purpose, early, genetic and modern systems of classification - USDA Soil taxonomy - Structure and differentiating characters - Appreciation and Criticism.
5. USDA Soil taxonomy – Epipedons and Endopedons
6. Diagnostic organic materials, diagnostic soil characteristics - Soil moisture and Temperature regimes.
7. Soil orders - Characteristics and distribution in world , Soils of India and Tamil Nadu
8. Soil maps, kinds of soil maps and their preparation
9. Midsemester Examination
10. Soil survey report preparation and interpretation
11. Land Evaluation - Land Capability Classification (LCC)- Fertility Capability Classification (FCC) Soil and Land Irrigability Classification, Storie's Index Rating and Productivity potential - Land Suitability Classification
12. Land Use Planning - Concepts and objectives - Tropical, subtropical and Temperate regions.
13. Soil physical constraints - slow permeable, excessively permeable soils, Soil crusting, sub soil hard pan, fluffy paddy soil, shallow soil - Characteristics and management
14. Acid soil and Acid sulphate soils - Genesis and characteristics. Lime requirement of acid soil, liming materials and reclamation / management of acid soil
15. Genesis and classification of salt affected soils - Effect of salts on plant growth, Saline soil, sodic and saline sodic soil - characteristics and their management
16. Aeolian , ill drained and polluted soils- Characteristics and their management
17. Quality of irrigation waters - quality criteria and appraisal- USSL and other systems-- Effect of poor quality water on soil health, crop growth and management.

Practical schedule

1. Profile description
2. Estimation of CEC in soil- Part-I
3. Estimation of CEC in soil- Part-II
4. Estimation of Exchangeable cations and working out ESP
5. Estimation of lime requirement of acid soil
6. Estimation of gypsum requirement of sodic soil
7. Nomenclature of soil as per Soil Taxonomy
8. Land suitability for field crops, horticultural crops and forest trees
9. Estimation of pH, EC, TSS and chloride in irrigation water
10. Estimation of carbonate and bicarbonate in irrigation water
11. Estimation of sulphate in irrigation water by turbidimetry
12. Estimation of calcium and magnesium in irrigation water
13. Estimation of sodium and potassium in irrigation water
14. Classification of irrigation waters as per USSL and other systems
15. Computation of salts in irrigation water
16. Field visit to problem soils area

17. Practical Examination

Text Books

1. Sehgal,J. 2005. A Text Book of Pedology Concepts and Application, Kalyani Publishers, New Delhi
2. Brady, N.C. and Weil, R.C.2012.The nature and properties of soils.14th Edn,Pearson Publication
3. Soil Survey Staff, 2003. Keys to soil taxonomy, USDA, NRCS publication
4. Jean Paul Legros, 2013.Major soil groups of the world, Ecology, Genesis, Properties and Classification, CRC Press, Taylor and Francis, Florida
5. David Wynne Thorne and Howard Boyd Peterson, 2010. Irrigated soils, their fertility and Management, 2nd Edn in India, biotech Books, New Delhi
6. Richards, L.A,.1954, USDA hand book No.60, U.S.dept. of Agriculture
7. Thorne, D.W. and Peterson,H.B. 2010. Irrigated soils, their fertility and Management, 2nd Edn in India, biotech Books, New Delhi
8. Somani, L.L.1991.Crop production with saline water, Agro Botanical Publishers, Bikaner

References

1. Boul, S.W., R.J. Southard, R.C.Graham and P.A.McDaniel. 2005. Soil genesis and classification. 5th Ed. Iowa State University Press, Ames, IA.
2. Eswaran, H., T.Rice, R.Ahrens and B.A.Stewart (Eds.) 2003. Soil classification: A global desk reference. CRC Press, Boca Raton, FL. *f-\ 7.* FAO, 2004. Soil salinity assessment. Scientific Publishers.
3. Field Book for Describing and Sampling Soils (Version 3.0). 2012. National Soil Survey Center, Natural Resources Conservation Service and U.S.Department of Agriculture.
4. Gupta, S.K. and I.C. Gupta 2014. Salt affected soils : Reclamation and Management. Scientific Publishers.
5. Gupta, I.C., N.C.S. Yaduvanshi and S.K.Gupta. 2012. Standard Methods for Analysis of soil, plant and water. Scientific Publishers.
6. Sehgal, J. 2005. Pedology concepts and applications, Kalyani Publishers, New Delhi.
7. Richards, L.A. 2012. Diagnosis and improvement of saline and alkali soils. Scientific Publishers
8. Sanchez, P.A., C.A. Palm and S.W.Boul. 2003. Fertility Capability soil classification: A tool to help assess soil quality in the tropics. Geoderma. 114:157-185.
9. Soil Survey Division Staff 1999. Soil Survey Manual, United States Department of Agriculture. Handbook 18. Soil Conservation Service.
10. Soil Survey Staff. 2006. Keys to Soil Taxonomy. United States Department of Agriculture, Natural Resources Conservation Service.
11. Somani, L.L. and K.L.Totawat 1993. Management of Salt Affected Soils and Water.
12. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers.
13. Subramanian.S., G.V. Kothandaraman, S. Natarajan, and P.P. Ramaswami. 1987. Soil Survey and Land Use Planning for Watershed Management. Directorate of Soil and Crop Management Studies, Tamil Nadu Agricultural University, Coimbatore - 641 003.
14. USDA 1954. Diagnosis and improvements of Saline and alkali soils. (Ed)

L.A.Richards. Handbook No.60. USDA Washington DC.

e-references

1. ftp://ftp-fc.sc.egov.usda.gov/NSSC/NCSS/Conferences/scanned/
2. ftp://ftp-fc.sc.egov.usda.gov/NSSC/Lab References/SSIR 51.pdf
3. tp://ftp-fc.sc.egov.usda.gov/NSSC/Lab_References/SSIR 51 .pdf
4. www.iuss.org/Bulletins/00000096.pdf
5. www.oosa.unvienna.org/pdf/sap/centres/rscurrE.pdf-
6. www.csre.iitb.ac.in/~dd/detail.html
7. www.dvsinstitute.org/forms/pg/M.Sc.%20-%20RS%20&%20GIS-350.pdf
8. inkinghub.elsevier.com/retrieve/pii/S0166248197800335
9. www.scribd.com/doc/40246764/Description-Pedon-Copy-
10. www.angrau.net/BSc(Aq)CourseCurriculum.htm
11. ww.SDringerlink.com/index/BJGOOEL8FLNTFUNL.pdf
12. www.euroiournals.com/ejsr 42 2 10.pdf
13. inkinghub.elsevier.com/retrieve/pii/S0166248197800335
14. www.springerlink.com/index/R177R744722222UN.pdf-Similar
15. content.alterra.wur.nl/lnternet/webdoc$/ilri-publicaties/.../Bib10.pdf
16. www-wds.worldbank.org/external/.../INDEX/multi_..page.txt-Cached
17. http://www-ds.worldbank.orq/external/default/WDSContentServer/ WDSP/IB/1999/09/14/000094946 990617055 13766/Rendered/INDEX/multi _page.txt
18. openaccess.icrisat.org/.../Proceedings-integrated-watershed-management-for-land-Asia.pdf
19. www.springerlink.corn/inde)(/ilu87tk58363.pdf
20. www.buc.edu.in/sde_book/msc_soil.pdf

Outcome:

The students will gain a comprehensive knowledge and skills in assessing land suitability for various agricultural and non-agricultural uses. Further, the knowledge and skill gained in this course can be applied by the students in solving / managing the soil related problems and poor quality irrigation waters.

16 ANM 201 AGRICULTURAL NEMATOLOGY 1+1

THEORY

Unit I: History and Development of Nematology, Importance of Nematodes and Beneficial nematodes

Introduction – Brief history and development of Nematology at National and International level – Position of nematodes in animal kingdom – Economic loss due to nematodes to crop plants. Beneficial nematodes. (entomopathogenic nematodes – *Steinernema* and *Heterorhabditis*), Parasites of insects (*Mermis, Agamermis, Romanomermis).*

Unit II: Morphology and Taxonomy of Nematodes

Morphology and Anatomy of nematodes (cuticle, cephalic region, alimentary, excretory, reproductive and nervous system, sense organs) – Taxonomy of plant parasitic nematodes – Classification, of nematodes based on feeding habits.

Unit III: Symptoms, Interaction and Bio-ecology of nematodes

Symptoms of nematode damage – interaction with other microorganisms (fungi, bacteria and viruses) – Biology, life cycle and ecology of important plant parasitic nematodes (*Meloidogyne, Heterordera, Rotylenchulud, Tylenchulus* and *Radopholus*) –Interaction with other micro organisms.

Unit IV: Nematode Management

Principles of nematode management –Legislative (plant quarantine), physical methods (soil solarisation, hot water treatment, seed cleaning); cultural methods – (deep ploughing, fallowing, solarization, crop rotation, antinemic plants; host plant resistance to nematodes; biological control – nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR and predators; chemical control – soil fumigants and non fumigants-mode of action— formulations-methods of application--Integrated nematode management

Unit V: Nematode pests of crops

Major nematode parasites and management in cereals (rice and wheat), millets (sorghum, and maize), pulses (redgram, blackgram, greengram and cowpea),oilseeds (castor, groundnut and gingely), fibre crops (cotton), vegetables (tomato, brinjal, bhendi, chilli and potato), cole crops (cabbage, carrot, cauliflower), beet root, sugarbeet, tapioca, tuber crops (yam, dioscorea), fruits (banana, citrus, grapevine, guava and papaya), spices and plantation crops (turmeric, pepper, betelvine and coconut), flower crops (crossandra, jasmine, carnation, rose, gerbera, chrysanthemum, eustoma and tuberose) and medicinal and aromatic plants, (medicinal coleus, geranium and patchouli).

Other roles of nematodes

Nematodes as bioindicators, nematodes as biological model, nematodes as dysoprobes

PRACTICAL

Usage and handling of microscopes (binocular, trinocular, zoom and compound microspores) -Soil and root sampling – Extraction of active nematodes and cysts from soil and roots (Cobb‘s sieving and decanting technique, Baermann funnel technique, conical flask technique, Sugar floatation technique, Fenwick can method, Incubation and Blender technique) – Nematode processing techniques (preservation, slow and rapid method of processing, making semi permanent and permanent slides) – Morpholoy of orders *Tylenchida* (*Hoplolaimus*), and

Dorylaimida (*Xiphinema*) – Identification of important nematodes (*Tylenchorhynchus, Helicotylenchus, Pratylenchus, Hirschmanniella. Hemicriconemoides* / *Criconema Heterodera* / *Globodera, Tylenchulus*, and *Aphelenchoides*) – Life stages of sedentary and migratory endoparasites – symptoms of important nematode diseases – Nematicides and their application – Biocontrol agents-bacteria and fungi.

LECTURE SCHEDULE
THEORY

1. Introduction – Brief history and development of nematology at National ande International levels.
2. Position of nematodes in animal kingdom – Importance of nematodes (human being, animals and plants, Parasites of insects) – Economic loss in crop plants.
3. External morphology of nematode.
4. Anatomy of nematodes – Digestive, excretory and nervous system and sense organs.
5. Anatomy of nematodes – Reproductive system.
6. Taxonomy of plant – parasitic nematodes of the Secernentea and Adenophorea.
7. Classification of plant – parasitic nematodes based on feeding habits – Beneficial nematodes.
8. Symptoms of nematode damage.
9. **Mid semester examination.**
10. Interaction of nematodes with other micro-organisms.
11. Biology and ecology of *Meloidogyne, Heterodera, Tylenchulu*s, *Rotylenchulus* and *Radopholus.*
12. Principles of nematode management (Legislative, physical, cultural, biological and chemical).
13. Integrated nematode management.
14. Nematode parasites of cereals and millets.
15. Nematode parasites of pulses, oilseeds and fibre crops.
16. Nematode parasites of vegetables and fruit crops, spices and plantain crops, flower crops and medicinal and aromatic plants.
17. Other roles of nematodes

PRACTICAL

1. Soil and root sampling. Extraction of nematodes by Cobb‘s sieving method; Baermann funnel Technique and modified Baermann funnel technique.
2. Extraction of nematodes by sugar flotation technique; Extraction of cysts by conical flask technique and fenwick can method.
3. Extraction of nematodes from roots and staining of roots infested with endoparasitic and semi – endoparasitic nematodes.
4. Preservation of nematodes and preparation of temporary and permanent slides.
5. Observing morphology of the order Tylenchida (*Hoplolaimus*) and Dorylaimida (*Xiphinema*, *Longidorus*).
6. Identification of nematodes – *Tylenchorhynchus, Helicotylenchus*.
7. Identification of nematodes – *Pratylenchus*, *Hirschmanniella*.
8. Identification of nematodes – *Hemicriconemoides – Criconema*, *Heterodera – Globodera*.
9. Identification of nematodes – *Tylenchulus, Aphelenchoides*.
10. Study of life stages of *Meloidogyne*
11. Study of life stages of *Rotylenchulus*.
12. Study of life stages of *Radopholus*.
13. Nematodes diseases of rice (White tip and rice root nematode)

14. Damage caused by root – knot and reniform nematodes indifferent crops.
15. Symptoms of damage caused by citrus nematode; the lesion nematode and the burrowing nematode of banana.
16. Study of types of nematicides, application methods and calculation of dosages; study of biocontrol agents.
17. Practical examination.

REFERENCE BOOKS

Introduction and history

Parvatha Reddy, P. 1986. *A Treatise on Phyto Nematology*, Agricole Publishing Academy, New Delhi, p.381.

Maggenti, A.R. 1981. *General Nematology*. Springer-Verlag, New York. 372 pages.

Chitwood, B.G. and M.B. Chitwood. 1950. *Introduction to Nematology*. University Park Press, Baltimore. 334 pages.

Nematode taxonomy

Jenkins, W.R. and D.P. Taylor. 1967. *Introduction. in Plant Nematology*. Reinhold Publishing Corporation, New York. 270 pages.

Maggenti, A.R. 1981. *General Nematology*. Springer-Verlag, New York. 372 pages.

Nickle, W.R. 1991. *Manual of Agricultural Nematology*. Marcel Dekker, Inc., New York. 1035 pages.

Chitwood, B.G. and M.B. Chitwood. 1950. *Introduction to Nematology*. University Park Press, Baltimore. 334 pages.

Chitwood, B.G. and M.B. Chitwood. 1950. *Introduction to Nematology*. University Park Press, Baltimore. 334 pages.

Interaction

Khan, W. 1993. *Nematode Interactions*. Chapman and Hall. Pp. 377.

Powell, N.T. 1971. Interaction of plant parasitic nematodes with other disease causing agents. *In: Plant Parasitic Nematodes Vol. II*. (B.M. Zuckerman., W.F. Mai and R.A. Rohde. Eds), Academic press. Pp. 347.

Damage symptoms and feeding habits

Nickle, W.R. 1991. *Manual of Agricultural Nematology*, Marcel Dekker Inc. New York, pp. 940.

Siddique, M.R. 2000. *Tylenchida : Parasites of plants and Animals*. CAB. International Academic Press.

Morphology

Maggenti, A.R. 1981. *General Nematology*. Springer-Verlag, New York, Heidelberg, Berlin. 381 pages.

Alan.F.Bird. 1971. The structure of Nematodes. Acdemic Press, New York and London. 323 pages.

Lee, D.L. 1965. *The Physiology of Nematodes*. Oliver and Boyd, Great Britain. 54 pages.

Nickle, W.R. 1991. *Manual of Agricultural Nematology*. Marcel Dekker, Inc., New York. 1035 pages.

Thorne, G. 1961. *Principles of Nematology*. McGraw-Hill Book Company, Inc., New York. 553 pages.

Biology of nematodes

Wallace, H.R. *Biology of Plant Parasitic Nematodes*. Arnold, London. Pp. 426.

Maggenti, A. 1981. *General Nematology* – Springer Verlag, New York Inc., p.372.

Other books:

1. Bhatti, D.S. and R.K. Walia. 1992. *Nematode pests of crops*, CBS Publishers and Distributors, Delhi.p.381.
2. Goodey, J.B., Technical Bulletin No.2, 1963, *Laboratory methods for work with plant and soil nematodes*, Ministry of Agriculture, Fisheries and Food, London,p.72.
3. Gopal Swarup and Dasgupta, D.R. 1986, *Plant parasitic nematodes of India – Problems and progress*, ICAR, New Delhi. P.76.
4. Singh, R.S. and K. Sitaramaiah. 1993. *Hand Book of Economic Nematology*, Cosmo Publication, New Delhi, p.386.
5. Webster,J.(Ed.), 1972. *Economic Nematology*, Academic Press, London,P.396.

e books:

Ronald N. Perry and Maurice Moens. 2006. *Plant Nematology*. CABI Publishing. 463 pages.

Parvatha Reddy P. 2014. Biointensive Integrated Pest Management in Horticultural Ecosystems. Springer Publication. 278 pages.

Ciancio. A and K.G.Mukerji. 2009. *Integrated Management of Fruit Crops and Forest Nematodes.* Springer publication. 358 pages.

John Bridge ande James L. Starr. 2007. *Plant Nematodes of Agricultural Importance*. A Colour Handbook. Manson Publishing. 153 pages.

David A. Warton. 1986. *Functional Biology of Nematodes*. Croom Helm, London & Sydney.

Wajid Khan, M. 1993. *Nematode Interactions*. Springer-Science+Business Media, B.V 387 pages.

Navon, A and K.R.S.Ascher (Eds). 2000. Bioassays of Enotomopathogenic Microbes and Nematodes. CABI Publishing. 337 pages.

Ke-Quin Zhang and Kevin D. Hyde (Eds). 2014. Nematode-Trapping Fungi. Springer Publication. 400 pages.

Michel Luc, Richard A. Sikora and John Bridge (Eds). Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. CABI Publishing. 917 pages.

V Semester

S. No.	Course No.	Course Title	Credit Hours
1.	16 AGR 301	Crop Production-I	0+1
2.	16 AGR 302	Agronomy of field Crops- II	1+1
3.	16 SAC 301	Soil Fertility, Fertilizers and Manures	2+1
4.	16 AEN 301	Pests of Field Crops and their Management	1+1
5.	16 PAT 301	Diseases of Field Crops and Their Management	1+1
6.	16 ABT 301	Plant Biotechnology	2+1
7.	16 PBG 301	Principles and Methods of Plant Breeding	2+1
8.	16 AGM 301	Soil and Applied Microbiology	1+1
9.	16 AEC 301	Agricultural Marketing, Trade and Prices	1+1
10.	16 ARM 301	Agribusiness Management and Entrepreneurship	1+1
11.	16 SST 301	Seed Quality Regulation and Storage	1+1
		Total	13+11=24

16 AGR 301 CROP PRODUCTION - I 0+1

- Each student will be allotted a minimum land area of 100/200 m^2 and he / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Under exigencies like water scarcity to raise wetland rice of the crop production programme shall be with two irrigated dry crops, with an area of not less than five cents.
- Irrigated puddled lowland rice / any irrigated dry crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame).

Course Outline:

- Rice *(Transplanted and direct seeded rice)*
- Rice ecosystems - Climate and weather - Seasons and varieties of Tamil Nadu.
- Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds - Weed management and plant protection to nursery.
- Preparation of main field - Application of organic manures - Green manuring - Bio-fertilizers - Pulling out seedlings and transplanting - Rajarajan 1000 (SRI) - Application of herbicides - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation - Recording growth, yield attributes and yield.
- Harvesting, threshing, drying and cleaning the produce - Working out cost of cultivation and economics.

Practical Schedule:

Transplanted rice:

1 Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu.
2 Selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery.
3 Acquiring skill in seed treatment, seed soaking and incubation, nursery sowing and management.
4 Study and Practice of main field preparation and puddling operations.
5 Practicing of field preparatory operations - sectioning of field bunds and plastering, leveling and basal application of fertilizers.
6 Practicing transplanting techniques in lowland rice.
7 Estimation of plant population and acquiring skill in gap filling and thinning.
8 Study of weeds and weed management in rice.
9 Study and practice of green manuring and bio-fertilizer application in rice.
10 Acquiring skill in nutrient management and practicing top dressing techniques.
11 Study of water management practices for lowland rice.
12 Observation of insect pests and diseases and their management.
13 Recording growth and other related characters of rice.
14 Estimation of yield and yield parameters in rice.
15 Harvesting, threshing and cleaning of the produce.
16 Working out cost of cultivation and economics.
17 **Practical Examination.**

References:

Ahlawat, I.P.S., Om Prakash and G.S.Saini. 1998. Scientific Crop Production in India. Rama Publishing House, Meerut.

Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co.

Pvt. Ltd., New Delhi.

ICAR 2006. Hand book of Agriculture. Indian Council of Agricuture, New Delhi.

Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.

Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.

K Annadurai and B Chandrasekaran. 2009. A Text Book Of Rice Science. Scientific Publishers

E-References:

www.irri.org
www.crri.nic.in
www.drrindia.org

16 AGR 302 Agronomy of Field Crops – II 1+1

Theory:

Unit - I: Sugar Crops

Sugarcane and Sugarbeet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit - II: Fibre Crops

Cotton, Jute and Mesta - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit - III: Forage Crops

Sorghum, Maize, Pearlmillet, Guinea grass, Cumbu - Napier, Water grass, Buffalo grass, Elephant grass, Kolukkattai grass, Lucerne, Berseem, Desmanthus, Stylosanthus and Cowpea - Economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit - IV: Green Manure Crops

Daincha, Sunhemp *S.rostrata*, Glyricidia, Kolingi - Origin, geographic distribution, economic importance, soil and climatic requirement, Varieties, cultural practices, yield.

Unit V: Narcotics

Tobacco, Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices.

Practical:

Identification of sugar, fibre, forage and narcotics - nursery preparation and management for sugarcane and tobacco - main field preparation; Seed treatment techniques - Sowing and manuring - Seeding equipment‘s - Estimation of population - After cultivation practices - Study of growth and yield parameters and yield estimation, harvesting of above crops; Fodder preservation techniques - Silage and hay making, Cost and returns - Visit to institutes and industries - Farmers‘ fields.

Theory - Lecture Schedule:

1. Sugar crops - Sugarcane - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices and yield.
2. Sugarcane - Crop logging, maturity and ripening sugar and gur manufacture - Value addition and byproduct utilization.
3. Sugarbeet - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, yield and by product utilization.
4. Fibre crops - Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements, cultural practices, yield and quality parameters.
5. Rainfed Cotton, Rice fallow Cotton and transgenic cotton.
6. Jute - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
7. Mesta - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
8. **Mid-semester Examination.**
9. Sunhemp - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
10. Forage crops - Cumbu Napier Hybrid grass and Guniea grass: Economic importance,

soil and climatic requirement, varieties, cultural practices and yield.

11. Forage crops - Sorghum, Maize, Oats and Cowpea: Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
12. Forage crops - Cenchrus, Lucerne, Hedge lucerne: Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
13. Berseem and Desmodium Economic importance, soil and climatic requirement, varieties, cultural practices and yield.
14. Silage and hay making - green manure and green leaf manure crops.
15. Sesbania sp., Kolingi and Glyricidia - economic importance, soil and climatic requirement, varieties, cultural practices and yield.
16. Narcotics - Tobacco - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices - yield, curing methods.
17. Sugarcane and Cotton based cropping systems in India and Tamil Nadu.

Practical Schedule:

1. Identification of sugar crops, fibre, forage, green manure and narcotics in the crop cafeteria.
2. Nursery preparation and management for Sugarcane and Tobacco.
3. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations.
4. Acquiring skill in different seed treatment techniques and foliar nutrition of crops.
5. Estimation of plant population per unit area for crops.
6. Acquiring skill in after - cultivation practices in sugarcane - detrashing, Cotton – Earthing up, Tobacco - topping.
7. Study on growth parameters of sugar, fibre, forage crops, Greenmanures and narcotics.
8. Study on yield parameters and estimation of yield in sugar / fibre.
9. Study on yield parameters and estimation of yield in forage and narcotics.
10. Cost and returns of important sugar, fibre forage and narcotics.
11. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its by products.
12. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
13. Visit to - Cotton Research Station, nearby ginning factory and Tobacco curing centre.
14. Visit to Dairy Unit / farmers field to acquire skill in hay, silo and silage making.Visit to farmers field to study sugarcane and cotton based cropping systems.
15. On / Off Farm visit to study forage crops and green manures.
16. **Practical Examination.**

References:

Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.

Ahlawat,I.P.S., Om Prakash and G.S. Saini. 2010. Scientific Crop Production in India. Rama publishing House, Meerut

Chidda Singh, Prem Singh and Rajbir Singh. 2011. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.

E.References:

http://sugarcane.tn.nic.in

http://fibre.tn.nic.in

www.tnau.ac.in/agriportal

16 SAC 301 SOIL FERTILITY, FERTILIZERS AND MANURES 2+1

Aim:

To impart knowledge on essential nutrients, soil fertility, nutrient transformations in soil, manures, fertilizers and soil fertility management through various approaches.

Syllabus-Theory

Unit-l-Essential Nutrients

Soil fertility and productivity. Essential nutrients- functions, deficiency and toxicities. Concepts and methods of soil fertility evaluation.

Unit-ll- Nutrient Dynamics

Nutrients - sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron, molybdenum, nickel, chloride in soils - Beneficial elements -Nutrient interactions

Unit-III-Classification of Fertilizers

Fertilizers - Definition and classification, sources, properties and reactions of primary, secondary and micro nutrient fertilizers in soil - Manufacture of urea, ammonium sulphate, SSP, DAP, MOP and SOP. Complex, mixed fertilizers, customized / Specialty fertilizers - Water soluble fertilizers, liquid fertilizers. Micro nutrient mixtures and chelated micronutrients - Preparation, characteristics and compatibility -Fertilizer Control Order (FCO). Manures- classification, nutrient contents. Composting techniques.

Unit-IV-Application Methods

Methods of fertilizer application - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray - Fertigation - water soluble fertilizers, fertigation scheduling (Fertilizer- water interaction, fertilizer solubility, comparison of fertilizer application methods)

Unit-V-Nutrient Management

Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM. Nutrient use efficiencies of major and micronutrients and enhancement techniques (Soil, Cultural and Fertilizer strategies). Soil health -Quality indices and their management - Organic farming and Precision Farming - Long term effect of fertilization on soil

Practical Syllabus

Soil Nutrient Analysis - Available nutrient status (N, P, K, S and DTPA extractable micronutrients) in soils- Fertilizer Nutrient Analysis- Analysis of nutrient contents in urea, ammonium nitrate, SSP, RP, MOP and SOP- Manure Analysis-Determination of nutrient contents (N, P& K) in FYM/GM - Colloquium on Soil testing laboratories - Soil test based fertilizer prescription - Visit to fertilizer mixing unit.

Theory- Lecture shedule

1. Soil fertility and productivity - essential nutrients- criteria of essentiality - N, P and K nutrients -functions, deficiency and toxicity symptoms
2. Secondary nutrients, micro nutrients and beneficial elements - functions, deficiency and toxicity symptoms
3. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law and Bray's nutrient mobility concept. Approaches - Deficiency symptoms, tissue analysis,

biological tests and chemical tests

4. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique,
   crop logging, critical level, DRIS and agronomic approach
5. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
6. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
7. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil
8. Sources, forms, mobility, transformation, fixation, losses and availability of calcium magnesium and sulphur in soil
9. Sources, forms, mobility, transformation, fixation, losses and availability of micro nutrients in soil
10. Nutrient interactions in soil
11. Fertilizers - Definition, classification of N,P and K fertilizers
12. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN, properties and their reactions in soil
13. Manufacture of urea and ammonium sulphate
14. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil
15. Manufacturing of SSP and DAP
16. K fertilizers- MOP and SOP- properties and reactions in soil
17. Mid Semester Examination
18. Synthesis of MOP and SOP
19. Complex fertilizers- definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes
20. Mixed fertilizers-definition, preparation and compatibility
21. Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Water soluble fertilizers, liquid fertilizers, Micro nutrient mixtures and chelated micronutrients
22. Fertilizer Control Order
23. Organic manures- Definition, classification and sources- Fortified organics
24. Composting techniques- Aerobic and anaerobic (Bangalore & Coimbatore method) enriched FYM and vermicompost. Composting of organic waste-Sugarcane trash and coir waste
25. Methods of fertilizer application for different soil types - Fertigation - Definition - water soluble fertilizers
26. Types of fertigation - Fertilizer schedule
27. Fertilizer application methods - Seed coating, pelletization, seedling dipping - Nutriseed pack - Soil Application - Foliar spray
28. Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM - Tools - DSSIFER and VDK
29. Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancement techniques

30. Nutrient use efficiency of P, K and micronutrients and their enhancement techniques
31. Soil health - Definition - Soil Quality Indices - Physical, chemical and Biological indicators-Soil enzymes
32. SOM maintenance - Role of SOM in sustaining soil health
33. Precision farming and organic farming - Concepts and applications
34. Long term effect of fertilization on soil

Practical schedule

1. Estimation of alkaline $KMnO_4$ N in soil
2. Estimation of Olsen P and Bray P in soil
3. Estimation of Neutral Normal NH_4OAc K in soil
4. Estimation of available sulphur in soil by turbidimetry
5. Estimation of DTPA extractable micronutrients in soil
6. Identification of fertilizers - Fertilizer sampling techniques
7. Estimation of N in urea
8. Estimation of ammoniacal and nitrate N in ammonium nitrate
9. Estimation of water soluble P in SSP
10. Estimation of citric acid soluble P in rock phosphate - Pemberton's method
11. Estimation of K in KCI and K_2SO_4
12. Estimation of N in FYM / Compost by Macro Kjeldahl method
13. Preparation of triple acid extract - Estimation of P in FYM / Compost by Vanado molybdate yellow colour method
14. Estimation of K in FYM / Compost by Flame Photometry.
15. Colloquium on establishment of soil testing laboratories -Fertilizer calculations- Soil test based fertilizer prescription
16. Visit to STL and FTL, Visit to fertilizer manufacturing / mixing unit
17. Practical Examination.

Text books

1. John L. Havlin, James D. Beaton, Samuel L. Tisdale and Werner L. Nelson.2011. Soil Fertility and Fertilizers- An Introduction to Nutrient Management. PHL Learning Pvt. Ltd.,New Delhi
2. Gupta, P. K. 2012. A Handbook of Soil, Fertilizer and Manure. Agrobios (India), Jodhpur.
3. Michael, A. M. 2009. Irrigation Theory and Practice. Second Edition. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Ramesh Chandra and S. K. Singh. 2009. Fundamental and Management of soil quality. Westville Publishing House, New Delhi.

References

1. Cooke G.W., 1972. Fertilizers for maximizing yield, Grenada Publishing Ltd, London.
2. Black, C.A. 1965. Agronomy Monograph. Methods of Soil Analysis. Part 1. Physical and Mineralogical properties including Statistics of Measurement and Sampling. Wiley, New York.
3. Das, P.C. 1999. Manures and Fertilizers, Kalyani Publishers, New Delhi.
4. Dilip Kumar Das, 2007. Micronutrients : Their Behvaiour in soils and plants. Kalyani

Publishers, New Delhi.

5. Epstein, E. and A.J.Bloom. 2005. Mineral Nutrition of Plants: Principles and perspectives (2nd ed!). Sinauer Associates, Sunderland, MA.
6. FAO, 2000. Manual on integrated soil management and conservation practices. FAO land and water bulletin. No. 8. Food and Agriculture Organization of the United Nations, Rome.
7. Fertilizer Manual. 1998. UN Industrial Development Organization and International Fertilizer Development Center.
8. Horst Marschner. 1995. Mineral Nutrition of Higher Plants, 2nd edition. Academic Press Inc. San Diego, CA.
9. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson, 2006.Soil Fertility and Fertilizers - An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, NJ.
10. Kanwar. J.S. 1976. Soil fertility - Theory and Practice. ICAR- New Delhi.
11. Mengel, K., E.A. Kirkby, H.Kosegarten and T.Apple. 2006. Principles of Plant Nutrition, 5th ed. Springer International.
12. Page, A.L, R.H.Miller and D.R.Keeney. 1982. Methods of Soil Analysis. Part 2. Chemical and Microbiological properties. Madison Wiscinsonin, USA.
13. Russell. E.J.1973.Soil conditions and plant growth, Tenth edition English Language Book Society, London.
14. Sree Ramulu, U.S. 2003. Principles in the quantitative analysis of waters, fertilizers, plants and soil. Scientific Publishers, Jodhpur
15. Tandon, H.LS. 1994. Fertilizer, Organic Manures, Recyclable Wastes and Biofertilizers. Fertilizer Development and Consultation Organization, New Delhi
16. Westerman, R.L. (ed.) 1990. Soil Testing and Plant Analysis, 3rd. edition. Soil Science Society of America, Inc., Madison, Wl.
17. Yawalkar, K.S., J.P. Agarwal and S.Bokde.2008. Manures and Fertilizers. Agri - Horticultural Publishing House, Nagpur.

e-references

1. www.fspublishers.org/ijab/past-issues/IJAB Vol_5_No_3/47.pdf
2. www.springerlink.com/index/IQ11256h8t325054.pdf
3. www.ipni.net/ppiweb/bcrops.nsf/$webindex/.../Better_Crops_2009-4 J_.pdf
4. onlinelibrary.wiley.com/doi/10.1002/9780470431771 .index/pdf
5. agtr.ilri.cgiar.org/agtrweb/Documents/Library/docs/.,./Module4.htm
6. www.uoa.edu.er/academics/graduate/.../courses.html -
7. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
8. www.fao.org/wairdocs/ilri/x5546e/x5546e08.htm
9. www.uoa.edu.er/academics/graduate/.../courses.html -
10. www.ncpahindia.com/articles/article17.pdf-Similar
11. www.energy.ca.gov/process/agriculture/ag_pubs/fertigation.pdf -
12. www.soilandhealth.org/.../010117attrasoilmanual/010117attra.html
13. goliath.ecnext.com/.../Deficiencies-in-the-soil-quality.html-

Out come

The knowledge gained by students through this course will be useful in making decisions on nutrient dose, choice of fertilizers and method of application etc. practiced in crop production. The skill acquired from this course can be practiced for assessing soil fertility. The

students will also gain confidence in managing soil health for sustained productivity.

C. SUPPLEMENTARY REFERENCES:

1. Nair, M.R.G.K. 1995. *Insects and Mites of Crops in India.* Indian council of Agricultural Research, New Delhi, 408p.
2. Ayyar, T.V.R. 1963. *Hand Book of Economics Entomology for South India.* Govt. Press Madras.
3. Sivasubramanian, P., K.Samiayyan, N.Ganapathy, K. Bhuvaneswari and S.Jayaprabhavathi.2012. *A treatise on Integrated Pest Management.* Associated Publishing Company, New Delhi. 287 p.

D. WEB RESOURCES:

1. http://www.ncipm.org.in
2. http://agritech.tnau.ac.in/
3. http://www.nbaii.res.in/
4. http://www.nrcg.res.in/

16 PAT 301 PRINCIPLES OF PLANT DISEASE MANAGEMENT (1+1)

UNIT I: Epidemiology and Diagnosis of Plant Diseases

Classification of plant diseases - Disease triangle- Epidemiology of plant diseases-role of weather factors in disease development and spread- survival and dispersal of plant pathogens- Disease surveillance, assessment and forecasting– Diagnosis of plant diseases- Seed health tests- chemodiagnosis, serodiagnosis and Molecular diagnosis

UNIT II: Exclusion & Avoidence

Different principles of Plant Diseases Management- Exclusion- Plant quarantine – domestic, International and Embargo - Phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India- Role of cultural practices in plant disease management.

UNIT III: Eradication

Eradication from seed and Planting materials – Eradication of diseased plants-Surgery and Rouging – Eradication of Alternate and Collateral host- different methods of eradication- Mechanical, physical , chemical and Biological methods.

UNIT IV: Protection

Protection of crops from air borne, seed borne, soil borne and vector borne plant diseases-Physical methods- soil solarization, Hot water treatment, Incineration. Chemical control of plant diseases- fungicides- Different group of fungicides and antibiotics in plant disease management- Biological control of plant diseases - Plant products and Antiviral principles- method of application- plant protection appliances.

Unit V: Immunization and Biotechnological approaches

Immunization - cross protection and host plant resistance – Types of resistance - vertical and horizontal resistance – Resistant varieties. Mechanism of resistance- structural and bio chemical resistance in plants -Biotechnological approaches for crop disease management.

Practical

Survey and Assessment of important plant diseases- Diagnosis of Plant diseases= Classification and grouping of fungicides- Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound-Calculation of fungicides quantity and methods of application of fungicides – Special methods of application. Mass multiplication of *Trichoderma viride, Pseudomons fluorescens* and *Bacillus subtilis* and method of application-Preparation of leaf extracts, oil emulsion of neem and antiviral principles.Cross protection-Tissue culture –meristem tip culture technique. Visit to seed Testing Laboratory and pesticide testing laboratory

Theory Schedule

1. Plant diseases –Classification based on mode of infection, inoculums built up, spread, symptoms, severity and occurrence- Disease triangle- Role of weather factors in plant disease development.
2. Survival and dispersal of Plant Pathogens
3. Disease surveillance –Different methods- surveillance report-Disease surveillance programme in Tamil Nadu. Assessment of Plant Diseases- different methods- Measurement of disease growth rate by Area under disease Progressive curve (ADUPC)
4. Diagnosis of plant diseases-Seed health tests, Chemodiagnosis, serodiagnosis and

Molecular diagnosis

5. Exclusion- Plant quarantine – domestic, International and Embargo -phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India.
6. Role of cultural practices in plant disease management. Different methods of Eradication of Plant Diseases
7. Protection –Physical methods of protection- Chemical fungicides – Definition – classification- Sulphur and Copper fungicides, mode of action and uses
8. Mercury fungicides, Heterocyclic Nitrogen compounds , Organo tin, Quinone, Benzene and Miscellaneous compounds , Mode of action and Uses
9. Mid semester examination
10. Systemic fungicides including antibiotics – classification – mode of action - uses. New generation fungicides
11. Methods of application of fungicides: seed treatment, foliar spray, soil drenching and special methods of application
12. Biological control – Definition - mechanism of action – Mass production of

    Trichoderma viride , *Pseudomonas fluorescens* & *Bacillus subtilis* - methods of application - Plant products – antiviral principles – preparation – methods of application
13. Plant Protection appliances – Duster, Sprayers, Soil injector/Soil gun, Granular applicator and slurry seed treater
14. Disease Resistance- Types- Resistant varieties. Methods of developing resistant varieties
15. Mechanisms of resistance- structural and bio chemical resistance in plants
16. Immunization technique- Cross protection against viral and bacterial diseases.
17. Biotechnological approaches in plant diseases management: Tissue culture techniques- meristem tip culture, somoclonal variation and transgenic plant production by genetic engineering.

Practical Schedule

1. Survey and Assessment of important plant diseases
2. Diagnosis of Plant diseases: Tetrazolium test, Iodine test and ELISA test
3. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter test and ELISA.
4. Classification and grouping of fungicides.
5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound.
6. Calculation of fungicides quantity and methods of application of fungicides – Seed (wet and dry) soil, foliar and post harvest dipping.
7. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application

8. Special methods of application: Corm injection, Paring and prolinage, , root feeding and trunk injection.
9. Mass multiplication of *Trichoderma viride* and method of application
10. Mass multiplication of *Pseudomons fluorescens* and method of application
11. Mass multiplication of *Bacillus subtilis* and method of application
12. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
13. Cross protection: production of pre immunized citrus seedlings against tristeza virus.
14. Tissue culture – Production of virus free plants through meristem tip culture technique.
15. Visit to seed Testing Laboratory
16. Visit to pesticide testing laboratory
17. Practical Examination

REFERENCES

1. Agrios, G. N. 2008. Plant Pathology, 5 th edition, Academic Press, New York.
2. Nene,Y.L. and Thapliyal, P.N. 1998. Fungicides in plant disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
3. Chattopadhyay,S.G. 1998. Principles and procedure of plant protection, Oxford and IBH publishing Co. Ltd., New Delhi.
4. Narayanasamy,P. 1997. Plant pathogens detections and disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
5. Narayanasamy,P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.
6. Nagarajan 1983 .Dynamics of plant disease .Allied publishers,New Delhi.
7. Dinakaran,D, Arjunan,G and Karthikeyan,G.2003. Biological control of crop diseases
8. Prakasam,V., T.Raguchander and K.Prabakar, 2006. Applied Plant Pathology, A.E. publications, Coimbatore.
9. Cooke,B.M, Jones,D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

E- Books

1. Agrios, G.N. 2005. Plant Pathology – (5th Edition). Academic Press, New York
2. Pal, K. K. and B. McSpadden Gardener, 2006. Biological Control of Plant Pathogens. *The Plant HealthInstructor* DOI: 10.1094/PHI-A-2006-1117-02.APS Net
3. J.M. Waller, J.M. Lenné and S.J. Waller 2002. Plant Pathologist‘s Pocketbook 3rd Edition, CABI Publishing UK
4. Cooke,B.M, Jones,D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

On line References

www.plantdisease.com
www.cropprotection.html

16 ABT 301 PLANT BIOTECHNOLOGY 2+1

Aim

To impart knowledge on basic and applied aspects of plant biotechnology

Theory

Unit I Basics of Plant Tissue Culture

Plant tissue culture: Concepts, history and scope - Media and Culture Conditions - Sterilization techniques- Regeneration methods - morphogenesis, organogenesis and embryogenesis - culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture; anther and pollen culture; ovule and embryo culture

Unit II Applied Plant Tissue Culture

Micropropagation - banana and ornamental plants; National certification and Quality management of TC plants- Applications of organ culture - Meristem tip culture (virus free plants) and anther culture (doubled haploids)- Protoplast isolation and fusion- somaclonal variation- synthetic seeds - secondary metabolite production- invitro germplasm conservation

UNIT III Basic Molecular Biology

Genome organization- prokaryotes vs eukaryotes- Central dogma of life - Structure of nucleic acids - DNA replication, aminoacids and their classification- genetic codes-transcription, translation and protein synthesis- Structure of a gene, regulation of gene expression, Operon concept- basic techniques in molecular biology-Blotting techniques-Polymerase chain reaction-DNA sequencing methods.

Unit IV Recombinant DNA Technology and Genetic Transformation

DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases - Different types of vectors: plasmids, phagemids, cosmids, BAC - Construction of recombinant DNA molecules- Bacterial transformation - Direct and indirect gene transfer methods in plants: microinjection, electroporation, particle bombardment, *Agrobacterium* mediated method - Tissue specific promoters, selectable and scorable markers, reporter genes- Molecular analysis of transgenic plants – Transgenic plants: herbicide, pest and disease resistant, abiotic stress resistant, nutritional enhancement and traits for improved quality- Detection of GMOs – regulations and biosafety.

Unit V Molecular Marker Technology and Molecular Breeding

DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs - DNA fingerprinting of crop varieties – Development of mapping populations- linkage and QTL analysis- principles, methods and applications of Marker Assisted Selection in crop improvement- Applications of Plant Genomics and genome databases

Practicals

Biotech Laboratory organization, safety regulations – basics of reagents and solution preparation- Plant tissue culture media preparation- shoot tip culture (rose) - Meristem culture (tapioca)- Micro propagation of banana - Callus culture – Culturing of E.coli and determination of growth curve- Isolation of bacterial plasmid DNA- Restriction Digestion and Ligation-Competent cell preparation and Bacterial transformation – confirmation of transformation through colony screening - DNA extraction from plants- Quantification of DNA and quality check through Agarose gel electrophoresis - Molecular marker analysis-

DNA fingerprinting using RAPD/SSR markers - NTSys- analysis of diversity in crop plants-Visit to tissue culture units /biotech labs in seed industry/Bt cotton field/tissue culture banana fields

References

Text book

- Chawla. H S. 2009. **Introduction to Plant Biotechnology (3/e).** CRC Press , London. 730 P ISBN 9781578086368

Additional resources

- Neal Stewart, Jr. C. 2008. Plant Biotechnology and Genetics: Principles, Techniques and Applications John Wiley & Sons, Inc ISBN: 978-0-470-04381-3
- George, E.F, Hall M. A. and Geert-Jan De Klerk. 2009. **Plant Propagation by Tissue Culture,** 3rd Edition, Springer, The Netherlands. 501p.
- Nelson, D.S. and M.M. Cox. 2012. **Lehninger's Principles of Biochemistry. Sixth edition. Chapters- 1,3,8,9,25,26,28** (weblinks, tutorials and lecture companion art) W.H. Freeman and Company.
- Brown,T. A. 2010. **Gene Cloning and DNA Analysis: An Introduction,** 6th Edition, Wiley-Blackwell- Companion site (Chapters 1 to 12 and 15)
- Xu **,**Y 2010. **Molecular Plant Breeding.** International Maize and Wheat Improvement Centre (CIMMYT). 752 Pages
- H.P. Singh, S. Uma, R. Selvarajan and J.L. Karihaloo. 2011. **Micropropagation for Production of Quality Banana Planting Material in Asia-Pacific.** Asia-Pacific Consortium on Agricultural Biotechnology, New Delhi, India. P. 92.
- Kranthi, K.R. 2012. **Bt cotton – Questions and answers** -Indian Society for Cotton Improvement, Central Institute for Research on Cotton Technology, Mumbai 400 019. 70p.
- http://www.isaaa.org/india/- Briefs

Lecture Schedule

1. Plant tissue culture: Concepts, history and scope
2. Media and Culture Conditions and Sterilization techniques
3. Regeneration methods - morphogenesis, organogenesis and embryogenesis
4. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture
5. Anther and pollen culture; ovule and embryo culture
6. Micropropagation - banana and ornamental plants
7. National certification and Quality management of TC plants
8. Meristem tip culture (virus free plants) and anther culture (doubled haploids)
9. Protoplast isolation and fusion- somaclonal variation-synthetic seeds
10. Secondary metabolite production, *invitro* germplasm conservation
11. Genome organization- prokaryotes vs eukaryotes
12. Central dogma of life - Structure of nucleic acids
13. DNA replication
14. Aminoacids and their classification and genetic codes, transcription
15. Translation and protein synthesis
16. Structure of a gene
17. Mid semester Examination
18. Regulation of gene expression, Operon concept
19. Blotting techniques and Polymerase chain reaction
20. DNA sequencing methods
21. DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases
22. Different types of vectors: plasmids, phagemids, cosmids, BAC
23. Construction of recombinant DNA molecules- Bacterial transformation
24. **D**irect and indirect gene transfer methods in plants: microinjection, electroporation, particle

bombardment, *Agrobacterium* mediated method

25. Tissue specific promoters, selectable and scorable markers, reporter genes,Molecular analysis of transgenic plants
26. Transgenic plants: herbicide, pest and disease resistant, abiotic stress resistant,
27. Transgenic plants: nutritional enhancement and traits for improved quality
28. Detection of GMOs – regulations and biosafety.
29. DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs
30. DNA fingerprinting of crop varieties
31. Development of mapping populations
32. Linkage and QTL analysis
33. Principles, methods and applications of Marker Assisted Selection in crop improvement
34. Applications of Plant Genomics and genome databases

Practical schedule

1. Biotech Laboratory organization, safety regulations
2. basics of reagents and solution preparation-
3. Plant tissue culture media preparation- shoot tip culture (rose)
4. Meristem culture (tapioca)
5. Micro propagation of banana
6. Callus culture
7. Culturing of *E.coli* and determination of growth curve
8. Isolation of bacterial plasmid DNA
9. Restriction Digestion and Ligation
10. Competent cell preparation and Bacterial transformation
11. Confirmation of transformation through colony screening
12. DNA extraction from plants
13. Quantification of DNA and quality check through Agarose gel electrophoresis
14. DNA fingerprinting using RAPD/SSR markers
15. NTSys- analysis of diversity in crop plants
16. Visit to tissue culture units /biotech lab in seed industry/Bt cotton field/tissue culture banana field
17. Practical examination

Outcome

The students will be exposed to plant biotechnology comprehensively and will also have hands on expereince in plant tissue culture and molecular techhiques.

16 PBG 301 PRINCIPLES AND METHODS OF PLANT BREEDING 2+1

Aim To expose the students to basic and applied principles of plant breeding

Theory

Unit I: Reproductive systems in plant breeding

Objectives and role of plant breeding - historical perspective – activities in Plant Breeding. Centres of origin – contribution of Vavilov, Harlan, Zhukovosky – law of homologous series. Plant genetic resources – importance – germplasm – types – activities – gene erosion - gene bank – collection - conservation – types of conservation – agencies – quarantine. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine. Modes of reproduction – sexual – asexual - self and cross fertilization – significance of pollination. Self incompatibility – classifications – mechanisms – application – measures to overcome and limitations. Sterility

– male sterility – classification – CMS, GMS, CGMS - inheritance and applications. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications. Apomixis – introduction – classification - applications; Parthenocarpy and its types.

Unit II: Breeding methods of self pollinated crops

Basic biometrics - nature and significance of qualitative and quantitative variation - phenotypic, genotypic and environmental - heritability and genetic advance. Plant introduction as a breeding method – types of introduction – objectives – quarantine - acclimatization – achievements - merits and demerits. Genetic basis of self pollinated crops – Vilmorin principle of progeny selection - Johannsen‘s pure line theory. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection – merits and demerits – achievements; Mass selection in self pollinated crops – types – comparison of mass and pureline selection – achievements. Breeding methods of self pollinated crops involving artificial hybridization: Creating variability in self pollinated crops - Hybridization and selection — choice of parents – combining ability - combination breeding and transgressive breeding – kinds of emasculation. Pedigree breeding – mass pedigree – merits – demerits – achievements; Bulk breeding – merits – demerits – achievements. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – application – merits and demerits. Backcross breeding – prerequisites – procedures for transferring dominant and recessive genes – merits – demerits – multi lines and multi blends - population improvement approach in self-pollinated crops.

Unit III: Breeding methods of cross pollinated crops and clonally propagated crops

Genetic structure of a population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops – modified mass selection – unit selection – mass selection with progeny testing – half sib family selection – full sib family selection. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits. Heterosis breeding – theories - genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbreds. Heterosis breeding – procedure – use of male-sterility systems and manual emasculation in hybrid seed production – maintenance of parental lines -types of hybrids – achievements – merits and demerits – hybrid variety – merits and demerits. Synthetics and composites - steps in development of synthetics

and composites – achievements – merits and demerits. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.

Unit IV: Special breeding methods

Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and diploid x hexaploid crosses - achievements – limitations. Wide hybridization-history - importance-barriers and techniques for overcoming barriers-utilization. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Ideotype concept. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques – – Use of doubled haploids in crop improvement. Concept of biotic and abiotic stress resistance Breeding. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements.

Unit V: Maintenance breeding

Types of cultivars – procedure for release of new varieties – stages in seed multiplication – concept of seed certification and TC plants certification. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation. Current trends in Plant Breeding: Marker assisted breeding , Transgenic crops. Concept of Plant Varietal protection, geographical indications and DUS.

Practical

Observation on pollination and reproduction in plants - Alternation of generation and life cycle. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops; Pollen morphology - Exine structure of different crops. Assessment of pollen fertility and sterility in A, B, R and TGMS lines. Breeder kit and its components – uses; Basic steps of selfing and crossing techniques. Emasculation and pollination techniques in field crops and horticultural crops. Studies on segregating generation and maintenance of records. Maintenance of A, B and R line and TGMS lines - Hybrid seed production techniques. Estimation of heterosis. Induction of polyploidy using colchicines. Studies on different wild species in crop plants and wide hybridization. Irradiation - dosimetry - half life period - procedure for irradiation of seeds and planting materials. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis of seeds and planting materials. Germplasm preservation – conservation - records maintained in research stations. Calculation of PCV, GCV, heritability, genetic advance. Layout of different yield trials - Observing the experimental plots - nucleus and breeder seed production plots. Screening methods – laboratory and field – for biotic and abiotic stresses -marker assisted selection.

Theory schedule

1. Objectives and role of plant breeding - historical perspective – activities in Plant Breeding.
2. Centres of origin – contribution of Vavilov, Harlan, Zhukovosky – law of homologous series.
3. Plant genetic resources – importance – germplasm – types – activities – gene erosion - gene bank – collection - conservation – types of conservation – agencies – quarantine.
4. Germplasm: evaluation – use of descriptors, documentation, utilization; Agencies – national and international; germplasm exchange – quarantine.
5. Modes of reproduction – sexual – asexual - self and cross fertilization – significance of pollination.
6. Self incompatibility – classifications – mechanisms – application – measures to overcome

and limitations.

7. Sterility – male sterility – introduction – classification – CMS, GMS, CGMS -inheritance and applications.
8. TGMS, PGMS, Gametocides, Transgenic Male sterility and applications.
9. Apomixis – introduction - classification-applications; Parthenocarpy and its types.
10. Basic biometrics-nature and significance of qualitative and quantitative variation-phenotypic, genotypic and environmental-heritability and genetic advance
11. Plant introduction as a breeding method – types of introduction – objectives – quarantine - acclimatization – achievements - merits and demerits.
12. Genetic basis of self pollinated crops – Vilmorin principle of progeny selection - Johannsen's pure line theory.
13. Breeding methods for self pollinated crops without involving artificial hybridization: Pure line selection – procedure – merits and demerits – achievements; Mass selection in self pollinated crops – procedure - types – comparison of mass and pureline selection – achievements.
14. Breeding methods of self pollinated crops involving artificial hybridization: Creating variability in self pollinated crops - Hybridization and selection – objectives types – choice of parents – combining ability - combination breeding and transgressive breeding – steps in hybridization - kinds of emasculation.
15. Pedigree breeding – procedure – mass pedigree – merits – demerits – achievements; Bulk breeding – procedure – merits – demerits – achievements.
16. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method – procedure – application – merits and demerits.
17. **Mid Semester examination**
18. Backcross breeding – genetic principles – prerequisites – procedures for transferring dominant and recessive genes
19. Back cross breeding – merits – demerits – multi lines and multi blends - population improvement approach in self-pollinated crops.
20. Genetic structure of a population in cross pollinated crop – Hardy Weinberg law – gene frequencies in random mating population – principles in population improvement.
21. Breeding methods of cross pollinated crops without involving artificial hybridization: Mass selection in cross pollinated crops – modified mass selection – unit selection – mass selection with progeny testing – half sib family selection – full sib family selection.
22. Breeding methods of cross pollinated crops involving artificial hybridization: Recurrent selection principles – types – merits and demerits.
23. Heterosis breeding – theories - genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbreds.
24. Heterosis breeding – procedure – use of male-sterility systems and manual emasculation in hybrid seed production – maintenance of parental lines -types of hybrids – achievements – merits and demerits – hybrid variety – merits and demerits.
25. Synthetics and composites - steps in development of synthetics and composites – achievements – merits and demerits
26. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements; Chimeras and its types; Tree breeding – clonal orchards.
27. Polyploidy breeding – classification – induction of polyploidy – diploid x tetraploid and

diploid x hexaploid crosses - achievements – limitations.

28. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
29. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations. Ideotype concept
30. Somaclonal variation - utilization in crop improvement; *In vitro* selection techniques — Use of doubled haploids in crop improvement. Concept of biotic and abiotic stress resistance Breeding
31. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements.
32. Types of cultivars – procedure for release of new varieties – stages in seed multiplication – concept of seed certification and TC plants certification.
33. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation.
34. Current trends in Plant Breeding: Marker assisted breeding, Transgenic crops. Concept of Plant Varietal protection, geographical indications and DUS

Final theory examination

Practical schedule

1. Pollination and reproduction in plants - Alternation of generation and life cycle.
2. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops; Pollen morphology - Exine structure of different crops. Fertility and sterility in A, B, R and TGMS lines.
3. Breeder kit and its components – uses; Basic steps of selfing and crossing techniques.
4. Emasculation and pollination techniques in field crops.
5. Emasculation and pollination techniques in horticultural crops.
6. Studies on segregating generation and maintenance of records.
7. Maintenance of A, B and R line and TGMS lines - Hybrid seed production techniques
8. Estimation of heterosis.
9. Induction of polyploidy using colchicine
10. Studies on different wild species in crop plants and wide hybridization.
11. Irradiation - dosimetry - half life period - procedure for irradiation of seeds and planting materials. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis of seeds and planting materials.
12. Germplasm preservation – conservation - records maintained in research stations
13. Calculation of PCV, GCV, heritability, genetic advance
14. Layout of different yield trials - Observing the experimental plots - nucleus and breeder seed production plots.
15. Screening methods – laboratory and field – for biotic and abiotic stresses.
16. Procedure for marker assisted selection.
17. **Final Practical examination**

OUTCOME

The plant breeding methodologies and applications employed for self, cross and vegetatively propagated crops will be exposed.

References

- Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
- Allard, R. 1989. Principles of Plant breeding. John Wiley and Sons, New Delhi.
- D.N.Bharadwaj.2012. Breeding Field Crops. Agrobios (India), Jodhpur
- Chahal, G.S. and S.S.Gosal. 2002. Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. Narosa Publishing House (India)

Further Reading

- Phundhan Singh. 2001. Essentials of plant breeding, Kalyani publishers, New Delhi.
- Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai – 15.
- Chopra, V. L., 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
- Sharma, J. R. 1994. Principles and practice of plant breeding. Tata McGraw-Hill publishing Co., New Delhi.
- Chaudhary, H. K. 1980. Elementary Principles of plant breeding. Oxford and IBH publication Co., New Delhi

Web resources

- http://www.edugreen.teri.res.in/explore/bio/breed.htm
- http://cuke.hort.ncsu.edu/gpb/
- http://www.stumbleupon.com/tag/plant-breeding
- http://www.iaea.org/

16 AGM 301 SOIL AND APPLIED MICROBIOLOGY 1+ 1

Aim

- To enlighten the students with the knowledge of microbial diversity in soils
- To high lighten the role of soil microorganisms in soil fertility and plant growth promotion
- To develop experimental skills in soil microbiology which includes isolation of
- beneficial microorganisms from soil and plant and their mass production
- To make students gain expertise in practical aspects of production of industrial products

Theory

Unit I Introduction to Soil Microbiology

Soil Microbiology- definition and scope. Historical developments in soil microbiology. Diversity of soil microorganisms - culturable (bacteria, actinobacteria, yeasts, moulds and algae) and unculturable microorganisms - metagenomic approach - factors influencing the microbial diversity

Unit II Microbial Processes in soil

Organic matter decomposition and humus formation- C:N ratio.. Carbon cycle. Nitrogen cycle - biological nitrogen fixation (BNF) – nodulation and biochemistry of BNF. Phosphorus cycle and sulphur cycle. Microbial transformation of potassium, zinc and silica in soil – role of soil enzymes

Unit III Soil Microorganisms and plants

Rhizosphere, spermosphere, phyllosphere, epiphytic and endophytic microorganisms and their significance. and Plant growth promoting rhizobacteria. Soil microorganisms and their interactions – positive and negative interactions

Unit IV Microbial inoculants

Bioinoculants – types of bioinoculants – nitrogen fixers, P, K, Zn and Si solubilizers and phosphate mobilizers, sulphur oxidizers and PPFM. BGA and Azolla. Mass production and quality control of bacterial and fungal bioinoculants. Methods of application of bioinoculants.

Unit V Industrial Microbiology

Industrial utilization of microorganisms - Alcohol fermentation – wine and beer. Antibiotics and vitamin production. Microbes in food industry – single cell protein, baker‘s and brewer‘s yeast and dairy products – cheese and yoghurt. Biofuels- ethanol and biodiesel.

Practical

Enumeration of soil microbial population - quantitative and qualitative methods. Organic matter decomposition. Isolation of symbiotic nitrogen fixing bacteria, free living, associative and endophytic nitrogen fixing bacteria. Isolation of phosphobacteria and sulfur oxidizing bacteria. Isolation of zinc and silicate solubilizing and potassium releasing bacteria. Isolation of plant growth promoting rhizobacteria (*Pseudomonas* sp) and phyllosphere (PPFM) microbes. Examination of AM fungal infection in plants and recovery of AM spores from soil. Isolation of Blue Green algae. Mass production of bacterial bioinoculants, blue green algae, azolla and AM fungi. Isolation of yeast and *Lactobacillus*. Industrial products – wine and sauerkraut fermentation.

Theory schedule

1. Introduction and historical developments in soil microbiology. Contributions of Beijerinck, Winogradsky, Fleming and Waksman

2. Diversity of soil microorganisms - culturable and unculturable microbial diversity. Factors influencing the activities of soil microorganisms
3. Carbon cycle – C:N ratio. Role of soil microorganisms in the decomposition of organic matter and humus formation
5. Nitrogen cycle – microbiology and biochemistry of mineralization, ammonification, nitrification and denitrification
6. Biological nitrogen fixation – free living, associative, endophytic and symbiotic microorganisms
7. Nodulation in *Rhizobium*- legume and *Frankia* – actinorhizal symbioses. Biochemistry of nitrogen fixation
8. Phosphorus cycle and microbial transformation of phosphorus - phosphate solubilizer and mycorrhizae
9. **Mid Semester Examination**
10. Sulphur cycle - sulphur oxidizers; microbial transformation of K, Zn and Si. Role of soil enzymes in nutrient transformation
11. Importance of soil and plant associated microorganisms – rhizosphere, spermosphere phyllosphere, epiphytic and endophytes
12. Soil microorganisms and their interactions – positive and negative interactions. Bioinoculants - types - bacterial, fungal (AMF) and algal bionoculants
13. Mass production of bioinoculants
14. Industrial utilization of microorganisms –alcohol fermentation – alcoholic beverages
15. Antibiotics production (Penicillin and Streptomycin) and Vitamin production (Vitamin B2 and Vitamin B12).
16. Microbes in food industry – Single Cell Protein, Baker‘s and Brewer‘s yeast, Dairy products – cheese and yoghurt
17. Biofuels – alcohol and biodiesel production

Practical schedule

1. Enumeration of soil microorganisms - quantitative Conn‘s direct microscopic method – qualitative buried slide technique
2. Enumeration of rhizosphere microorganisms and determination of R:S ratio
3. Studying organic matter decomposition by measurement of CO_2 evolution
4. Antibiosis in soil – Crowded plate technique
5. Isolation of *Rhizobium* from root nodules
6. Isolation of *Azospirilum* and *Azotobacter*
7. Isolation of *Gluconoacetobacter* from sugarcane
8. Isolation of phosphobacteria and PPFM
9. Isolation of PGPR (*Pseudomonas* sp)
10. Examination of AM infection in roots and recovery of spores from soil
11. Mass production of bacterial bioinoculants and AM fungi
12. Mass multiplication of blue green algae and *Azolla*
13. Methods of application of different bioinoculants
14. Isolation of yeast and *Lactobacillus*
15. Wine fermentation
16. Yoghurt and sauerkraut fermentation
17. **Practical Examination**

Outcome

- Students will be imparted with the knowledge of microorganisms in soil
- The contribution of soil microorganisms in soil fertility and plant growth promotion will be made clear
- Students will acquire experimental skills in Soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production
- Students will gain expertise in practical aspects of production of industrial products.

Text Books

1. Alexander, M. 1977. Soil Microbiology. John Wiley and Sons. New York
2. Waiter.M.J.,N.L.Morgan,J.S.Rocky and G.Higton.1999. Industrial Microbiology – An Introduction. Blackwell Scientific
3. e book: Paul , E .A. 2007. Soil Microbiology, Ecology and Biochemistry. 3rd Ed., Academic Press, USA
4. e book: Waksman, S. A 1952.Soil Microbiology John Wiley & Sons, Inc.

Reference Books

1. Rangaswamy,G.and Bagyaraj, D.J. 1992. Agricultural Microbiology, Asia Publishing House, New Delhi.
2. Subba Rao,N.S.1999. Soil Microorganisms and plant Growth. Oxford and IBH, New Delhi
3. Osborn, M., Smith, C.J. 2005. Molecular Microbial Ecology. Taylor and Francis.

Web Pages

fire.biol.wwu.edu/hooper/416_05Ncycle1.ppt
www.fao.org/docrep/009/a0100e/a0100e05.htm

16 AEC 301 AGRICULTURAL MARKETING, TRADE AND PRICES 1+1

Objective

The aim of the course is to give exposure to the Under Graduate students on market concepts, marketing of agricultural commodities, intermediaries involved, domestic and export trade, risk in agricultural marketing, marketing institutions involved, price dynamics and the role of Government in regulation of markets.

Theory

Unit 1: Agricultural Marketing – Nature and Scope

Market and Marketing: Definitions, Components and Dimensions of a market - Agricultural Marketing: Definition, Scope and Subject matter - Classification of markets and Approaches to the study of marketing - Market functionaries and Market forces, Price Determination - Marketing of agricultural Vs manufactured goods - Producer surplus of agricultural commodities - Types: Marketable and Marketed surplus, importance, relationship between marketable and marketed surplus and factors affecting marketable surplus.

Unit 2: Marketing Functions and SCP Paradigm

Marketing Functions: Buying and Selling, Packaging and Transportation, Grading and Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking - Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Market structure and Price determination.

Unit 3: Marketing Efficiency and Marketing Institutions

Marketing Channels: Definition, Channels for different products and Factors affecting marketing channels - Marketing costs, Margins and Price Spread. Marketing efficiency: Meaning, Definition and Types. Market Integration: Definition and Types - Market Research: Steps in market research - Marketing of agricultural inputs and its channels - Role of

Government in promoting agricultural marketing viz., Regulated Markets, Co-operative Markets and Farmers‘ Markets - Problems in traditional marketing systems - Advantages of modern marketing system over traditional agricultural marketing system.

Marketing Institutions: Directorate of Marketing and Inspection – Grading and Quality Control - AGMARK – Market Intelligence - NAFED, TANFED, State Agricultural Marketing Boards, FCI, National Horticultural Board, NDDB and Commodity Boards - Legal measures for improving agricultural marketing: APMC Act.

Unit 4: Trade in Agricultural Products

International Trade - Free trade and Autarky - Theories of Trade: Absolute and Comparative Advantage - Status of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA: Market Access, Domestic Support and ExportSubsidies - New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, NHB and Commodity boards.

Unit 5: Agricultural Prices and Risk Analysis

Agricultural Prices: Price characteristics of agricultural products - Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock - Risk in marketing: Meaning and Importance - Types of risk: Speculation and Hedging and Forward and Futures trading – Role of Contract Farming in risk mitigation.

Practical

Preparation of farm survey schedule - Farmers' marketing practices - Farmers' Market - Regulated Market and its role in marketing of farm produce- Cooperative Marketing Society –- Estimation of marketed and marketable surplus- Identification of marketing channels - Price spread estimation for agricultural / horticultural products – Marketing efficiency – Market integration - Role of Food Corporation of India (FCI) / Civil Supplies Corporation in Marketing of Agricultural Produce - Central Warehousing Corporation (CWC) / State Warehousing

Corporation (SWC) and their role in storage of farm produce – AGMARK Laboratory / Grading institutions Farm input marketing - Commodity Boards - Export oriented units - Time Series Analysis of prices - Trend and Seasonal Variations, Cyclical and Irregular Variations – Index Numbers.

Lecture Schedule

1. Market and Marketing: Definition, Components and Dimensions - Agricultural Marketing: Definition, Scope and Subject matter - Classification of market and Approaches to the study of marketing - Functional, Institutional, Commodity and Behavioral system.
2. Market Functionaries and Market Forces - Price Determination - Marketing of agricultural Vs manufactured goods. Characteristics of agricultural and horticultural commodities in relation to marketing.
3. Producer Surplus of agricultural commodities: Definition and Types of producer surplus - Marketable and Marketed surplus: Importance and Relationship and Factors affecting marketable surplus.
4. Marketing Functions: Buying and Selling, Packaging and Transportation, Grading and Standardization, Market Finance, Storage and Warehousing, Processing and Value Addition and Risk Taking.
5. Market structure: SCP paradigm. Market Structure, Conduct and Performance – Definitions, Components and their dynamics - Market Structure and Price Determination.
6. Marketing Channels: Definition - Channels for different products - Marketing costs, Margins and Prices. Price spread – Factors affecting cost of marketing.
7. Marketing Efficiency: Types: Operational and Pricing - Market Integration - Vertical, Horizontal and Conglomeration - Market Research and Steps in market research.
8. Factor Market: Marketing of various agricultural inputs: seed, fertilizers, pesticides - Channel of distribution.
9. **Mid -Semester Examination**
10. Problems in traditional marketing systems - Advantages of modern marketing system over traditional system - Role of Government in promoting agricultural marketing viz., Regulated Markets, Cooperative Markets and Farmers Markets.
11. Marketing institutions: Directorate of Marketing and Inspection – Grading and Quality Control – AGMARK – Market Intelligence. NAFED and TANFED, State Agricultural Marketing Boards, FCI, National Horticultural Board, NDDB and Commodity Boards.

12. Legal measures for improving agricultural marketing - APMC Act.
13. International Trade: Free trade and Autarky Theories of trade: Absolute and Comparative advantage trade theories – Share of agricultural commodities in total trade - Major exports and imports of agricultural and Agri-allied commodities - Barriers to Trade: Tariff and non tariff barriers.
14. Trade policy instruments - Terms of trade - Institutions for promoting trade in agricultural commodities – National and International - GATT, UNCTAD and WTO - Free Trade Agreements - Agreement on Agriculture – Market Access, Domestic Support and Export Subsidy.
15. New EXIM Policy of India – Advantages of Agri. Export Zones, ITPO, Export promotion Councils, APEDA, MPEDA, NHB and Commodity boards.
16. Agricultural Prices: Function and Scope - Price characteristics of agricultural products – Price Policy and Price Stabilization – Role of CACP - Role of administered prices – MSP, SMP and SAP - Procurement of food grains - Buffer Stock.
17. Risk in marketing: Types of risk - Speculation and Hedging - Forward and Futures market - Role of Contract farming in risk management.

Practical Schedule

1. Preparation of farm survey schedule.
2. Visit to Farm to collect information on marketing practices of agricultural commodities and marketing problems.
3. Estimation of marketable and marketed surplus and study of marketing channels.
4. Price spread estimation for major agricultural and agri-allied products to assess the marketing efficiency.
5. Visit to weekly shandy / Farmers‘ market.
6. Visit to Regulated Market to study its role in marketing of farm produce.
7. Visit to Cooperative Marketing Society to study the services and marketing of farm produce.
8. Visit to Whole sale vegetable market / Commission mandy.
9. Estimation of Market Integration.
10. Visit to FCI / TNCSC.
11. CWC/ SWC and their role in storage of farm produce.
12. Visit to AGMARK Laboratory/Grading institutions.
13. Visit to farm input dealer to study marketing of farm inputs.
14. Visit to Commodity Boards / AEZ / Export oriented Units.
15. Time series analysis of prices - TCSI.
16. Index number-construction and uses.
17. **Practical Examination.**

References

1. Acharya S.S. and N.L.Agarwal. 2002. Agricultural Marketing in India. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Acharya S.S. and N.L.Agarwal. 1994. Agricultural Prices - Analysis and Policy. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Kahlon A.S. and S.D.Tyagi, 2000. Agricultural Price Policy in India - Allied Publishers Pvt. Ltd. Bombay.
4. SakOnkvisit. John J.Shaw.1999. International Marketing Analysis and Strategy. Prentice Hall of India. New Delhi.
5. Sivarama Prasad A. 1999. Agricultural Marketing in India. Mittal Publications, New Delhi.

Kohls R.L. and N. Uhl. Joseph. 1980. Marketing of Agricultural Products. Collier Macmillan. New York.

16 ARM 301 AGRIBUSINESS MANAGEMENT AND ENTREPRENEURSHIP 1 + 1

Setting

- The course is designed so that the student would use the knowledge and skill gained for starting new agribusinesses and managing the business.
- The students should apply the knowledge gained in this course during the Experiential Learning course offered in VI and VIII semester.
- Therefore this course could be offered in the **III year V Semester**

Objectives

To enable students to start new agribusiness To enable students to manage agribusiness

Theory

Unit I – Agribusiness Management

Concept – components of agribusiness – forms of agribusiness firms. Management - concept – functions of management – managerial roles and skill (Mintzbergs) required at various levels of management.

Unit II – Management Functions

Planning – steps and types of plans. Organizing – basis for Departmentation. Staffing – human resource planning process. Directing –techniques of direction. Coordination and control - types.

Unit III Functional Area – I

Operations management - planning and scheduling - supply chain management in agribusiness. Human resource management – job analysis, recruitment and selection process

Unit IV Functional Area – II

Marketing Management – market segmentation, consumer buying behaviour and marketing mix. Financial management – concept and financial planning for agribusinesses

Unit V – Entrepreneurship

Entrepreneur – entrepreneurship – types, characteristics and process. Innovation, business incubation and financing entrepreneurs.

Practical

Mapping opportunities in Agribusiness sectors – functional areas of agribusiness firm - Identification of the form of agribusiness organization - Business plan and information needs - procedure for establishing agro business firms - forecasting demand for products - Production planning – Exercise on Inventory Management - Purchase management and vendor rating methods - Assessment of entrepreneurial skills and competency - Market survey for understanding client needs and satisfaction - Pricing methods for small agribusinesses - Market promotion programs for an agribusiness firm - Assessing and acquiring finance for agribusiness firms – Financial Performance of a firm – Ratio Analysis - Presentation of business plan and discussion

Theory schedule

1. Agribusiness – components of agribusiness – Management
2. Levels of management – top, middle and junior levels - Managerial Roles (Mintzbergs) – interpersonal, informational and decisional. Managerial skills – technical, human, conceptual and design.

3. Management functions – planning - steps and types of plans for agribusiness
4. Organizing - basis of departmentation; staffing – human resource planning process
5. Directing – techniques; coordination – types; and controlling – types
6. Operations management - meaning, scope, production planning and scheduling
7. Supply Chain Management – drivers, flows and importance
8. Human resource management – job analysis, job description and specification
9. **Mid Semester Examination**
10. Role of HR manager - Recruitment and selection process
11. Marketing management – basis of market segmentation and consumer buying behaviour
12. Marketing mix – product, price, placement and promotion
13. Entrepreneur –Entrepreneurship – types of entrepreneur- characteristics
14. Entrepreneurship Process – identification and evaluation of opportunities, writing business plan, identification of resources and managing the firm
15. Business Incubation –meaning, process and role in entrepreneurship
16. Financial management - Assessing and acquiring finance for agribusiness firms
17. Financing entrepreneurs –Venture capital financing– stages and process and Angel investors

Practical schedule

1. Mapping opportunities in Agribusiness sectors and selecting an agribusiness (The classes that follow could be based on building up this idea into a business)
2. Guest lecture by entrepreneur / Visit – understanding functional areas of agribusiness firm.
3. Discussion on Sole Proprietorship, Partnership, and Public Limited, One Man Company, Cooperative Society and Farmer Producer Company
4. Business plan - components and models. Identifying information needs for business plan preparation.
5. Documenting the procedure for establishing agribusiness firms – guest lecture / visit to District Industries Centre
6. Exercise on forecasting demand for agricultural products
7. Preparation of production plans for agribusiness firm
8. Exercise on Inventory Management – types, cost and basic EOQ model
9. Purchase management and Vendor rating methods
10. Market survey for understanding customer needs and satisfaction
11. Pricing of products of small agribusinesses
12. Preparation of advertisement and sales promotion programs for an agribusiness firm
13. Balance sheet and Income Statement of agribusiness and Ratio analysis.
14. Cost, Volume Profit analysis and Investment Analysis
15. Assessment of entrepreneurial skills and competency
16. Presentation of business plan and discussion
17. **Final Practical examination**

Books

1. Koontz.H and Weihrich.H, 2013, _Principles of Management‘, Tata McGraw Hill, New Delhi.
2. Rao, V.S.B, and P.S. Narayana, 2004, _Principles and Practices of Management‘,

Konark Publishing Pvt. Ltd. New Delhi.

3. Prasad, L.M, 2005, _Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
4. Howard H Fredrick and Donald F Kuratko, 2010, _Entrepreneurship – Theory, Process, Practice', Cengage Learning Publishers, Melbourne
5. Veerabhadrappa Havinan , 2009 _Management and Entrepreneurship', New Age International Publishers, New Delhi

16 SST 301 SEED QUALITY REGULATION AND STORAGE 1+1

Aim :

To make the students understand the importance of seed quality regulation and legislative frame work and seed storage techniques.

Theory

Unit I - Seed legislations and regulatory framework

Introduction and importance of seed quality regulation - The Seeds Act and Rules - Composition and role of Central Seed Committee and its Sub Committee-Central Sub Committee on Crop Standards, Release and Notification of crop varieties - State Seed Sub Committee- Central Seed Certification Board, State Seed Certification Agency - Central Seed Testing Laboratory cum Referral Laboratory and Notified Seed Testing Laboratories - Seed Inspector - duties and responsibilities - offences and penalties - Seeds (Control) Order 1983 and labeling- seed standards - PPV& FRA 2001- National Seed Policy 2002- Salient features of Seed Bill 2004.

Unit II - Seed certification

Seed certification - definition - phases - procedures - Field inspection, field counts, field and seed standards - LFR- Downgrading - Post harvest inspection and seed quality assurance - Processing, bagging and tagging - Assigning of seed lot number - Validity period - Revalidation.

Unit III - Seed quality testing

Seed testing - importance - seed sampling - mixing and dividing - seed quality assessment (seed moisture content, physical purity, ODV, seed germination test, quick viability test, vigour tests and seed health test) - Pre and post quality regulation system (grow out test - molecular markers).

Unit IV - Seed storage

Types of seed - orthodox, recalcitrant and intermediate seeds - seed storage - stages - factors affecting seed longevity - Types of seed storage - Seed treatments and containers - Mid storage treatments - Storage godown sanitation - Advances in seed storage techniques.

Unit V - Seed marketing

Seed marketing- Seed demand forecasting - Marketing organization - structure - pricing policy, factors influencing seed marketing - Farmers centric market driven approach- International seed movement - blue, green and orange certificates.

Practical

Seed certification procedures - application, registration of seed farm - sowing report - Field inspection - verification of seed source and area - isolation distance - counting procedure - reporting status of seed farm - LFR- Down grading - Post harvest inspection - kapas and cob sorting- pod verification - Visit to seed certification agency - Assigning seed lot number - Types of sample (service sample - certified sample - official sample) - seed sampling procedures - mixing and dividing - Seed moisture content estimation - Physical purity analysis - Seed germination test - Seedling evaluation - Viability test - Vigour tests - Seed health - Grow out tests and electrophoresis - Pre storage seed treatments and containers

- Layout of seed testing laboratory and seed storage godown - Visit to seed testing laboratory- Visit to grow-out test field - Seed inspection procedures by Seed Inspector at seed retail outlet - Stop Sale Order.

Theory schedule

1. Introduction and importance of seed quality regulation.
2. The Seeds Act and Rules - Composition and role of Central Seed Committee and its Sub Committee - Central Sub Committee on Crop Standards, Release and Notification of crop varieties - State Seed Sub Committee.
3. Central Seed Certification Board, State Seed Certification Agency - Central Seed Testing Laboratory cum Referral Laboratory and Notified Seed Testing Laboratories - Seed Inspector - duties and responsibilities - offences and penalties.
4. Seeds (Control) Order 1983 and labeling- seed standards – PPV&FRA 2001- National Seed Policy 2002 - salient features of Seed Bill 2004.
5. Seed certification - definition - phases - procedures.
6. Field inspection, field counts, field and seed standards- LFR- Downgrading- Post harvest inspection and seed quality assurance.
7. Processing, bagging and tagging - Assigning of seed lot number - Sampling- Validity period - Revalidation.
8. Seed testing - importance - Seed sampling procedures - mixing and dividing.
9. Mid-semester examination.
10. Seed quality assessment (seed moisture content, physical purity, ODV).
11. Seed germination test and quick viability test.
12. Vigour tests and seed health test.
13. Pre and post quality regulation system (grow out test - molecular markers).
14. Types of seeds- orthodox, recalcitrant and intermediate-Seed storage - stages - factors affecting seed longevity - Types of seed storage.
15. Seed treatments and containers - Mid storage treatments -Storage godown sanitation - Advances in seed storage techniques - ultra dry storage, modified atmospheric seed storage and cryopreservation.
16. Seed marketing- seed demand forecasting- marketing organization- structure- - pricing policy.
17. Factors influencing seed marketing- farmers centric market driven approach- International seed movement – blue, green and orange certificate.

Practical

1. Application, registration of seed farm- sowing report.
2. Field inspection - verification of seed source and area - isolation distance - counting procedure - reporting status of seed farm- LFR- Down grading.
3. Post harvest inspection - kapas and cob sorting- pod verification.
4. Visit to seed certification agency.
5. Assigning seed lot number - types of sample - service sample-certified sample-official sample- sampling - mixing and dividing.
6. Seed moisture content estimation.
7. Physical purity analysis.
8. Seed germination test and seedling evaluation.
9. Practicing viability test.
10. Practicing vigour tests.
11. Seed health assessment test.
12. Grow out test and electrophoresis.
13. Pre storage seed treatments and containers - Layout of seed testing laboratory and seed

storage godown.

14. Visit to seed testing laboratory.
15. Visit to grow-out test field.
16. Seed inspection procedures by Seed Inspector at seed retail outlet – Stop Sale Order
17. Final practical examination.

Out come

The students will gain knowledge about the seed quality regulation system, certified seed production method and seed marketing.

Standard Text Books

1. Indian Minimum Seed Certification Standards. 2014. Published by GOI, MOA, New Delhi.
2. Seed legislations. 2014. Published by GOI, MOA, New Delhi.

Online references

1. www.fao.org
2. www.seednet.gov.in
3. www.agricoop.nic.in
4. www.online library.willey.com
5. www.sciencedirect.com

e-journals

1. Seed Science Research (www.jgateplus.com)
2. Seed Science and Technology (www.jgateplus.com)

e- books

1. ―Seeds‖, Baskin, Carol. Academic Press. (Elsevier e-books) (ISBN No. 9780124166776).
2. *"Seeds" Derek Bewley, Kent. (Springer e- books) (www-link-springer.com) (ISBN NO. 978-1-4614-4693-4)*

III year VI semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 304	Principles and practices of cropping and Farming Systems	1+1
2.	16 AGR 303	Crop Production – II	0+1
3.	16 SAC 302	Crop and Pesticide Chemistry	2+1
4.	16 AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1 +1
5.	16 AEN 302	Pests of Horticultural Crops and their Management	1+1
6.	16 NST 301	Fundamentals and Applications of nanotechnology	1+0
7.	16 FPE 301	Post Harvest and Food Engineering	1+1
8.	16 ENS 301	Environmental Pollution and Management	1+1
9.	16 HOR 311	Production Technology of Vegetables and Spice crops	2+1
10.	16 ENG 301	Soft skills for Employability	0+1
11.	16 EXP 301	Experiential Learning - I*	0+3
12.	16 PAT 301	Principles of plant disease management	1+1
	Total		**11+13=24**

16 AGR 304 PRINCIPLES AND PRACTICES OF CROPPING AND FARMING SYSTEM (1+1)

Unit - I: Cropping System

Cropping systems - Definition - Principles - Concepts - Classification - mono cropping - intensive cropping - cropping systems of India and Tamil Nadu - Interaction between different cropping systems - Cropping system management - Resource management - land, nutrient, water and weed.

Unit - II: Evaluation of Cropping System

Index for evaluation of cropping systems - Land use - yield advantages - Economic evaluation - sustainability.

Unit - III: Farming System

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems - interaction between enterprises.

Unit - IV: Evaluation of Farming System

Resource recycling in IFS - Evaluation indicators of integrated farming system - LEIA & HEIA - concepts and principles - Conservation agriculture - principles, concept and scope.

Unit - V: Resource and labour management in farming system

Resource management under constraint situation - Cost reduction strategies in crop production - Non-monetary inputs and low cost technologies - Labour management - farming system and environment.

Practical:

Preparation of cropping scheme - working out input requirements for crops, cropping systems - preparation of calendar of operations for wetland, irrigated upland and dry land cropping system - visit to cropping system experiments - working out indices for evaluation of cropping systems - visit to different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas - study on evaluation indicators on farming system - preparation of integrated farming system models for different eco-systems - on farm field visit - analysis of farming system models.

Theory - Lecture Schedule

1. Cropping system: Definition, Principles and basic concepts.
2. Classification of cropping system - Mono cropping, intensive cropping, multiple cropping, mixed cropping.
3. Major cropping systems prevailing in India and Tamil Nadu for different agro eco systems.
4. Complementary and competitive interaction in different cropping system - light, nutrient, water and weed.
5. Cropping system management : agronomic requirement for crops and cropping system selection of crops and varieties, tillage and land shaping, plant population and crop geometry.
6. Cropping system management: agronomic requirement for crops and cropping system water management, soil fertility management and plant protection.
7. Indices for evaluation of cropping system - land use, yield advantage and economics.

8. Mid Semester Examination

9. Farming system: definition, principles and concepts and factors influencing choice and size of enterprises.

10. Scope and advantages of integrated farming system.

11. Allied enterprises for wetland, irrigated upland and dryland - selection and management and their interaction.

12. Resource recycling in integrated farming system.

13. Integrated Farming System evaluation indicators.

14. Integrated farming system - models for wetland, irrigated upland and dryland eco system.

15. Cost reduction technologies and non monetary inputs in integrated farming system.

16. LEIA and HEIA - principles and concepts and Labour management in integrated farming system.

17. Conservation agriculture and environmental impact of integrated farming system.

Practical Schedule:

1. Visit to cropping system experiments in wetland.
2. Visit to cropping system experiments in irrigated upland and dryland.
3. Preparation of cropping scheme for wetland and working out input requirement.
4. Preparation of cropping scheme for irrigated upland and working out input requirement.
5. Calendar of operations for wet land and irrigated upland cropping system.
6. Working out indices for evaluating the cropping system - land use, yield advantage.
7. Working out indices for evaluating the cropping system - Economics, sustainability.
8. Visit to dairy, goat and poultry units.
9. Visit to mushroom unit.
10. Visit to sericulture and biogas unit.
11. Preparation of integrated farming system models : wetland eco-system.
12. Preparation of integrated farming system models : irrigated upland and dryland eco systems.
13. Resource recycling in integrated farming system models of different eco systems.
14. Evaluation of integrated farming system models : wetland eco-system.
15. Evaluation of integrated farming system models : irrigated upland and dryland eco systems.
16. On-farm visit to cropping fields and integrated farming system units.
16. **Practical examination.**

References:

Palaniappan, SP and K. Sivaraman.1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.

Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House.Delhi.

S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.

16 AGR 303 CROP PRODUCTION - II 0+1

Any irrigated dry crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame)

Practical Schedule for Irrigated dry crop (Eg. Maize):

- Ecosystem - Climate and weather - Seasons and varieties of Tamil Nadu
- Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre- emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water management - Pest management - Observation on nutrient and weeds - Recording growth, yield attributes and yield
- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics

Practical Schedule:

1. Study of ecosystems, climate, weather, seasons and varieties of Tamil Nadu
2. Selection of field for maize cultivation
3. Acquiring skill in seed treatment practices
4. Study and Practice of main field preparation for maize
5. Practicing of application of manures and fertilizers for maize
6. Practicing sowing of maize
7. Acquiring skill in pre-emergence application of herbicides
8. Estimation of plant population and acquiring skill in gap filling and thinning
9. Observation on nutritional deficiency symptoms and corrective measures
10. Study of weeds and weed management in maize
11. Recording growth parameters and assessing dry matter production
12. Study of water management practices for maize
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters in maize
15. Harvesting, threshing and cleaning of the produce
16. Working out cost of cultivation and economics
17. **Practical Examination**

References:

Ahlawat, I.P.S., Om Prakash and G.S.Saini.2010. Scientific Crop Production in India. Rama Publishing House, Meerut.

Crop Production Guide. 2012. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.

Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.

E-References:

www.cimmyt.org

16 SAC 302 CROP AND PESTICIDE CHEMISTRY 2+1

Aim:

To impart knowledge on the chemistry and nutritional significance of various field and horticultural crops so as to include them in the breeding and biofortification programmes towards nutritional security. This course will also impart knowledge on different pesticides, their nature and, mode of action and their fate in soil so as to monitor their effect on the environment

Syllabus - Theory

Unit-l- Chemistry of Agricultural Crops

Chemical constituents of plants - Proximate and ultimate constituents - Chemical composition and nutritional quality of cereals, pulses, fibre and forage crops. Chemical composition and nutritional quality of oilseeds and sugarcane. Post harvest changes in Sugarcane. Chemistry of fats and oils.

Unit-Il- Chemistry of Horticultural Crops, alkaloids and Essential oils

Chemical composition and nutritional quality of fruits, vegetables, spices, condiments, narcotics and beverages. Post harvest changes in fruits. Chemistry of essential oils and alkaloids - Medicinal and aromatic plants.

Unit –III- Pesticide and its Formulations and Insecticides

Pesticides - Definition - Pesticides - classifications-Trends in pesticide use. Pesticide formulations -dusts, wettable powders, emulsifiable concentrate, granules. Insecticides - classification-. Characteristics, Mode of action and use of organochlorine compounds-Organophosphates - Carbamates - Pyrethroids , Botanicals, Microbial Insecticides, Insect Growth Regulators and Newer insecticides.

UNIT IV - Fungicides ,Rodenticides, Herbicides &PGRs

Fungicides - classification of fungicides -properties, mode of action of inorganic ,organic and systemic fungicides - Rhodenticides- Zinc phosphide - Aluminium phosphide - Bromodiolone Herbicides - classification - properties - mode of action of inorganic and organic herbicides like phenoxy compounds, substituted ureas, amides, thiocarbamates, triazines, pyridines, imidazolines and sulphonyl ureas. PGRs -Auxins, Gibberellins, cytokinins,ABA, Ethylene and brassinosteroids

Unit-V-Pesticides and Environment

Insecticide Act and Insecticide Rules - Fate of pesticides in soil- Impact of pesticides on environment

Lecture schedule

1. Proximate and ultimate constituents of plants.
2. Chemical composition and nutritional quality of cereals - Rice, wheat, maize, sorghum, ragi and pearl millet. Synthesis of starch
3. Chemical composition and nutritional quality of pulses - Red gram, blackgram, greengram, cowpea, lablab and soybean-Protein synthesis
4. Chemistry of fibre crops- Cotton, jute, sunhemp and mesta

5. Chemical composition and nutritional quality of forage crops
6. Chemical composition and nutritional quality of oil seed crops - Groundnut, sesame, sunflower, castor, coconut and palm.
7. Chemical composition and nutritional quality of sugar crops- sugarcane and sugar beet - Sucrose synthesis - Post harvest changes in sugarcane
8. Chemistry of fats and oils (Physical, Chemical properties and Analytical constants)
9. Chemical composition and nutritional quality of fruits - Mango, banana, papaya, grapes, guava, sapota, citrus, amla, apple and pomegranate.
10. Chemistry of post harvest changes in fruits.
11. Chemical composition and nutritional quality of vegetables -Tomato, bhendi, brinjal, moringa, gourds and greens.
12. Chemical composition and nutritional quality of cabbage, cauliflower, potato, radish and peas.
13. Chemical composition of spices and condiments - Turmeric, chillies, pepper, ginger, onion, garlic, coriander and fenugreek.
14. Chemical composition of Narcotics - Tobacco, arecanut, cocoa and opium - Beverages - Tea and coffee.
15. Essential oils in aromatic plants- Geranium, eucalyptus
16. Alkaloids in medicinal plants - Cinchona, gloriosa, coleus and aloevera
17. Mid semester examination
18. Pesticides - Definition - Pesticides - classifications-Trends in pesticide use.
19. Pesticide formulations - dusts - wettable powders flowables sprays - manufacture, characteristics and uses.
20. Pesticide formulations – sprays – emulsion concentrates – water soluble liquids-manufacture, characteristics and uses.
21. Pesticide formulations - granules, fumigants and aerosols - Manufacture - Characteristics and uses.
22. Insecticides classification -Characteristics, Mode of action and use of Organochlorines - Lindane and Endosulphan. Characteristics, Mode of action and use of Organophosphates - Phosphamidon, Malathion and Chlorpyriphos, Phorate, Dimethoate, Quinalphos and Profenophos
23. Characteristics, Mode of action and use of Carbamates - Carbaryl, carbofuran, carbosulfan and aldicarb.
24. Characteristics, Mode of action and use of synthetic pyrethroids - Deltamethrin, Fenvalerate, Cypermethrin and Lambdacyclothrin
25. Characteristics, Mode of action and use of Botanicals - nicotine pyrethrum, neem Rotenoids, Insecticide butyl amides - Characteristics, Mode of action and use of Insect Growth Regulators -Novaluron, Buprobasin and GABA inhibitors.
26. Microbial Insecticides - NPV, *Bacillus thuringiensis*, Spinosad and Protozoan insecticides. Characteristics, Mode of action and use of newer insecticides - Neonicotinoids - Imidachloprid, Thiachloprid, Acetamiprid, Flupendiamide, Fipronil, Emamectin, Thiomethoxam, Indoxacarb, Chlorantraniliprole
27. Fungicides - Classification - Inorganics - Characteristics, Mode of action and use of sulfur and copper - Wettable sulphur and Lime sulphur - Bordeaux mixture and copper oxychloride

/ copper hydroxide.

28. Organic fungicides - Dithiocarbamates - Characteristics, Mode of action and use of Mancozeb, Chlorobenzene and Chlorothalanil.
29. Systemic fungicides - Characteristics, Mode of action and use of Benomyl, Carbendazim, Metalaxyl, Quinones, Diclones, Dicarboximides.-vincozolin
30. Rodenticides - Characteristics, mode of action and use of Zinc phosphide - Aluminium phosphide -Bromodiolone
31. Herbicides - Classification of herbicides - Characteristics, Mode of action and use of 2, 4-D, Sulfonyl ureas - Metsulfuron, Pyrosulfuron, Imidazoline.
32. Characteristics, Mode of action and use of Alachlor, Butachlor, Oxyfluorfen, Fulchloralin, Pendimethalin, Atrazine, Paraquat and Glyphosate. PGRS-Auxins,Gibbrelins,cytokinins,ABA, Ethylene and brassinosteroids
33. Highlights of Insecticide Act -1968 and Insecticide Rules -1971
34. Fate of pesticides in soil-Impact of pesticides on the environment

Practical syllabus

Estimation of moisture, ash, crude protein, P, K and crude fibre in plant samples - Determination of reducing and non-reducing sugars in jaggery —Acid and Saponification value in oils - Estimation of total solids, ascorbic acid, titratable acidity in fruits. Analysis of pesticides - Physical tests - Bulk density, wettability, suspensibility - Chemical test - Acidity &Alkalinity -Estimation of pesticide residues in water, soil and pesticidal calculations Visit to pesticide formulation unit and pesticide testing laboratory

Practical Schedule

1. Sampling, processing and storage of plant materials for chemical analysis
2. Estimation of moisture and ash content
3. Microwave digestion, preparation of di and tri acid extracts of plant samples and Estimation of P and K in triple acid extract
4. Estimation of crude protein
5. Estimation of crude fibre
6. Estimation of reducing and non-reducing sugars in jaggery
7. Estimation of acid value and saponification value in oils
8. Estimation of total solids, ascorbic acid and titrable acidity in fruit samples
9. Colloquium on-Safe handling and use of pesticide - label - storage - mixing - application methods
10. Determination of bulk density in dust formulation,Wettability and suspensibility test in wettable powder formulations
11. Estimation of emulsion stability in EC formulation
12. Estimation of acidity and alkalinity of pesticides
13. Visit to Pesticide Testing Laboratory
14. Pesticide residue analysis in water
15. Pesticide residue analysis in soil and pesticide requirement calculations
16. Visit to pesticide manufacturing unit
17. Practical Examination

Text books

1. Konard Mengel *et al.,* 2006. Principles of Plant Nutrition. 5th Edition, Springer International.
2. Vasanthi ,D, T.Chitdeshwari, M.R.Latha, C.Sudhalakshmi and A.Vadivel,2014. Text book on Crop and Pesticide Chemistry Pp.310
3. Dhakshinamoorthy, M. 2000. An Introduction to Plant Biochemistry and Chemistry of Crops, Suri Associates, Coimbatore Pp.192
4. Handa, S, K,2004. Principles of Pesticides Chemistry, Agrobios (INDIA), Jodhpur.
5. Roy,N.K, 2002. Chemistry of Pesticides.CBSPublishers &Distributors, New Delhi.

References

1. Brijesh Tiwari and Narpinder Singh. 2012. Pulse Chemistry and Technology. Scientific Publishers, Jodhpur, India.
2. Hand book of Agriculture, 2009. Published by Indian Council of Agricultural Research, New Delhi 110 012.Pp.1583
3. Paul H.Moore and Frederik C.Botha. 2014. Sugarcane : Physiology, Biochemistry and Functional Biology (World Agriculture Series). Amazon Publishers, India.
4. Petra Marschner. 2012. Marschner's mineral nutrition of higher plants.3rd Edition. ISBN: 978-0-12-384905-2.Elsevier publications.
5. Yash P. Kalra, 1998, Handbook of Reference Methods for Plant Analysis, Taylor & Francis Group, LLC, New york, London
6. Dodia, D.A., I.S.Patel and G.M.Patel. 2010. Botanical Pesticides for Pest Management. Amazon Publishers, India.
7. Gupta,A.2006. Pesticide Residue in Food commodities. Agrobios Publishers, Jodhpur.
8. Hassall, K.A. 2013. The Chemistry of pesticides, their metabolism, mode of action and uses in crop production. Scientific Publishers, Jodhpur, India.
9. Koul, 0., G.S.Dhaliwal, S.Khohar and R.Singh. 2014. Biopesticides in Sustainabie Agriculture. Progress and Potential. Amazon Publishers, India.
10. Mac Bean, C. 2013. The Pesticide Manual: A World Compendium. Amazon Publishers, India.
11. Sree Ramulu, U.S. 1979. Chemistry of Insecticides and Fungicides - Oxford and IBM Publishing Co, New Delhi.

e-references

1. www.apo-tokyo.org/OOe-books/AG-12_Leg
2. www.researchgate.net/...Chemical_composition...nutritional.../60b7d52b...
3. www.pulsecanada.com/food...nutrition/composition.../Canadian-Pea-Co...
4. www.wiley.com >... > Food Types > Functional Foods & Nutraceutical
5. www.iipr.res.in/csciences.html
6. www.aiou.edu.pk/FoodSite/Research%20Papers/48.pdf
7. www.plantphysiol.org/content/124/4/1532.full
8. www.amazon.in/Medicinal-Plants-Chemistry-Properties.../1578083958
9. www.tandfonline.com > List of Issues > Table of Contents
10. www.studiauniversitatis.ro/v15/pdf/20-2010/20.../SU20-2-10Caunii.pdf
11. www.fao.org/docrep/t0073e/t0073e01 .htm
12. www.pulseaus.com.au/.../Pulses%20Nutritional%20Value%20and%20Th..
13. www.researchgate.net/...Nutritional...oilseeds/.../9fcfd50633dab9e5d7.pd.
14. www.uvm.edu/extension/cropsoil/wp-content/uploads/turner_refining.pdf

15. journals.cambridge.org/article_S0021859600040156
16. www.intechopen.com/.../pesticides-in-the-modern-world-trends-in-pestic...
17. cibrc.nic.in/insecticides_rules.htm
18. www.agcsa.com.au/static/atm_articles/html/3_3c.html
19. www.agf.gov.bc.ca > Agriculture > Pesticide Wise

Outcome:

The students of undergraduate will gain knowledge on chemical composition and nutritional quality of various field and horticultural crops. Proper understanding of chemistry of pesticides will be inculcated among the students. The students will acquire the skills on quality monitoring of crops and pesticides through practices.

16 AEX 301 EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY 1+1

Objective

To impart knowledge to the students on different extension methods and approaches used for transfer of agricultural technology. The course will also enable to develop practical skills on preparation of different extension teaching methods.

Theory

Unit I Communication

Communication – meaning, definition, types; Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker) – elements and their characteristics; Barriers in communication.

Unit II Extension Teaching Methods

Extension teaching methods – meaning, definition, functions, classification (individual, group, mass contact methods), merits and demerits; Audio aids, Visual aids and Audio-Visual aids – definition, classification, purpose, planning, selection, combination, use; Training – definition, types, training functions of FTC, KVK, EEI, MANAGE, NAARM.

Unit III e-Extension and Agricultural journalism

e-Extension – Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS); Agricultural journalism (Print media) – definition, principles, importance, ABC of news, types of news.

Unit IV Experiential Learning and Participatory Extension

Experiential Learning (EL) – concept, three types of learning (Scientia, Techne & Praxis), Kolb‘s Cycle, Participatory Extension Approaches – RRA, PRA & PTD

Unit V Diffusion of Innovations

Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.

Practical

Study of communication pattern in State Department of Agriculture; Planning and writing of script for radio, television, print media; Planning and preparation of visual aids - charts, posters, PowerPoint slides and extension literature; Planning and practice in conduct of method demonstration, panel discussion, buzz session; Practicing PRA techniques in a village setting; Practice in handling of still camera, video camera. Study of spread and acceptance of TNAU technologies.

Theory Schedule

1. Communication – meaning, definition, types.
2. Communication models - Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker, elements and their characteristics; Barriers of communication.

3. Extension teaching methods – meaning, definition, function, classification.
4. Individual contact methods – farm and home visit, office call, telephone call, personal letter, observation, result demonstration – merits and demerits.
5. Group contact methods – method demonstration, meeting, lecture, debate, workshop, seminar, forum, conference – merits and demerits.
6. Group contact methods – symposium, panel, brainstorming, buzz session - – merits and demerits.
7. Mass contact methods – campaign, exhibition, Farmers Day, field trips, radio, television – merits and demerits.
8. Mass contact methods – written communication – circular letter, leaflet, folder, pamphlet, newspaper, newsletter - merits and demerits.
9. **Mid semester Examination.**
10. Audio aids, Visual aids, Audio-Visual aids – definitions, scope, importance, classification, merits and demerits, factors influencing planning and selection, purpose.
11. e-Extension – Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS) applications in e-Extension.
12. Agricultural journalism (Print media) – definition, principles, importance, ABC of news, types of news.
13. Training – definition, types, training functions of Farmers Training Centre (FTC), Krishi Vigyan Kendra (KVK), Extension Education Institute (EES), National Institute of Agricultural Extension Management (MANAGE), National Academy of Agricultural Research Management (NAARM).
14. Experiential Learning (EL) – concept, three types of learning (Scientia, Techne & Praxis),
    Kolb‘s Cycle.
15. Participatory Extension Approaches, Meaning, Definition, Importance, Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) – Resource Mapping, Transect Walk, Matrix ranking, Venn diagram, Seasonal calendar.
16. Diffusion of Innovations – definition, elements; Innovation – definition, attributes. Adoption – meaning, steps in adoption process,
17. Adopter categories, factors influencing adoption of innovations; Consequences of innovations.

Practical schedule

1. Understanding the communication pattern in State Department of Agriculture.
2. Planning and preparation of posters, charts and PowerPoint slides.
3. Planning and preparation of extension literature- leaflet, folder, pamphlet and booklet
4. Practice on conduct of method demonstration in a village.
5. Exercise on conducting panel discussion and buzz session.
6. Practice on script writing for Radio.
7. Practice on script writing for television.
8. Practice on script writing for newspapers.
9. Visit to All India Radio to study their media activities
10. Visit to local press (newspaper agency)to study their media activities

11. Practice on handling of still camera, video camera.
12. Study on applications of Geographical Information System (GIS) in agriculture / e-Extension.
13. Practicing PRA techniques in a village setting.
14. Preparation of interview schedule to study the spread and acceptance of TNAU technologies
15. Visit to village to study the spread and acceptance of TNAU technologies
16. Processing of data and presentation of reports.
17. **Final Practical Examination.**

References

- Ahuja, B.N. 1997. Theory and Practice of Journalism, Surjeet Publications, New Delhi.
- Chauhan Nikulsinh. 2013. Use of ICTs in Agricultural Extension, Biotech Books.
- Janakiram, B. 2007. Training and Development, Wiley India Private limited, New Delhi.
- Lynton Rolf, P and Pareek Udai. 1990. Training for Development, Vistaar Publications, New Delhi.
- Narayanasamy, N. 2009. Participatory Rural Appraisal Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
- Pandey, V.C. 2003. Information Communication Technology and Education (The Changing World ICT Governance), Isha Publishers.
- Ray, G.L. 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
- Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
- Rishipal. 2011. Training and Development Methods, S.Chand and Co. Ltd., New Delhi.
- Rogers, E.M. 2003. Diffusion of Innovations, The Free Press, New York.

Journals

- Indian Journal of Social Sciences
- Agricultural Extension Review
- Journal of Extension Education - Coimbatore
- Journal of Rural Development
- Yojana

Web resources

- www.i4d.com
- www.panasia.org
- www.joe.org

16 AEN 302 PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT (1+1)

Aim:

To impart knowledge on distribution, bionomics, symptoms of damage and management strategies of pests of horticultural crops.

Theory

Unit I: Pests of Vegetable Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus Crucifers, Cucurbits.

Unit II: Pests of Fruit Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Citrus, Banana, Guava, Grapevine, Sapota, Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack

Unit III: Pests of Tuber Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Potato, Sweet potato, Tapioca, Yam and Colocasia

Unit IV: Pests of Spices and Plantation Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

Unit V: Pests of Flower Crops, Medicinal Plants, Lawn and Stored products

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle, Lawn and Stored products.

Practical

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, spices, tubers, plantation crops, flower crops, medicinal plants, lawn and stored products.

Theory lecture schedule:

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Brinjal, Bhendi and Tomato
2. Chillies, Onion, Garlic, Moringa and Amaranthus
3. Crucifers and Cucurbits
4. Mango and Citrus
5. Banana, Guava, Grapevine and Sapota
6. Pomegranate, Papaya and Aonla
7. Apple, Pine apple, Custard apple and Jack
8. Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Midsemester examination
10. Coconut and Arecanut
11. Tea and Coffee
12. Cashew, Cocoa and Betelvine
13. Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

14. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle and lawn
16. Stored product pests
17. Strategies for stored product pest management

Practical schedule:

Identification of symptoms of damage and life stages of important pests

1. Pests of Brinjal, Bhendi and Tomato
2. Pests of Chillies, Onion, Garlic, Moringa and Amaranthus
3. Pests of Crucifers and Cucurbits
4. Pests of Mango, Citrus and Sapota
5. Pests of Banana, Grapevine and Guava
6. Pests of Pomegranate, Aonla, Papaya
7. Pests of Jack, Pine apple, Custard apple, Ber and Apple
8. Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Pests of Coconut and Arecanut
10. Pests of Coffee and Tea
11. Pests of Cashew, Cocoa and Betelvine
12. Pests of Turmeric, Ginger and Coriander
13. Pests of Cardamom, Pepper, Curry leaf and Tamarind
14. Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna and Periwinkle
16. Pests of Lawn and stored products
17. Final Practical Examination

Assignment:

- Collection and submission of 50 pests of horticultural crops
- Rearing of 15 insect pests

Outcome/Deliverables:

The students develop skills for the identification and management of pests of vegetables, fruits, tubers, plantation crops, spices, commercial flowers, medicinal plants, lawn and stored products.

References:

A. Text Book:

1. Muthukrishnan,N., N.Ganapathy, R.Nalini and R.Rajendran.2005. *Pest Management in Horticultural Crops.* New Madura Publishers, Madurai. 325p. {ISBN: 81-902832-0-0}

B. Reference Books:

2. Nair,M.R.G.K.1986. *Insects and mites of crops in India.* Publications and Information Division, ICAR, NewDelhi. 408p.
3. ParvathaReddy.2010. *Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops.* Scientific Publishers, Jodhpur. 384p. {ISBN: 978-81-7233-628-8}
4. David, B.V. and V.V.Ramamurthy.2011. *Elements of Economic Entomology.* Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}
5. Butani, D.K. and M.G.Jotwani.2013. *Insects in Vegetables.* Daya Publishing House, NewDelhi. 356p.
6. Regupathy,A. and R.Ayyasamy.2013. *A Guide on Crop Pests.* Namrutha Publications, Chennai.368p. {ISBN: 978-81-921477-1-0}

C. Supplementary references:

1. Srivastava, K.P. and D.K.Butani. 2009. *Pest Management in Vegetables* (Vol. I & II). Studium Press (India) Pvt. Ltd., New Delhi . 777p. {ISBN: 978-81-907577-3-7}
2. Ayyar, T.V.R. 1963. *Hand Book of Economics Entomology for South India.* Govt. Press Madras.
3. Sathe,T.V. 2012. *Pests of Ornamental Plants.* Daya Publishing House, New Delhi.199p. {ISBN: 978-81-7035-757-5}

D. Web resources:

1. http://agritech.tnau.ac.in/horticulture/horti_plantprotection_pest.html
2. http://www.nbaii.res.in/insectpests/pestsearch.php?cropname=Mango
3. http:www.ncipm.org.in/data bases.htm
4. ipm.illinois.edu

16 NST FUNDAMENTALS AND APPLICATIONS OF NANOTECHNOLOGY
(1+0)

Syllabus

Unit I - Principles of Nanoscience (4 Lecture) : History, definition, terminologies in nanoscience - Importance of Moore's law- Introduction to nanomaterials – Semiconductor

– Diode – Quantum Dots- Buckyball - CNT - Polymers- types – PLGA – coreshell nanoparticles - micelle - Introduction to nanobiosensor- types- properties and applications

Unit II - Synthesis of Nanomaterials (3 Lectures): Top-down and bottom-up approaches - Physical, Mechanical, Chemical and Biological synthesis of nanomaterials

***Unit III - Properties and Characterization of Nanomaterials (4 Lectures)*:** Physical, Mechanical, optical, magnetic, thermal and electrical properties – Characterization – SEM, TEM, AFM, FT-IR, XRD

Unit IV - Application of Nanotechnology (2 Lectures)

Agriculture and Food Systems

Unit V - Application of Nanotechnology (3 Lectures)

Energy, Environment, Health – Social, Economic and Ethical issues – Nanotoxicology

Lecture schedule

Unit 1 Principles of Nanoscience (4 lectures)

1. History, definition, terminology in nanoscience and importance of Moore's law.
2. Nanomaterials – Semiconductor – Diode – Quantum Dots - Buckyball - CNT – - characteristics – Applications
3. Polymers - Types – PLGA – Coreshell nanoparticles - Micelles - characteristics – Applications
4. Biosensors – Principle, Components, Types, Applications

Unit 2 Synthesis of Nanomaterials (3 lectures)

5. Top down and Bottom up approaches - Physical method, Physical Vapour Deposition (PVD), Etching - Molecular Beam Epitoxy – Sputtering – Lithography - Mechanical synthesis - Ball milling – Types - Mechanical alloying
6. Chemical synthesis – Sol-gel Method – Chemical Vapour Deposition (CVD) – electro-deposition- thin film
7. Biological synthesis using Microorganisms and Plants

Unit 3 Properties and Characterization of Nanomaterials (4 lectures)

8. Mechanical, magnetic and thermal properties of nanomaterials
9. Optical and electrical properties of nanomaterials
10. *Principle, components and application of nanotechnology equipments*: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM)
11. *Principle, components and application of nanotechnology equipments*: X-ray

Diffraction (XRD) – Fourier Transform Infra Red Spectroscopy (FT-IR) – Atomic Force Microscope (AFM)

Unit 4 Applications of Nanotechnology in Agriculture & Food Systems (2 Lectures)

12. Agriculture – Nano fertilizers – Nano-herbicides – Nano-pesticides – Seed technology
13. Nanotechnology in Food Systems – Nano foods, Nano-encapsulation of functional foods, Nano-packaging, Quality assessment.

Unit 5 Applications of Nanotechnology in Energy, Environment, Health (3 Lectures)

14. Nanotechnology applications in Energy and Environment
15. Applications in Health Sciences and Nanotoxicology

16. Social, Economic and Ethical Issues in Nanotechnology

References:

1. Nano: The essentials understanding nanoscience and Nano- T.Pradeep - 2009 - Mc Graw Hill.
2. Nano materials - B.Viswanathan - 2009 -Narosa.
3. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008 – Wiley.
4. Fundamentals of biomems and medical microdevices - Steven S.Saliterman – 2006 - Wiley Interscience.
5. Instrumental methods of analysis - Hobart H. Willam; Lynne L. Merrit – 2006 -CBS.
6. Fundamentals of physics - David Halliday; Robert Resnick – 2007 – Willey.
7. Chemistry Raymond Chang – 2009 - Tata Mcgraw Hill.
8. Nanomaterial chemistry - C.N. Rao, A. K . Chettam, A. Muller – 2007 – Wiley – VCH.
9. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

16 FPE 301 POST HARVEST AND FOOD ENGINEERING 1+1

Unit I: Post harvest losses, moisture content and properties

Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation - engineering properties of grains – mass, volume, density, porosity, sphericity – Thermal properties- applications .

Unit II: Threshing, cleaning and grading

Threshing – threshers for different crops - parts, terminology – operational safety and maintenance - winnowing – manual and power operated winnowers- cleaning, grading and sorting - types of screens - air screen cleaners- construction and operation-care and maintenance –Screen effectiveness-construction and working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator.

Unit III: Shelling, drying and storage

Shelling equipments - maize sheller, husker sheller, hand and power operated groundnut decorticator - construction and working – performance evaluation - grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - performance of dryers - storage of food grains – factors affecting storage, traditional and improved methods - modified atmosphere storage.

Unit IV: Cereals, pulses and oilseed processing

Rice processing – Parboiling- traditional and modern methods - , modern rice milling –Size reduction – principles- equipment used- wheat milling – process flow chart – roller flour mill - construction and operation - pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation - oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.

Unit V: Material handling and Food Plant layout

Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation –Food plant location – selection- layout-types- Food Packaging-requirements- types- Packaging of raw and processed foods.

Practical

Determination of moisture content - study of threshers, winnowers and graders – components, operations, adjustment and performance - determination of efficiency of maize shellers, groundnut decorticators, cleaners and graders, rice milling and pulse milling - experiments on tray and thin layer drier- experiments on screw conveyor and bucket elevator, study of improved grain storage structures – Study of packaging machine – visit to food processing industry.

Theory schedule

1. Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation – direct and indirect methods – wet basis and dry basis.
2. Engineering properties of grains – mass, volume, density, bulk density, true density, porosity, surface area and sphericity– Thermal properties-applications.
3. Threshing – threshers for different crops - parts, terminology - operational safety and aintenance.
4. Winnowing – winnowers- cleaning, grading and sorting- Types of screens - air screen cleaners- construction and operation- screen effectiveness
5. Construction and working principles of spiral separator, magnetic separator, specific

gravity separator, colour sorter and inclined belt separator

6. Construction and working of maize sheller, husker sheller, hand and power operated groundnut decorticator -care and maintenance.
7. Grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - heat sources - performance of dryers.
8. Storage of food grains – factors affecting storage, traditional methods - types -bag and bulk storage - CA and MA storage.
9. **Mid Semester Examination**
10. Rice processing – Parboiling- traditional and modern methods -modern rice milling - layout of modern rice mills.
11. Size reduction – principles- laws in size reduction- equipment used.
12. Wheat milling – process flow chart – roller flour mill - important machineries used in wheat milling – construction and operation.
13. Pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation.
14. Oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.
15. Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation.
16. Introduction to food plant design – selection of plant location - layout – types.
17. Food Packaging – requirements-types- packaging of raw and processed foods..

Practical schedule

1. Determination of moisture content by direct and indirect methods
2. Study of types of thresher and components.
3. Performance evaluation of grain winnower.
4. Performance evaluation of grader.
5. Study of maize sheller / husker sheller for maize.
6. Study of groundnut decorticator.
7. Performance evaluation of cleaner cum grader.
8. Study on paddy parboiling .
9. Study of shelling equipment for paddy .
10. Study of pulse milling equipment.
11. Experiment on tray dryer / thin layer dryer to determine drying characteristics.
12. Performance evaluation of screw conveyor
13. Performance evaluation of bucket elevator
14. Study of improved grain storage structures
15. Study of packaging machine
16. Visit to modern rice mill / oil mill / pulse mill.
17. **Final Practical Examination**.

References

1. Chakraverty,A. 2000. Third Edition. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi.
2. Sahay. K.M. and Singh,K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.

Web resources

1. www.foodnetbase.com
2. www.fao.org
3. food.oregonstate.edu/security/preserve.html
4. www.postharvest.ucdavis.edu.

16 ENS 301 ENVIRONMENTAL POLLUTION AND MANAGEMENT 1+1

Scope :

It deals with the scientific study of environmental system (air, water, soil land), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

Objectives:

- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating the students to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems and striving to attain harmony with nature.

Unit-I-Pollution in Environment-Introduction-Pollution- Pollutants – Contaminants – Source and types of pollution inSoil-Water-Air-Impact on environment-Pollution Status in India

Unit– II Waste water Management: Waste water – Different types of waste water-pollutants and contaminants-Impact of waste water on ecosystem –Eutrophication – Biomagnification – Water borne diseases –Wastewater treatment methods – Physical, chemical and Biological – General water treatments-Wastewater recycling – Constructed wetlands-Reed bed system -Legislation and standards

Unit-III-Management of polluted soils: Soil pollutants – Sources – Urban and Industrial – Heavy metal – Pesticides – PAH‘s and PCB‘s-E-Waste-Fate of pollutants in Soil - Management of soil pollution – Bio and phyto remediation of polluted soil

Unit-IV - Air Pollution and its Management: Air pollutants from industrial anddomestic sources **–** Fate of air pollutants-Air pollution indicators - Monitoring and Control measures – Role of plants in controlling air pollutants-Legislation and Air quality standards - – Noise Pollution – Sources, Effect and Control Measures-Indoor air pollution and control measures

Unit-V- Solid waste management: Solid waste –Sources – Sludge from Industry and farm waste-Characteristics – Environmental problems – Management of sludge and farm wastes – Disposal methods – Sanitary land fills – Incineration – Pyrolysis - Recycling –Energy recovery –Composting – Vermicomposting – Maturity indices assessment-Standards and Legislation

Unit-VI-Environmental standards, Regulation and EIA - Environmental standards-CPCB Normsfor discharging industrial effluents to public sewers- CDM and Carbon foot print-Environmental Impact Assessment:Stages of EIA -Monitoring and Auditing – Environmental clearance procedure in India

Lecture Schedule:

1. Introduction-Pollution- Pollutants – Contaminants – Source and types of pollution inSoil-Water-Air-Impact on environment-Pollution Status in India
2. Waste water – Different types of waste water-pollutants and contaminants-Impact of waste water on ecosystem –Eutrophication – Biomagnification – Water borne diseases –
3. Wastewater treatment methods – Physical, chemical and Biological – General water treatments-
4. Wastewater recycling – Constructed wetlands-Reed bed system -Legislation and standards
5. Soil pollutants – Sources-Urban and Industrial – Heavy metal – Pesticides- PCB‘s-E-Waste

6. Fate of pollutants in Soil - Management of soil pollution – Bio and phyto remediation of polluted soil
7. Air pollutants from industrial anddomestic sources – Fate of air pollutants-Air pollution indicators – Air pollution episodes-Monitoring and Control measures–
8. Role of plants in controlling air pollutants- Legislation and Air quality standards,
9. **Mid Semester Examination**
10. Noise Pollution, Sources, Effect and Control Measures, Indoor air pollutants and control measures
11. **S**olid waste –Sources – Sludge from Industry and farm waste-Characteristics – Environmental problems
12. Management of solid waste, Disposal methods, Sanitary land fills, Incineration, Pyrolysis
13. Recycling –Energy recovery –Composting – Vermicomposting – Maturity indices assessment-Standards and Legislation
14. Environmental standards-CPCB Normsfor discharging industrial effluents to public sewers
15. Environment Impact Assessment,Introduction,Stages of EIA, -Monitoring and Auditing
16. CDM and Carbon foot print
17. Environmental clearance procedure in India

Practical Schedule

1. Sample collection and preservation from contaminated sites.
2. Waste water treatment by physical (column study with vermiculite and activated charcoal) and chemical (Alum treatment)
3. Waste water treatment through constructed wetland system and characterization
4. Estimation of Chlorides, Phosphates in waste water
5. Analysis of Nitrogen in industrial effluent and sludge
6. Collection of PAH‘s contaminated soils and analysis by GC-MS
7. Biosorption of heavymetal (Cr) by using Water hyacinth and analysis through AAS
8. Pesticide Residue analysis in contaminated water
9. Analysis of SPM in air, Methane and CO_2 in Municipal dumping site
10. Assessing the efficiency of plants to control Indoor air pollutants
11. Analysis of Organic carbon in Sludge and Organic manure
12. Composting and Vermicomposting of farm wastes
13. Energy recovery from wastes
14. Maturity indices of compost- C:N ratio and Phytotoxicity test
15. Maturity indices of compost: starch iodine test and sulphide test
16. Visit to water treatment plant
17. Final practical examination

Reference:

1. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions).* Brooks/cole, Cengage learning publication, Belmont, USA

2. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India

E-Books: Chiras D.D., 2016. Environmental Science, Tenth Edition. Jones & Bartlett Learning, Burlington, MA. ISBN: 978-1-284-05705-8, 708 Pages

16 HOR 311 PRODUCTION TECHNOLOGY OF VEGETABLES AND SPICE CROPS 2+1

Theory

Unit I: Scope, Importance and classification of vegetables

Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu-nutritive value of vegetables –classification of vegetables – types of vegetable growing : vegetable production in kitchen garden, roof garden, truck garden, market garden,floating garden, river bed cultivation, garden for vegetable forcing – nursery management – cropping systems in vegetables. Use of growth regulators in vegetables-Protected cultivation of vegetables (tomato ,capsicum and cucumber)

Unit II: Production technology of tropical vegetable crops

Climate and soil – varieties and hybrids – seeds and sowing –raising nursery in protrays – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients -physiological disorders - maturity indices – harvest-Post harvest technology

Crops: Tomato, chilli, brinjal, bhendi, gourds (pumpkin, ash gourd, ribbed gourd, bitter gourd and snake gourd), melons (watermelon and muskmelon) onion, cassava, amaranthus and moringa, sweet potato and yams.

Unit III: Production technology of temperate vegetable crops

Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrient and growth regulators- physiological disorders - maturity indices and harvest- Post harvest technology

(**Crops:** Cabbage, brussel sprout, cauliflower, broccoli, potato, carrot, radish, beetroot, peas and french beans).

Unit IV: Status of production, scope and crop production techniques of spice crops

Spices- Scope and importance- classification of spices –role of commodity boards - Climate and soil- varieties and related species- propagation, nursery management and planting-training practices- weed and water management- nutrient management–shade regulation-harvest

Crops: Black pepper, cardamom.

Unit V: Crop production techniques in spice crops

Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation-nutrient management including drip and fertigation –harvest- Post harvest technology

Crops: Turmeric, ginger, coriander, clove, nutmeg, vanilla and curry leaf.

Practical

Vegetable crops

Layout of kitchen garden – seed sowing- nursery management– nutrient management – fertigation - practices in use of plant growth regulators - Special horticultural practices in vegetable production - study of maturity indices - protected cultivation - visit to vegetable nursery unit/ /protected cultivation unit.

Spice crops

Black pepper- Description of varieties, study of different shoots, propagation. Cardamom- Description of varieties, propagation, shade management and processing. Coriander and curry leaf- study on varietal identification, seed treatment, sowing and harvest. Clove and nutmeg- Description of varieties, propagation, training, pruning and processing. Turmeric and ginger- description of varieties- propagation- processing and curing. Vanilla- description of varieties- propagation- processing and curing. Visit to spice gardens andcommodity boards.

Theory schedule

1. Importance of vegetable growing in India and Tamil Nadu and nutritive value and classification of vegetables.
2. Types of vegetable growing : Vegetable production in nutrition garden, kitchen garden, roof garden, truck garden, market garden, floating garden, river bed cultivation, garden for vegetable forcing
3. Nursery management and cropping systems in vegetable crops
4. Use of growth regulators in vegetables
5. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of tomato.
6. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of chilli.
7. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of brinjal.
8. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing, and storage of bhendi
9. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of onion.
10. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing, and storage of gourds (pumpkin and ash gourd,) and melons (water melon and musk melon).
11. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of gourds (ribbed gourd, bitter gourd and snake gourd)
12. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients -

physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of cassava.

13. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of moringa and amaranthus.
14. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of cabbage – a brief account of brussel sprout.
15. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing,and storage of cauliflower- a brief account of broccoli.
16. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of potato, sweet potato and yams.
17. **Mid semester examination**
18. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of peas
19. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of carrot and radish.
20. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of beetroot and French beans.
21. Protected cultivation of vegetables (tomato,capsicum and cucumber)
22. Scope and Importance- classification of spices
23. Role of commodity boards
24. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices of black pepper
25. Weed and water management- growth regulation - shade regulation- nutrient management including drip and fertigation – harvest - yield - post harvest technology of black pepper.
26. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation- nutrient management including drip and fertigation –harvest-yield- post harvest technology of cardamom.
27. Climate and soil- varieties and related species- propagation, nursery management and planting- weed and water management- inter cropping- nutrient management including drip and fertigation –harvesting and curing of turmeric.
28. Climate and soil- varieties and related species- propagation, rhizome selection and

treatment - planting- weed and water management- rotation and mixed cropping – mulching - nutrient management including drip and fertigation –harvest and curing of ginger.

29. Climate and soil- varieties –seeds and sowing- propagation and planting- weed and water management- cropping system- nutrient management including drip and fertigation – harvest of coriander
30. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- cropping system nutrient management–harvest of clove.
31. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- cropping system- nutrient management–harvest of nutmeg.
32. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation- nutrient management including drip and fertigation –harvest of vanilla
33. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- nutrient management including drip and fertigation –harvest of curry leaf
34. Value addition of important spices (Black pepper, nutmeg, vanilla, Turmeric, ginger)

Practical schedule

1. Layout of kitchen garden and roof garden.
2. Seed treatment and sowing practices in direct sown vegetables
3. Nursery management of transplanted ,bulb and tuber vegetable crops
4. Nutrient management in vegetable crops - fertigation
5. Practices in use of plant growth regulators in vegetable crops
6. Special horticultural practices in vegetable production
7. Study of maturity standards and harvesting of vegetables
8. Protected cultivation of vegetable crops
9. Visit to vegetable nurseries/protected cultivation/gardens.
10. Black pepper- Description of varieties, study of different shoots, propagation

12.Cardamom- Description of varieties, propagation, shade management and processing

13.Coriander and curry leaf- study on varietal identification, seed treatment, sowing and harvest.

14.Clove and nutmeg- Description of varieties, propagation, training, pruning and processing

15.Turmeric and ginger- description of varieties- propagation- processing and curing

16.Vanilla- description of varieties- propagation- processing and curing

17.Visit to spice gardens or commodity boards.

18. Practical Examination.

References

1 Gopalakrishnan, T.R. 2007. Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency.

2. Vishnu Swarup, S. 2012. Vegetable Science and technology in India , Kalyani publisher, New Delhi.

3 Veeraragavaththam ,D., M.Jawaharlal and SeemanthiniRamadas 2000 ― A guide on vegetable Culture‖

4. Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops., IBH

Publishing Co. Pvt. Ltd., New Delhi.

5.. SandhnaPandey, S.N. Pandey and P.H.Pandy, 2013. Spice crop management and technology, Kalyani publisher, New Delhi.

Journals

1.Indian Horticulture
2.Vegetable Science
3.Indian Journal of Horticulture Science
4. Journal of Horticultural Sciences
5. Acta Horticulturae
6. South Indian Horticulture
7. Hort Science

Web resources

1. http://www.idosi.org/aejb/1(1)08/2.pdf
2. http://www.academicjournals.org/ajar/PDF/pdf 2009/Sep/Baris
3. http://pods.dasnr.okstate.edu
4. http://www.avrdc.org
5. http://www.ces.ncsu.edu
6. http://www.attra.ncat.org/attra-pub//vegetables
7. http://www.icar.org.in/dipa/events/ICAR.NEWS/volume-II

16 ENG 301 SOFT SKILLS FOR EMPLOYABILITY 0+1

Aim:

- To impart soft skills including life skills for enabling the students to become employable
- To enable the students in advanced speaking and writing skills
- To train the students communicate with confidence and conviction in group discussions and interviews.
- To facilitate learners the corporate skills.

UNIT I – Introduction to Soft Skills

Soft skills – an introduction – career skills and corporate skills - definitions.

UNIT II – Life Skills

1. Attitude

Attitude - Psychological and sociological definitions – types of attitude - consequences – suggestions to keep good attitude.

2. Emotional Intelligence

Introduction to Emotional Intelligence – four branch model of EQ - five point scale to measure EI – suggestions to improve EI.

3. Interpersonal skills

Interpersonal Skills - Study of character traits - formal interpersonal skills - greeting, enquiring, answering, complimenting and acknowledging.

4. Self Development/Empowerment

Self Development - Empowerment - SWOC Analysis - Goal setting based on the principle of SMART – self motivation strategies.

UNIT III Communication Skills

5. Types of Communication

Communication - Basic Communication Model - Verbal and Non-verbal Communication.

6. Business Communication

Writing memo - short notes – short reports, Agenda , minutes, Business proposals, newspaper advertisement.

7. Group Dynamics

Study of affiliation, participation, goal consciousness – Forming, Storming, Norming –Performing.

8. Kinesics

Definition - personal appearance, posture, gestures, facial expressions, eye contact & movements.

9.MID SEMESTER

UNIT IV – Employability Skills

10. Interview Skills – I

Definitions of interview – two types of interview – preliminary requirements for success – Resume writing – CV writing – Job application – Cover Letter-Specially designed interviews.

11. Interview Skills – II

Telephone interview – Skype interview - Panel Interview - Five stages of interview –how to answer the questions

12. Group Discussion

Definition – contexts – why and how? – techniques and skills.

UNIT V – Corporate Skills

13. Leadership qualities

Definition - basic requirements – (responsibility - self – knowledge - rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work) – leadership and vision.

14. Negotiation skills

Select definitions – functions of negotiation – kinds of negotiation – phases of the process – rules – steps to improve negotiation skills.

15. Time management

Basic skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management.

16. Stress management

Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke –different kinds of stroke – stress in interview.

17.Final practical Examination

Text book :

1. Hariharan.S., Sundararajan.N and Shanmugapriya,S.P, *Soft Skills*, MJP Publishers, Chennai.2010.

e-books:

URL : http://www.citehr.com/28484-hand-book-soft-skills-e-book-doc.html

URL : http://promeng.eu/downloads/training-materials/ebooks/soft-skills/advanced-communication-skills.pdf

Outcome:

The students will acquire a good understanding of attitude formation, of being emotionally Intelligent and there by improve their Interpersonal skills. Knowledge on Self Development, Employability Skills viz., Interview Skills, Group Discussion, Corporate Skills, Leadership qualities, Negotiation skills, Time management and Stress management will enable the students will self reliant when they get in to the world.

Practical Schedule

1. Administration of 25 item questionnaire on Emotional Intelligence and introduction to Soft Skills.
2. Attitude, its types and seven steps to overcome challenged attention.
3. Interpersonal Skills, character traits, formal interpersonal skills and demonstration.
4. Self Development, empowerment and goal setting based on the principle of SMART SWOC analysis.
5. Types of communication viz., verbal and non verbal communication and basic communication model.
6. Writing - writing memo, short notes, short reports, agenda, minutes, business proposals, newspaper advertisement.
7. Group dynamics – the study of affiliation, participation, goal consciousness, forming, storming, norming and performing.

8. Definition of kinesics - personal appearance, posture, gestures, facial expressions, eye contact and movements, observation and explanation of the body language of a public speaker.
9. **MID SEMESTER EXAMINATION.**
10. Mock interview, group interview, telephone interview, skype interview and panel interview - simulation.
11. The techniques and skills of group discussion – group discussion on select topics.
12. Leadership qualities and the basic requirements of being a leader (responsibility, rapport with subordinates, knowledge of the assignment, goal setting, decision making and team work).
13. Goal setting and decision making – exercises.
14. Negotiation skills, functions of negotiation, kinds of negotiation and the phases of the process, rules and steps to improve negotiation skills.
15. Stress management and time management – brainstorming.
16. Teacher student interaction on causes of stress in students life.
17. **FINAL PRACTICAL EXAMINATION**

REFERENCE:

Alex, *Soft skills Know yourself and know the world.* S. Chand & Co. Publishing House, New Delhi, 2009.

Beverly Jaeger, *Making Work Work for the Highly Sensitive Person*, Tata McGraw – Hill, USA, 2004.
Dipali Biswas, *Enhancing Soft Skill*, Shoraff Publishers and Distributors,2009.

Gloria. J. Galanes, Kathreine Adams, John. K. and Brilhart, *Effective Group Discussion*, Tata McGraw – Hill, New Delhi, 2004.

Jagadeesan. G. and Santhanakrishnan, R, *Soft Skills Development*, ICFAI University Press. New Delhi, 2007.

Martin Avis, *Effective Time Management Skills for Everyone*, Avis Consultancy, London, U.K, 2010.
Mayer, J.D., Salovey, P and Caruso, D.R, *Models of Emotional Intelligence*, R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge,2000.

Patsy McCarthy and Caroline Hatcher, *Presentation Skill: The Essential Guide for Students*, Sage Publications, CA, 2002.

Peggy Claus, *The Hard Truth about Soft Skills*, Harper Collins Publishers, New York, USA, 2007.
Peter. J. Gosling, *Scientists Guide to Poster Presentations*, Kluwar Academic Pub, N.Y, USA, 2002.
Richard Ellis, *Communication Skills; Step ladders to success for professionals*, Intellect Books, Chicago, USA, 2009.

Robert, A. Day, *How to Write a Scientific Paper*, ELBS, U.K, 2000.
Sarvesh Gulati, *Corporate Soft Skills*, Rupa Publishers, New Delhi, 2006.
Soleman. D, *Working with Emotional Intelligence*, Bloomsbury Publishing, London, 1998.

WEBSITES :

www.softskills.com
www.reportingskills.com
www.writing-skills.com
www.negotiation.com
www.businessballs.com
www.study-habits.com
www.timethoughts.com

16 PAT 301 PRINCIPLES OF PLANT DISEASE MANAGEMENT 1+1

UNIT I: Epidemiology and Diagnosis of Plant Diseases

Classification of plant diseases - Disease triangle- Epidemiology of plant diseases-role of weather factors in disease development and spread- survival and dispersal of plant pathogens- Disease surveillance, assessment and forecasting– Diagnosis of plant diseases- Seed health tests- chemodiagnosis, serodiagnosis and Molecular diagnosis

UNIT II: Exclusion & Avoidence

Different principles of Plant Diseases Management- Exclusion- Plant quarantine – domestic, International and Embargo - Phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India- Role of cultural practices in plant disease management.

UNIT III: Eradication

Eradication from seed and Planting materials – Eradication of diseased plants-Surgery and Rouging – Eradication of Alternate and Collateral host- different methods of eradication- Mechanical, physical , chemical and Biological methods.

UNIT IV: Protection

Protection of crops from air borne, seed borne, soil borne and vector borne plant diseases-Physical methods- soil solarization, Hot water treatment, Incineration. Chemical control of plant diseases- fungicides- Different group of fungicides and antibiotics in plant disease management- Biological control of plant diseases - Plant products and Antiviral principles- method of application- plant protection appliances.

Unit V: Immunization and Biotechnological approaches

Immunization - cross protection and host plant resistance – Types of resistance - vertical and horizontal resistance – Resistant varieties. Mechanism of resistance- structural and bio chemical resistance in plants -Biotechnological approaches for crop disease management.

Practical

Survey and Assessment of important plant diseases- Diagnosis of Plant diseases= Classification and grouping of fungicides- Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound-Calculation of fungicides quantity and methods of application of fungicides – Special methods of application. Mass multiplication of *Trichoderma viride*, *Pseudomons fluorescens* and *Bacillus subtilis* and method of application-Preparation of leaf extracts, oil emulsion of neem and antiviral principles.Cross protection-Tissue culture –meristem tip culture technique. Visit to seed Testing Laboratory and pesticide testing laboratory

Theory Schedule

18. Plant diseases –Classification based on mode of infection, inoculums built up, spread, symptoms, severity and occurrence- Disease triangle- Role of weather factors in plant disease development.
19. Survival and dispersal of Plant Pathogens
20. Disease surveillance –Different methods- surveillance report-Disease surveillance programme in Tamil Nadu. Assessment of Plant Diseases- different methods-

    Measurement of disease growth rate by Area under disease Progressive curve (ADUPC)
21. Diagnosis of plant diseases-Seed health tests, Chemodiagnosis, serodiagnosis and Molecular diagnosis
22. Exclusion- Plant quarantine – domestic, International and Embargo -phytosanitary certificate- Quarantine in India. Exotic diseases introduced into India.

23. Role of cultural practices in plant disease management. Different methods of Eradication of Plant Diseases
24. Protection –Physical methods of protection- Chemical fungicides – Definition – classification- Sulphur and Copper fungicides, mode of action and uses
25. Mercury fungicides, Heterocyclic Nitrogen compounds , Organo tin, Quinone, Benzene and Miscellaneous compounds , Mode of action and Uses
26. Mid semester examination
27. Systemic fungicides including antibiotics – classification – mode of action - uses. New generation fungicides
28. Methods of application of fungicides: seed treatment, foliar spray, soil drenching and special methods of application
29. Biological control – Definition - mechanism of action – Mass production of

    Trichoderma viride , *Pseudomonas fluorescens* & *Bacillus subtilis* - methods of application - Plant products – antiviral principles – preparation – methods of application
30. Plant Protection appliances – Duster, Sprayers, Soil injector/Soil gun, Granular applicator and slurry seed treater
31. Disease Resistance- Types- Resistant varieties. Methods of developing resistant varieties
32. Mechanisms of resistance- structural and bio chemical resistance in plants
33. Immunization technique- Cross protection against viral and bacterial diseases.
34. Biotechnological approaches in plant diseases management: Tissue culture techniques- meristem tip culture, somoclonal variation and transgenic plant production by genetic engineering.

Practical Schedule

1. Survey and Assessment of important plant diseases
2. Diagnosis of Plant diseases: Tetrazolium test, Iodine test and ELISA test
3. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter test and ELISA.
4. Classification and grouping of fungicides.
5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture and Cheshnut compound.
6. Calculation of fungicides quantity and methods of application of fungicides – Seed (wet and dry) soil, foliar and post harvest dipping.
7. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application
8. Special methods of application: Corm injection, Paring and prolinage, , root feeding and trunk injection.
9. Mass multiplication of *Trichoderma viride* and method of application
10. Mass multiplication of *Pseudomons fluorescens* and method of application
11. Mass multiplication of *Bacillus subtilis* and method of application
12. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
13. Cross protection: production of pre immunized citrus seedlings against tristeza virus.
14. Tissue culture – Production of virus free plants through meristem tip culture technique.

15. Visit to seed Testing Laboratory
16. Visit to pesticide testing laboratory
17. Practical Examination

References

1. Agrios, G. N. 2008. Plant Pathology, 5 th edition, Academic Press, New York.
2. Nene,Y.L. and Thapliyal, P.N. 1998. Fungicides in plant disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
3. Chattopadhyay,S.G. 1998. Principles and procedure of plant protection, Oxford and IBH publishing Co. Ltd., New Delhi.
4. Narayanasamy,P. 1997. Plant pathogens detections and disease control. Oxford and IBH publishing Co. Ltd., New Delhi.
5. Narayanasamy,P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.
6. Nagarajan 1983 .Dynamics of plant disease .Allied publishers,New Delhi.
7. Dinakaran,D, Arjunan,G and Karthikeyan,G.2003. Biological control of crop diseases
8. Prakasam,V., T.Raguchander and K.Prabakar, 2006. Applied Plant Pathology, A.E. publications, Coimbatore.
9. Cooke,B.M, Jones,D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

E- books

1. Agrios, G.N. 2005. Plant Pathology – (5th Edition). Academic Press, New York
2. Pal, K. K. and B. McSpadden Gardener, 2006. Biological Control of Plant Pathogens. *The Plant HealthInstructor* DOI: 10.1094/PHI-A-2006-1117-02.APS Net
3. J.M. Waller, J.M. Lenné and S.J. Waller 2002. Plant Pathologist‘s Pocketbook 3rd
    a. Edition, CABI Publishing UK
4. Cooke,B.M, Jones,D.G and Kaye, B. 2006. The Epidemiology of plant Diseases. Published by Springer, The Netherlands

On line References

www.plantdisease.com
www.cropprotection.html

VII Semester

S.No	Course No.	Course Title	Credit Hours
1.	16 AEX 401	Rural Agricultural Work Experience - RAWE (VSP+ADA+NGO+INDUSTRY)	0+5
2.	16 PRJ 401	Project Work	0+2
3.	16 AEX 402	All India Study Tour (21 days)	0+1
		Total	0+8=8

16 AEX 401 RURAL AGRICULTURAL WORK EXPERIENCE (RAWE) 0+5

Objective

To enable the students to learn and understand issues related to farming and rural development in a natural setting on real-time basis. The course also provides opportunities for the students to learn about the functioning of the extension machinery, Non-Governmental Organizations (NGOs) and Agri-business firms.

UNIT I Village Resource Inventory and Planning (using PRA tools, Rich pictures, GIS maps, secondary data, interview, etc.)

- Describe the Natural Resources - Village boundaries, topography, historical background, water resources (river, canal, tank, etc.), soil resources, vegetation (trees, crops, etc.), fodder, animal husbandry (milch cattle, poultry, goatery, fishery, etc.), wild animals, climate, land utilization pattern, etc.

- Describe the Agricultural scenario - Cropping pattern, cropping systems, farming systems, area, production and productivity of crops, adoption pattern of recommended varieties / hybrids, technologies and machinery / implements, organic farming, contract farming, etc.

- Explain the Demographic details – population, literacy, land holdings, farmers, farm women, youth, caste, labour, etc.

- Analyze the Social factors – social structure, social stratification, social change, social groups, culture, social control, leadership, social processes, migration, social customs, social issues, etc.

- Study the Socio-psychological factors – group processes / dynamics, attitude towards innovations, etc.

- Assess the Village Infrastructure - Educational institutions, Government institutes / offices, private firms / offices, NGOs, Societies, Banks, Panchayat Union / Grama Panchayat, Clubs, SHGs, FPOs, Associations, Communication facilities, transport facilities, railway station, police station, hospitals, clinics, veterinary hospital, post office, markets, community centers, religious places of worship, etc.

- Analyze the Problems / Constraints – Problem / Constraints related to farming, marketing, processing, transport, communication, access to extension and other services, etc.
- Prepare village development plans in consultation with different stakeholders.

Unit II Farm Resource Inventory and Planning (using maps, Rich pictures, farm system modeling, family tree charts, flow diagrams, interview, etc.)

- Describe the Farm boundaries, topography, water resources, soil resources, vegetation, animal enterprises, etc.
- Describe the cropping pattern, cropping system, farming system, agri-business, etc.
- Explore Farmers Practices – Indigenous Technical Knowledge (ITK).
- Identify the constraints of the system environment (natural, economic, social, political, legal).
- Assess the linkages with Extension agencies, Markets, Input agencies, Media, Development departments, etc.
- Identify and describe all the people involved in the farm, their work, roles, visions, needs, values, interests and relationships.
- Analyze the system in terms of satisfying current needs. What are the critical factors that need
  to be managed to sustain the system? Are there opportunities for growth and development to satisfy the future needs of the system? Are there threats that also need to be managed?
- Describe the different sub-systems viz., production sub-system, management sub-system, marketing sub-system, human activity sub-system, landscape and natural sub-system, etc., and their relationships.
- Identify the linkages with the Supra System viz., economic, political, legal and social.
- Find out the adoption pattern of recommended varieties / hybrids, technologies, machinery / implements, etc.

- Analyze the financial status and performance of the system - Economics of production (area, production, productivity, yield gaps, net returns, cost benefit ratio, etc).

- Prepare farm development plans for different types of farmers, by involving them so as to improve their systems.

Unit III Studying activities of State Department of Agriculture

Visit to Office of Assistant Director of Agriculture to study the organizational structure, functions, duties and responsibilities of extension personnel, ATMA, schemes implemented, extension activities conducted, etc. Involve in different extension activities such as village meetings, demonstrations, campaigns, exhibition, radio / TV programmes and record observations and lessons learnt.

Unit IV Studying activities of an NGO

Visit to an NGO to study the organizational pattern, functions, projects, duties and responsibilities of staff, extension activities, schemes implemented, funding sources, etc.

Unit V Studying activities of an Agri Business Firm

Visit to an Agri-business firm to study the business activities, projects, managerial functions viz., planning, supervision, delegation, communication, budgeting, and related aspects.

16 AEX 402 ALL INDIA STUDY TOUR (0+1)

Objective

The course will provide an opportunity to the students to study the functioning of important national and international institutes related to agriculture and allied fields.

Syllabus

- 21 days visit to important National and International institutes related to agriculture, horticulture, forestry and allied fields in various regions of our country. Exposure to varied agro-climatic zones, crops grown, cultivation practices, socio-economic and cultural features of the farming community in different parts of the country.

VIII Semester

S.No.	Course No.	Course Title	Credit Hours
1.	16 AGR 401	Organic Farming	1+1
2.	16 PBG 401	Breeding Field and Horticultural crops	2+1
3.	16 PAT 401	Diseases of Horticultural crops and their management	2+1
4.	16 AEC 401	Agricultural Finance, Banking and Co-operation	1+1
5.	16 HOR 411	Production Technology of Flowers, Medicinal and Aromatic Crops	2+1
6.	16 EXP 401	Experiential Learning – II	0+3
7.	16 ENS 401	Climate Change and Disaster Management	2+0
8.	16 OPT 401	Optional Course	1+1
		Total	**11+9= 20**

16 AGR 401 ORGANIC FARMING (1+1)

Theory:

Unit - I: Components and Principles of Organic Cotton

Organic farming: Definition - Scope - principles and concepts - history of organic farming - global scenario - biodiversity: importance and measure to preserve biodiversity - pre requisites for Organic farming:- Soil organic carbon: status and improvement strategies.

Unit - II: Organic sources of Nutrients

Organic sources of nutrients - manures and other inputs - on farm and off farm sources - organic waste recycling - methods - Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers.

Unit - III: Non - Chemical weed and Pest disease management

Non-chemical weed management methods: preventive, physical, cultural, mechanical and biological measures - Bio-intensive pest and disease management.

Unit - IV: Indigenous Technical Knowledge (ITK)

Indigenous Technical Knowledge (ITK) in organic agriculture - scientific rationale - soil, nutrient, weed, water, management - prospects and problems in organic farming. **Unit - V: Certification of label**

Organic certification - NPOP guidelines - Certification agencies in India - crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities.

Practical:

Experiencing organic farming practices - soil, seed, nutrient, weed, water, pest and diseases, post - harvest management - hands on experience on bio composting, vermicomposting, ITK based biological preparations, bio - inoculants - quality aspects of inputs and products - grading, packaging - visit to organic farms, market outlets and organic certification (TNOCD).

Theory - Lecture Schedule:

1. Organic farming; definition - prospects - principles and concepts - History and genesis of organic farming in World and India: Present status in World, India and Tamil Nadu.
2. Introduction to bio - diversity; importance and measures to preserve bio - diversity.
3. Pre-requisites and basic steps for organic farming; conversation to organic farming - planning and processes in practices - IFS approach - Integration of animal components.
4. Organic carbon; status and improvement strategies - conservative tillage systems.
5. Sources of organic manures - plant, animal and microbial origin - on - farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, biogas slurry and vermicompost.
6. Off-farm resources; coir pith, press mud, oilcakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
7. Organic waste recycling methods and techniques - composting, vermicomposting, *in situ* composting - system approach.
8. **Mid-Semester Examination.**
9. Soil and crop management in organic farming; Inter cropping and companion planting, crop rotation , green manures and cover crops, mulching.
10. Weeds - Ecology - habitat management of weeds - Non - chemical weed management

methods; preventive, physical, cultural, use of tools and implements and biological measures - good crop husbandry practices.

11. Integrated pest and diseases management - bio control agents, bio rational pesticides; minerals, botanicals, soaps, trap crops, bird perches, and traditional preparations - sanitation.

12. Organic certification - procedures - certification agencies in India - labeling and accreditation processes.

13. Crop production standards - NPOP guidelines - principles, recommendations and standards - Quality considerations - assessment methods - premium and export opportunities.

14. Indigenous technical knowledge (ITK) in organic agriculture - rationale and principles - general, indigenous practices for soil, nutrient, weed, water pest and disease management in farming - ITK‘s in farmers practice.

15. Benefits and problems in organic farming.

16. Organic farming; Promotional activities; role of government and NGO‘s - action plan - policy considerations.

17. Economic evaluation of organic production systems - cost - benefit analysis and comparison with conventional systems.

Practical:

1. Resource inventory of organic farm- Soil sampling and analysis for organic carbon and pesticide residues / contaminants.
2. Raising of green manures (Sunnhemp / Daincha / Fodder cowpea).
3. Incorporation of green manure - seed treatment and raising of field crop (Rice / Maize / Cowpea / Cotton / Gingelly).
4. Hands on practice on preparatory cultivation; soil and water conservation methods.
5. Hands on experience on recycling techniques; bio-composting and vermicomposting.
6. Quantification of nutrients from organic sources and application of manures and bio-fertilizers.
7. Exposure visit to an organic farm to learn ITK based preparations.
8. Organic crop production and weed management.
9. Exposure visit to bio-pesticide and pheromone manufacturing units.
10. Organic crop production and pest management.
11. Exposure visit to bio-control agent (*Pseudomonas, Trichoderma* etc.,) production units.
12. Organic crop production and diseases management.
13. Exposure on macro quality aspects of crop produces in laboratories.
14. Hands on training on grading, packaging and post-harvest management.
15. Exposure visit to organic market out lets.
16. Exposure visit to organic certification agencies / Directorate of Organic Certification, Tamil Nadu.
17. **Practical Examination**

References:

1. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.
2. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008.

Scientific Publishers.

E:References:

www.ifoam.org
www.apeda.org
www.cowindia.org
www.ncof.org
www.earthfooda.co.uk
www.newfarm.org/training

16 PBG 401 BREEDING FIELD AND HORTICULTURAL CROPS (2+1)

Aim

Knowledge about the breeding of field and horticultural crops will be exposed to the students

SYLLABUS FOR THEORY

Unit I: Cereals

Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:

Cereals: Rice, Wheat, Grain and fodder Maize, Grain and fodder Sorghum, Pearl millet, Finger millet, Foxtail millet, Kodo millet, Little millet, Proso millet and Barn yard millet.

Unit II: Pulses, Oilseeds and Fibres

Pulses: Redgram , Bengal gram, Greengram, Blackgram, Grain and fodder Cowpea, Soybean, Horsegram and lab-lab ; Oilseeds: Groundnut, Gingelly, Mustard, Castor, Sunflower, Safflower, Niger, Jatropha, Coconut and Oilpalm; Fibres: Cotton,Jute and Mesta

Unit III; Sugars, Starch, Forages, Fumitories, Masticatories and Green manures

Sugars: Sugarcane, Sugar beet; Starch: Potato, Tapioca; Beverages: Coffee and Tea;Fumitories: Tobacco, Masticatories - Betelvine;Forage grasses: Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp*., Paragrass; Forage legumes: Lucerne, *Stylosanthes*, Desmanthus, Desmodium, Siratro, Subabul Green manures and green leaf manures: Daincha, Sunnhemp, Tephrosia, Glyricidia, Neem and Pungam

Unit IV: Horticultural crops

Breeding for other sexually propagated horticultural crops-Bhendi, tomato; Breeding for other sexually propagated horticultural crops- chilli, Brinjal, Papaya;Breeding for other clonally propagated horticultural crops- Banana, Rose, Jasmine

Unit V: Breeding for Biotic and Abiotic stresses and Quality

Breeding for pest and disease resistance - mechanisms of resistance; Breeding for Abiotic stress – drought and cold – salinity and alkalinity- mechanisms of resistance; Breeding for Abiotic stress –mechanisms of resistance; Breeding for quality produce; Ideotype breeding, PPV &FR act, 2001- Plant breeders‘ right, Farmers right, Biodiversity act, 2002; Germplasm registration.

SYLLABUS FOR PRACTICAL

Observation on floral biology – anthesis and pollination – selfing and crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record – in following crops.

- Cereals: Rice, Wheat, Maize, Sorghum, Pearl millet, Finger millet, Little millet, Kodo millet, Barn yard millet, Proso millet and Foxtail millet.
- Pulses: Redgram and Bengal gram, Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
- Oilseeds: Groundnut, Sesame, Sunflower, Safflower, Niger, Mustard. Castor, Jatropha, Coconut and Oilpalm
- Fibres: Cotton, Jute and Mesta

- Sugars: Sugarcane and sugar beet
- Starch: Potato and tapioca
- Beverages: coffee and tea
- Narcotics: Fumitories - tobacco
- Masticatories : betel vine
- Forages: Guinea grass, fodder Sorghum, fodder maize fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus*, Lucerne, fodder cowpea, *Desmanthus*, desmodium, *Stylosanthes*, siratro, subabul
- Green manures – Daincha, sunnhemp.
- Other sexually propagated horticultural crops: Chillies, bhendi, brinjal , tomato, papaya
- Other clonally propagated horticultural crops: Banana, Rose, Jasmine
- Screening techniques for biotic and abiotic stresses

  - Parental seed maintenance of hybrids, Field visit to hybrid seed production plots in Rice, Sorghum, Pearl millet, Maize, Cotton and Redgram.

Theory schedule

Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:

1. Cereals: Rice.
2. Cereals: Rice.
3. Cereals: Rice.
4. Cereals: Wheat
5. Cereals : Grain and fodder Maize
6. Cereals: Grain and fodder Sorghum, Pearl millet.
7. Cereals: Finger millet, Foxtail millet, Kodo millet, Little millet, Proso millet and Barn yard millet.
8. Pulses: Redgram , Bengal gram
9. Pulses: Greengram, Blackgram, Grain and fodder Cowpea
10. Pulses: Soybean, Horsegram, lab-lab
11. Oilseeds: Groundnut
12. Oilseeds: Gingelly and Mustard
13. Oilseeds: Castor and Sunflower
14. Oilseeds: Safflower, Niger and Jatropha
15. Oilseeds: Coconut and Oilpalm
16. Fibres: Cotton
17. Fibres:Jute, Mesta
18. **Mid Semester Examination.**
19. Sugars: Sugarcane, Sugar beet
20. Starch: Potato, Tapioca
21. Beverages: Coffee and Tea
22. Fumitories: Tobacco, Masticatories - Betelvine
23. Forage grasses: Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp*., Paragrass

24. Forage legumes: Lucerne, Stylosanthus, Desmanthus, Desmodium, Siratro, Subabul
25. Green manures and green leaf manures: Daincha, Sunnhemp, Tephrosia, Glyricidia, Neem and Pungam
26. Breeding for other sexually propagated horticultural crops-Bhendi, tomato
27. Breeding for other sexually propagated horticultural crops- chilli, Brinjal, Papaya
28. Breeding for other clonally propagated horticultural crops- Banana, Rose, Jasmine
29. Breeding for pest resistance - mechanisms of resistance
30. Breeding for disease resistance - mechanisms of resistance
31. Breeding for Abiotic stress – drought and cold. – mechanisms of resistance
32. Breeding for Abiotic stress – salinity and alkalinity - mechanisms of resistance
33. Breeding for quality produce.
34. Ideotype breeding, PPV &FR act, 2001- Plant breeders‘ right, Farmers right, Biodiversity act, 2002; Germplasm registration.

Final theory examination

Practical schedule

Observation on floral biology – anthesis and pollination – selfing – crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record in following crops.

1. Rice
2. Wheat and Maize.
3. Sorghum and Pearl millet. Finger millet, Little millet, Kodo millet, Barn yard millet, proso millet and Foxtail millet.
4. Redgram and Bengal gram
5. Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
6. Groundnut, Sesame and Sunflower.
7. Safflower, Niger, Mustard. Castor, Jatropha, Coconut and Oilpalm
8. Cotton, Jute and Mesta.
9. Sugarcane, sugar beet, potato, tapioca, coffee, tea, tobacco and betel vine.
10. Guinea grass, fodder Sorghum, fodder maize, fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus.*
11. Lucerne, fodder cowpea, *Desmanthus*, desmodium, stylo, siratro, subabul ; Green manures – daincha, sunnhemp.
12. Chillies, bhendi, brinjal , tomato, papaya Banana
13. Rose, Jasmine
14. Screening techniques for biotic stresses
15. Screening techniques for abiotic stresses.
16. Parental seed maintenance of hybrids, Field visit to hybrid seed production plots in Rice, Sorghum, Pearl millet, Maize, Cotton and Redgram.
17. **Final Practical Examination**

Outcome

The concepts of genetics and plant breeding, methodologies employed for self, cross and vegetatively propagated crops and current trends in plant breeding will be exposed.

References

- Singh, B.D. 2007. Plant breeding - Principles and methods. Kalyani Publishers,

NewDelhi.

- Phoelman, J.N. and Borthakur, 1969. Breeding Asian field crops Oxford & IBH Publishing Co., New Delhi.
- Harihar Ram and Hari Govind Singh, 1994. Crop breeding and Genetics. Kalyani Publishers, New Delhi.
- D.N.Bharadwaj.2012. Breeding Field Crops. Agrobios (India), Jodhpur - 342002
- Hari Har Ram, 2011. Vegetable Breeding– Principles and Practice, Kalyani Publishers, New Delhi.
- N.Kumar.2006. Breeding of horticultural crops- Principles and Practices. New India Publishing Agency. New Delhi
- D.A.Sleper and J.M.Poehlman. 2007. Breeding Field Crops. Blackwell Publishing Professional (USA)
- H.H.Ram. 2011. Crop Breeding and Biotechnology. Kalyani Publishers (India)

Further reading

- Chopra, V.L. 1990. Plant Breeding. Theory and Practice. Oxford and IBH Publishing Co., New Delhi.
- Daniel Sundararaj, D., G. Thulasidas, and M. Stephan Dorairaj. 1997. Introduction to Cytogenetics and Crop improvement. Popular Book Depot, Chennai - 15.
- Sharma, J.R. 1994. Principles and practice of Plant Breeding. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
- Singh, R.B., R.M. Singh and B.D. Singh, 1984. Advances in Cytogenetics and crop improvement. Kalyani Publishers, New Delhi.

Web resources

- www.cimmyt.org
- www.nbpgr.nic.in
- www.irri.org
- www.icrisat.org

16 PAT 401 DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT (2+1)

Theory

UNIT I Diseases of fruit crops

Etiology, symptoms, mode of spread, survival and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of the following crops, viz**.,**

Fruit Crops: Mango, banana, citrus, grapes, guava, sapota, pomegranate, annona, papaya, jack, pineapple, ber, aonla, apple, pear, peach, plum.

UNIT II Diseases of vegetable crops

Vegetable Crops: Brinjal, tomato, bhendi, cucurbits, crucifers, beans, peas, potato, sweet potato, beet root, raddish, cassava, yam and colacasia

UNIT III Diseases of spices and condiments

Spices and condiments: chillies, cardamom, turmeric, ginger, Onion, garlic, pepper, betel vine, fenugreek, coriander, Clove, Nutmeg and Cinnamon

UNIT IV Diseases of Plantation crops

Plantation crops: Tea, coffee, cocoa, rubber, coconut, arecanut and vanilla.

UNIT V Diseases of flower crops, medicinal plants and mushroom cultivation

Flower crops: Jasmine, rose, crossandra, chrysanthemum,Tuberose, Carnation, Lillium and Marigold; **Medicinal plants**-Gloriosa, Stevia, Coleus, Aloe. **Mushroom cultivation:** Cultivation of oyster mushroom, Milky mushroom, button mushroom and Paddy straw mushroom.

Theory Schedule

Etiology, symptoms, Mode of spread, survival, Epidemiology and management of diseases of the following crops.

1. Mango
2. Banana
3. Citrus and Grapes
4. Guava, Sapota, Pomegranate, annona and jack.
5. Papaya, pineapple, ber, aonla.
6. Apple, pear, plum, peach.
7. Post harvest diseases – Apple, Mango, banana, citrus, grapes, papaya
8. Brinjal and bhendi
9. Tomato
10. Cucurbits,
11. Cabbage, cauliflower, radish and beetroot
12. Potato, Sweet potato, and Cassava
13. Yam , colacasia, bean and peas
14. Onion and Garlic.
15. Post harvest diseases – Tomato, potato, carrot, and onion
16. Chillies,
17. Mid semester examination
18. Pepper and Betelvine,
19. Fenugreek, cinnamon, nutmeg, clove and coriander
20. Turmeric and ginger.
21. Tea

22. Coffee.
23. Coconut and Areca nut
24. Rubber
25. Cocoa , vanilla and cardamom
26. Jasmine and rose.
27. Crossandra and chrysanthemum.
28. Marigold, carnation, lilium and tuberose
29. Medicinal plants – *Gloriosa, Stevia*,
30. Coleus and *Aloe*
31. Mushroom cultivation : *Agaricus*
32. Mushroom cultivation : *Pleurotus* and *Calocybe*
33. Mushroom cultivation : *Volvariella*
34. Biotic and abiotic stresses of mushroom

PRACTICAL SCHEDULE

Study of symptoms and host parasite relationship of:

1. Diseases of mango and banana.
2. Diseases of Citrus and Grapes.
3. Diseases of Guava, sapota, pomegranate, annona, jack, papaya, pineapple, ber and aonla.
4. Diseases of apple, pear, plum, peach.
5. Diseases of tomato and brinjal.
6. Diseases of cucurbits and crucifers.
7. Diseases of bean, peas and potato.
8. Diseases of cassava, sweet potato, yam and colacasia.
9. Diseases of onion, garlic , chillies, pepper and betel vine
10. Diseases of turmeric, ginger, cardamom, fenugreek, coriander, Clove, Nutmeg, and Cinnamon
11. Diseases of tea, coffee and rubber.
12. Diseases of coconut, arecanut and vanilla.
13. Diseases of rose, jasmine, crossandra and chrysanthemum, Tuberose, Marigold, Lillium and Carnation
14. Diseases of Medicinal Plants – Coleus , Gloriosa, Stevia and Aloe
15. Mushroom cultivation: *Agaricus, Pleurotus, Calocybe* and *Volvariella*
16. Field visit
17. Practical examination.

Note: Students should submit 50 well-pressed diseased specimens.

REFERENCE BOOKS

1. Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
2. Das Gupta M.K. and Mandel W.C.1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Company,New Delhi.
3. Neeta Sharma and Mashkoor Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Co. UP.
4. Snowden, A.L.1990. A color atlas of post harvest diseases and disorders. Vol. I and II Wolfe Scientisfic Limited.

5. Pathak V.N. 1980. Diseases of Fruit crops –. Oxford and IBH publishing Co.Pvt.Limited.
6. Cook AA, 1981. Diseases of Tropical and sub tropical Field, Fiber and oil palms –. Mac. Millan Publishing Co. New Park
7. Rangaswamy C.2005, Diseases of crop plants in India –. Prentice Hall of India, Pvt. Limited, New Delhi.
8. Sohi, H.S, 1992. Diseases of Ornamental plants in India –. ICAR, New Delhi.
9. Singh, R.S. 1994. Diseases of vegetable crops –. Oxford & IBM Publishing Co.Pvt.Ltd.New Delhi
10. Madhu Meeta**, 2005.** Diseases of Ornamental Plants in India: Reference Book Cum Bibliography/. 320 p.,
11. Alfred Steferud**., 2005,** Diseases of Plantation Crops**.** Delhi, Biotech Books, , x, 317 p., ISBN 81-7622-136-8.
12. Srikant Kulkarni and Yashoda R. Hegde**, 2002**, Diseases of Plantation Crops and Their Management. Udaipur, Agrotech, 176 p., ISBN 81-85680-58-2.
13. Alfred Steferud**, 2005**, Diseases of Vegetable Crops**.** Delhi, Biotech Books, xi, 210 p., ISBN 81-7622-137-6.
14. Sonia Ahuja**, 2005,** Plant Diseases**.** New Delhi, Vishvabharti, viii, 286 p, ISBN 81-89000-42-X.
15. Dasgupta, M.K. and Mandal, W.C. 1989. Post harvest pathology of perishables. Oxford IBH publishing Co., New Delhi.

E- Books

1. Agrios, G.N. 2008. Plant Pathology, Academic Press, New York.
2. Rangasawmi ,G and Mahadevan, A. 1998. Diseases of crop Plants in India, Prentice Hall of India Pvt. Ltd., New Delhi

E-REFERENCES:

1. www.ucmp.berkeley.edu/fungi
2. www.ictv.org
3. www.vivo.library.cornell.edu

16 AEC 401 AGRICULTURAL FINANCE, BANKING AND COOPERATION

(1+1)

Objectives

This course aims at imparting knowledge on principles of finance, banking and co – operation, and farm financial analyses. This course will also help the Under Graduate students in understanding the functions of various institutions involved in farm financing and different crop insurance products implemented in India.

Theory

Unit 1: Agricultural Finance – Nature and Scope

Agricultural Finance: Definition, Importance, Nature and Scope - Agricultural credit: Meaning, Definition, Need and Classification - Sources of credit – Role of institutional and non - institutional agencies: Advantages and Disadvantages - Rural indebtedness: Consequences of rural indebtedness - History and Development of rural credit in India.

Unit 2: Farm Financial Analysis

Principles of Credit - 5C's, 3R's and 7 P's of Credit – Project Cycle and Management - Preparation of bankable projects / Farm credit proposals - Feasibility - Time value of money: Compounding and Discounting - Appraisal of farm credit proposals - Undiscounted and Discounted measures - Repayment plans - Farm Financial Statements: Balance Sheet, Income Statement and Cash Flow Statement – Financial Ratio Analysis.

Unit 3: Financial Institutions

Institutional Lending Agencies – Commercial banks: Nationalization, Agricultural Development Branches – Area Approach – Priority Sector Lending - Regional Rural Banks, Lead bank, Scale of finance - Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India – Microfinance and Its role in poverty alleviation – Self-Help Groups – Non-Governmental Organizations - Rural credit

policies followed by State and Central Government – Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme.– Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC).

Unit 4: Co-operation

Co-operation: Philosophy and Principles - History of Indian Co-operative credit movement: Pre and Post - Independence periods and Co-operation in different plan periods - Co-operative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of co-operative credit system, Policies for revitalizing co-operative credit: Salient features of Vaithiyanathan Committee Report on revival of rural co-operative credit institutions, Reorganization of Co-operative credit structure in Andhra Pradesh and single window system and Successful co-operative credit systems in Gujarat, Maharashtra, Punjab, etc. - Special Co-operatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives and functions.

Unit 5: Banking and Insurance

Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions - Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money - Financial Inclusion and Exclusion: credit widening

and credit deepening monetary policies. Credit gap: Factors influencing credit gap - Non-Banking Financial Institutions (NBFI) - Assessment of crop losses, Determination of compensation - Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation - Estimation of Crop Yields - Livestock Insurance Schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

Lecture Schedule

1. Agricultural Finance: Definition, Importance, Nature and Scope –- Agricultural credit: Meaning, Definition, Need and Classification.
2. Sources of credit – Role of institutional and non - institutional agencies: Types, Roles, Advantages and Disadvantages - Rural indebtedness: Consequences and Control measures of rural indebtedness - History and Development of rural credit in India.
3. Principles of Credit - 5C's, 3R's and 7 P's of Credit – Project Cycle and Management - Preparation and Appraisal of Bankable Projects / Farm Credit Proposals – Preparation of Feasibility Report of Project.
4. Time value of money: Compounding and Discounting Techniques – Project Appraisal: Undiscounted and Discounted measures.
5. Repayment plans - Farm Financial Statements: Balance Sheet, Income Statement and Cash Flow Statement – Financial Ratio Analysis.
6. Institutional Lending Agencies – Commercial banks: Nationalization, Agricultural Development Branches – Area Approach – Priority Sector Lending - Regional Rural Banks.
7. Lead bank: Role and Functions, Preparation of District Annual Credit Plan and Scale of finance, Kisan Credit Card (KCC) Scheme and Know Your Customer (KYC) - Rural credit policies followed by State and Central Government – Subsidized farm credit, Differential Interest Rate (DIR) Scheme – Relief Measures and Loan Waiver Scheme.
8. Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India: Role and their functions in rural credit.
9. **Mid Semester Examination**
10. Microfinance: Definition and Its role in poverty alleviation – Self-Help Groups: Characteristics, role, functions, growth and development in India – Role of Non-Governmental Organizations in promoting SHGs.
11. Co-operation: Philosophy and Principles - History of Indian Co-operative credit movement: Pre and Post - Independence periods and Co-operation in different plan periods.
12. Co-operative credit institutions: Two tier and three tier structure, Functions: Provision of short term and long term credit and Strength and weakness of co-operative credit system.
13. Policies for revitalizing co-operative credit: Salient features of Vaithiyanathan Committee Report on revival of rural co-operative credit institutions, Reorganization of Co-operative

credit structure in Andhra Pradesh and single window system and Successful co-operative credit systems in Gujarat, Maharashtra, Punjab, etc.

14. Special Co-operatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives and functions.
15. Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI: functions - Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money.
16. Financial Inclusion: credit widening and credit deepening monetary policies. Credit gap: Factors influencing credit gap - Non- Banking Financial Institutions (NBFI).
17. Assessment of crop losses, Determination of compensation - Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation - Estimation of Crop Yields - Livestock Insurance Schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

Practical Schedule

1. Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit.
2. Preparation of Bankable Projects / Farm Credit Proposals.
3. Project preparation and appraisal – Undiscounted methods.
4. Project preparation and appraisal – Discounted methods.
5. Preparation of Balance Sheet and Income Statement.
6. Preparation of Cash flow Statement and Exercise on preparation of Repayment plans.
7. Exercise on Financial Ratio Analysis.
8. Appraisal of farm credit proposals.
9. Guest lecture on Role and functions of Commercial Bank and Lead Bank.
10. Guest lecture on NABARD and its Role and Functions.
11. Visit to Regional Rural Bank to study its role and functions.
12. Visit to Primary Agricultural Co-operative Bank (PACB) to study its role, functions and procedures for availing loan.
13. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance.
14. Visit to Cooperative Agricultural and Rural Development Bank **(**Land Development Bank**)** to study procedures for availing long term credit.
15. Visit to Self-Help Group to study its characteristics, roles and functions.
16. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
17. **Practical Examination**

References

1. Muniraj, R. 1987. Farm Finance for Development. Oxford & IBH. New Delhi.
2. Subba Reddy, S and P. Raghu Ram. 2011. Agricultural Finance and Management. Oxford & IBH. New Delhi.
3. Lee, W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray. 1998. Agricultural Finance. Kalyani Publishers. New Delhi.
4. Mammoria, C.B. and R.D. Saxena. 1973. Cooperation in India. Kitab Mahal. Allahabad.
5. Patnaik, V.E. and A.K. Roy. 1988. Cooperation and Cooperative Management. Kalyani Publishers. Ludhiana.

16 HOR 411 PRODUCTION TECHNOLOGY OF FLOWERS, MEDICINAL AND AROMATIC CROPS (2+1)

Theory

Unit I: Scope, importance and fundamentals of floriculture

Fundamentals of Floriculture – Loose flowers and cut flowers - Classification – scope – area and production – Domestic and export potential of commercial flowers – protected cultivation - propagation – nursery practices – special practices like pinching, training and pruning – role of growth regulators

Unit II: Production and post harvest technology of Loose and cut flowers

Loose flower : rose, jasmine, chrysanthemum, tuberose, crossandra and marigold – Cut flowers - rose, carnation, cut chrysanthemum, gerbera, lilium, anthurium and tropical orchids – Macro and micro climate - varieties – planting methods – nutrient, water and weed management – Irrigation and fertigation — harvest - post harvest management practices – grading and packaging – export standards of loose and cut flowers –flower arrangement.

Unit III: Landscape gardening and lawn making

Ornamental Horticulture – importance of gardening — components of gardening – basic principles of landscaping – Lawn and Lawn making – use of important trees, shrubs ,climbers, plams – annuals – biennials and herbaceous perennials in gardening -designing garden

Unit IV: Production technology of medicinal crops

Medicinal crops- importance and scope – classification -conservation –- Good Agricultural practices - organic production and certification - soil and climate – varieties – propagation– planting methods – nutrient, water and weed management – harvest – post-harvest handling – storage, packaging of senna, periwinkle, glory lily, ashwagandha, medicinal coleus, aloe, Isabgol, poppy,– extraction of secondary metabolites.

Unit V: Production technology of aromatic crops

Aromatic crops - importance and scope – classification - soil and climate – varieties – propagation– planting methods – nutrient, water and weed management – harvest – post-harvest handling – storage, packaging of ocimum, davana, Japanese mint, lemon grass, citronella, geranium, rosemary, palmarosa and vetiver – distillation of essential oils.

Practical

Identification of varieties-propagation-special practices- nutrient management and disorders in rose, jasmine, crossandra, chrysanthemum, marigold, tuberose, cut rose, gladiolus, carnation, gerbera, anthurium and tropical orchids – visit to commercial floricultural units / floral oil extraction units and flower markets. Study of various components of garden – Lawn and Lawn making – identification of important trees – shrubs, creepers, annuals, biennials and herbaceous perennials used in gardening. Identification of varieties-propagation-special practices - nutrient management, processing of medicinal and aromatic crops - senna, periwinkle, glory lily, ashwagandha, phyllanthus, medicinal coleus, aloe, poppy, medicinal dioscorea, medicinal solanum, ocimum, davana, Japanese mint, lemon grass, citronella, geranium, rosemary, palmarosa and vetiver – visit to commercial medicinal and aromatic plants fields and processing units

Theory schedule

1. Fundamentals of Floriculture – Loose and cut flowers - Classification – scope –Domestic and Export potential of commercial flowers.
2. Propagation and nursery practices and special practices like pinching, training and pruning
3. Rose - varieties - soil and climate - planting- special horticultural practices - nutritional management - role of growth regulators-harvesting– post harvest management – grading and packing
4. Jasmine – varieties - soil and climate-planting- nutritional management-irrigation and weed management pressing - harvesting –post harvest handling – grading and packing.
5. Chrysanthemum – varieties - soil and climate -planting- nutritional management-irrigation and weed management - harvesting –post harvest handling – grading and packaging
6. Tuberose – varieties - soil and climate - planting-nutritional management-irrigation and weed management-harvesting –post harvest handling – grading and packing
7. Crossandra – varieties - soil and climate- planting-nutritional management-irrigation and weed management-harvesting –post harvest handling – grading and packing
8. Marigold - varieties - soil and climate - planting-nutritional management-irrigation and weed management-harvesting–post harvest handling – grading and packing
9. Protected cultivation of cut flowers.
10. Cut rose - varieties - soil and climate - planting- nutrient and water - harvesting – yield – post harvest handling–grading and packing
11. Carnation – varieties - soil and climate- planting-nutritional management-irrigation and weed management-harvesting – post harvest handling – grading and packing
12. Cut Chrysanthemum – varieties - soil and climate-planting-nutritional and water management-harvesting – post harvest handling – grading and packing
13. Gerbera - varieties - soil and climate-planting-nutrient management-irrigation - harvesting– post harvest handling – grading and packing
14. Lilium – varieties - soil and climate-planting-nutrient and water management-harvesting– post harvest handling – grading and packing
15. Anthurium and Tropical orchids – varieties - soil and climate - planting-nutrient management- irrigation -harvesting –post harvest handling – grading and packing
16. **Mid Semester Examination**
17. Importance, components of garden and basic principles of landscaping
18. Lawn and Lawn making
19. Important trees, shrubs and climbers used in ornamental gardening
20. Annuals, biennials and herbaceous perennials used in ornamental gardening.
21. Ornamental palms
22. Scope and importance of medicinal & aromatic crops- conservation methods
23. Good Agricultural Practices and Organic production and certification of medicinal and aromatic crops
24. Senna, periwinkle – varieties – soil and climate – propagation – sowing and planting. Nutrient, water and weed management – harvest and processing – post harvest handling
25. Ashwagandha and poppy – varieties – soil and climate propogation – sowing and planting- nutrient, water and weed management – harvest and processing – post harvest handling
26. Medicinal coleus, aloe – soil and climate – propagation – planting, nutrient, water and weed management – harvest, yield and processing – post harvest handling.
27. Gloriosa and lsabgol propagation – soil and climate – propagations and planting –

standards – pollination – nutrient, water and weed management – harvest, yield and processing – post harvest handling.

28. Methods of extrataction of secondary metabolites from medicinal plants
29. Ocimum, davana and Japanese mint – varieties – soil and climate – propagation - planting – nutrient, water and weed management – harvest, distillation of essential oil
30. Citronella, lemon grass - varieties – soil and climate - Propagation - planting –nutrient, Water and weed management – harvest- distillation of essential oil
31. Palmrosa and vetiver - varieties – soil and climate - Propagation - planting –nutrient, Water and weed management – harvest- distillation of essential oil.
32. Geranium and rosemary - varieties – soil and climate - Propagation - planting - nutrient, Water and weed management – harvest- distillation of essential oil.
33. Methods of distillation of essential oil from aromatic crops

PRACTICAL SCHEDULE

1. Identification of varieties and propagation, fertilizer application and pruning practices in rose, jasmine and chrysanthemum.
2. Identification and propagation of varieties of crossandra, marigold and tuberose.
3. Identification and description of varieties of cut rose, carnation and cut chrysanthemum.
4. Identification and description of varieties of gerbera, lilium, anthurium and tropical orchids.
5. Fertigation, harvesting and packing in different cut flowers.
6. Identification of important trees, shrubs, creepers and palms used in garden
7. Identification of important annuals, biennials and herbaceous perennials used in garden.
8. Lawn and lawn making
9. Identification of medicinal and aromatic plants – study on economic parts used and their products
10. Propagation techniques of senna and periwinkle and glory lily
11. Propagation techniques of medicinal coleus, isabgol and aloe.
12. Propagation techniques of ashwagandha and phyllanthus.
13. Identification of species/varieties and propagation techniques of ocimum, davana and Japanese mint
14. Identification of varieties and propagation techniques of lemon grass, palmarosa, vetiver, citronella, Rosemary and geranium
15. Visit to commercial floriculture and floral oil extraction units
16. Visit to commercial medicinal and aromatic crops field and extraction unit.
17. **Final Practical Examination**.

References

1. Bhattacharjee, S.K and De L.C (2003) Advanced Commercial Floriculture Vol. Aavishkar publishers, Distributors, Jaipur.
2. Bhattacharjee, S.K and De L.C (2005) Medicinal Herbs & Flowers, Aarishkar, Jaipur.
3. Bhattacharjee, S.K., 2004. Hand book of medicinal plants, Pointer publications, Jaipur.
4. Bose, T.K., Yadav, L.P., Pal. P., Parthasarathy, V.A., Das. P., 2003. Commercial flowers. Vol. I and II. Naya udyog, Kolkata-6.
5. Ravindrasharma (2004) Agro techniques of Medicinal plants. Daya publishing, New Delhi.
6. Trivedi, P.C. (2004) Medicinal Plants: Utilization and Conservation, Aavishkar Publisher, Distributors, Jaipur.
7. Allan M. Armitage and Judy M. Laushman ―Speciality Cut Flowers‖ , Second Edition, Published by Timber press 2003, ISBN - 0881925799

8. Atal. C. K. and B. M. Kapur. 1992. Cultivation and utilisation of medicinal plants RRL. CSIR, Jammu – Tawi.
9. Bose, T.K., Yadav, L.P., Pal. P., Das. P. and Parthasarathy, V.A., (2002) Commercial Flowers. Vol.1, Naya Prakash, Calcutta.
10. Chadha, K.L.1994. Advances in Horticulture, Vol.10. Malhotra Publishing house, New Delhi.
11. Chadha, K.L.1994. Advances in Horticulture, Vol.11. Malhotra Publishing house, New Delhi.
12. Farooqi, M., M. M. Khan and M. Vasundhara. 2004. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore – 561229.
13. Surendraprasad and Updesh Kumar (1998), Commercial floriculture, Agrobotanica, Bikaner.
14. Kumar, N. Introduction to Horticulture. 2010. Oxford and IBH Publications, New Delhi.
15. Kumar, N. Introduction to Spices, Plantation, Medicinal and Aromatic crops. 1995. Oxford and IBH Publications, New Delhi.
16. Nambisan, K.M.P.1992. Design elements of landscape gardening. Oxford and IBH Publishing Co.Pvt.Ltd.66.Janpath Newdelhi-110 001.
17. Veena Amarnath.2007.Nursery and Landscaping. AGROBIOS (India),Agro house, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342 002.

Journals

1. Amruth
2. Journal of Medicinal and Aromatic Plants

Web resources

1. http://www.theflowerexport.com
2. http:// www.intuxford.tripod.com
3. http://www .webct.uark.edu
4. http://www.pubmed.com
5. http://www.bestgarden.net/
6. http://www.indiaagronet.com/
7. http://www.intuxford.tripod.com/
8. http://www.lawngrasses.com/
9. http://www.frlht.org
10. www.herbs.org
11. www.nmpb.nic.in

16 ENS 401 CLIMATE CHANGE AND DISASTER MANAGEMENT (2+0)

Objective

1. To impart basic knowledge into climate change, impact, assessment, mitigation strategies and policies.
2. To impart theoretical knowledge on disaster, impact, management and policies

Theory

UNIT I – Climate change and it causes

Introduction to climatic fluctuations and climate change. Climate change over India and World, issues on global climate change. IPCC assessment on climate change and International conventions, role of ocean in climate change and El nino effect, climate change and global desertification process, freak monsoon cyclone; flood, drought and cyclone.

Causes of climate change - Global C, N, S and H cycles and greenhouse effect. Greenhouse gases - CO_2, CH_4, NOx, CFCs etc. Change in concentrations of greenhouse gases in atmosphere, global warming potential, etc. Biotic and abiotic factors on production and emission of greenhouse gases from terrestrial and aquatic ecosystems

UNIT II – Impact of climate change

Impacts of climate change on various systems: Agriculture, hydrology and water resources; terrestrial and fresh water ecosystems; coastal and marine ecosystems; human health; human settlements, energy, and industry; insurance and other financial services; climate change on crop diversification, loss of biodiversity, microbes and pest dynamics; climate change on weed management and soil fertility problems.

UNIT III – Measurements of climate change factors

GHG monitoring and measurement at atmosphere and different ecosystem.

UNIT IV – Mitigation and adaptation to climate change

Climatic projections from different sources. Carbon sequestration potential of various sink. Mitigation options of greenhouse gases. Physiological and biochemical effects, avoidance and adaptation mechanisms in plants and animals. CO_2 enrichment and plant response, change in quality and quantity of crop produce. Adaptation to climate change – types and improvement, developing adaptation strategies through crop simulation models. Government policies on Climate change.

UNIT IV – Basic concepts of disaster:

Definition, introduction to natural and manmade disaster, Levels of disasters, History on natural disasters in India, Disaster phenomena and events (global national and regional), Concept of risk, hazard, and vulnerability.) Hydro meteorological Disasters: Floods and flash floods: General characteristics, causes, nature and frequency of flooding, floodplains, flood hydrographs, river and coastal floods, lake outburst, cloud burst; Droughts: Causes, classification – agricultural, hydrological and meteorological droughts; drought frequency and intensity; Cyclones and Tsunami: Structure and nature of cyclones and tsunami, characteristics, factors, hazard potential; Frost, heat and cold waves: cause, intensity and extent of frost, heat and cold waves and its impact on agricultural crops. Geological disaster - Landslides: causes, susceptibility to landslides and slope failures; **Manmade Disasters**: chemical hazards, nuclear hazards, forest fire, oil spill and road accidents

UNIT V - Disaster Impact Assessment: Severity, extent of damage on agricultural production systems, economic losses affecting livelihood, social and economic perspective; Crop Loss: quantity, quality, yield, sustainability, insects, pest and disease incidence; Livestock/Fish/Poultry: Mortality, morbidity, health, reproduction yield, feed and fodder availability; Irrigation Infrastructure: siltation, damage to canal network, tube wells, open wells, dug wells, channels, ponds etc; Soil and Water: Impact on soil erosion, water availability, accessibility and quality.

Unit VI - Planning and Preparedness for Disaster Management: Strategies for disaster management planning, priority setting for preparedness strategies in agricultural production system, formulation of a disaster risk reduction plan. disaster preparedness for crops, livestock and fisheries, hazard and risk reduction strategies. role of IT, remote sensing, GIS and GPS in disaster preparedness. weather forecasting and early warning systems, flood forecasting agricultural drought monitoring and forecasting.

Unit VII Frameworks, Approaches and Methods for Disaster Risk Reduction: understanding resilience, linking vulnerability reduction and disaster recovery, disaster response and post-disaster recovery. nature and type of immediate response, disaster management plans, key response functions logistic, recovery rehabilitation reconstruction. Contingency Planning for Disaster Risk Reduction: agronomic, engineering other non-engineering interventions for drought, flood, cyclone and heat/cold waves, agro-met advisories, crop advisories, community nursery, contingent seed bank, mini-kit availability, strategies for fisheries management in flood prone areas, livestock shelters, feed and fodder banks, mass vaccination of livestock, etc

Unit VIII- Policies for Disaster Management: Disaster Management Act and Policies in India, Organizational structure for disaster management at national, state and district levels, Existing schemes and government policies to tackle agricultural disasters. Insurance and loan schemes: criteria and constraints of crop/animal insurance and credit guarantee schemes.

Suggested readings

Frame,B., Y.Medury and Y.Joshi (eds.). 1992. Global climate change – Science, Impactand Response. Proc. Indo British symposium on climate change, 15 - 17,Jan. 1992, New Delhi, 267pp.

Lal. D.S., 2012. Climatology. Published by Shradha Pustak Bhavan, Allahabad. ISBN:13– 978 81 862 04122. 448 pp

De. A.K., 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp

Dhar Chakrabarti. P.G., 2011. Disaster management & climate change - India‘s risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Banaalore. 36 pp.

Proceedings of 2nd India disaster management congress, New Delhi. Organized by National Institute of Disaster Management, New Delhi during 4 – 6, November 2009.

Theory schedule

1. Introduction to climatic fluctuations and climate change. Climate change over India and World. Issues on global climate change.
2. IPCC assessment on climate change and international conventions.
3. Role of ocean in climate change and El nino effect. Climate change and global desertification process.
4. Freak monsoon - cyclones -flood -drought –hurricane and ongoing efforts on climate change research.
5. Impact of GHG on Global warming. Global C, N, S and H cycles, greenhouse effect and causes of climate change. Greenhouse gases - CO_2, CH_4, NO_3, CFCs - Change in Conc. greenhouse gases in atmosphere and global warming potential.
6. Biotic and abiotic factors on production and emission of greenhouse gases from terrestrial ecosystems and aquatic ecosystems
7. Impacts of climate change on agriculture food security and Hydrology.
8. Impacts of climate change on Terrestrial, Coastal zones, freshwater and marine ecosystems
9. Impacts of climate change on human health and human settlements. Impacts of climate change on energy, industrial, insurance and other financial services.
10. Climate change on crop diversification, biodiversity, soil fertility, weed, pest and microbes dynamics.
11. Monitoring of GHG at atmosphere and different ecosystem.
12. CO_2 enrichment and plant response, change in quality and quantity of crop produce.
13. Mitigation options of greenhouse gases, Physiological and biochemical effects on biota avoidance and adaptation mechanisms in plants and animals
14. Carbon sequestration and sequestration potential of various sink.
15. Adaptation to climate change – types and improvement. Crop simulation models in developing adaptation strategies.
16. Government policies on Climate change.
17. Mid semester examination
18. Definition, Introduction to natural and manmade disaster, Levels of disasters, History on natural disasters in India, Disaster phenomena and events (global national and regional), Concept of risk, hazard, and vulnerability.)
19. Hydro meteorological Disasters: Floods and flash floods: General characteristics, causes, nature and frequency of flooding, flood plains, flood hydrographs, river and coastal floods, lake outburst, cloud burst; Droughts: Causes, classification – agricultural, hydrological and meteorological droughts; drought frequency and intensity.
20. Hydro meteorological Disasters: Cyclones and Tsunami: Structure and nature of cyclones and tsunamis, characteristics, factors, hazard potential; Frost, heat and cold waves: cause, intensity and extent of frost, heat and cold waves and its impact on agricultural crops.
21. Geological disasters Landslides: causes, susceptibility to landslides and slope failures;

Earthquake – Causes, magnitude and intensity

22. Manmade Disasters: chemical hazards, nuclear hazards, forest fire, oil spill and road accidents
23. Severity, extent of disaster damage on agricultural production systems, economic losses affecting livelihood, social and economic perspective; Crop Loss: quantity, quality, yield, sustainability, insects, pest and disease incidence;
24. Severity, extent of disaster damage on livestock/Fish/Poultry: Mortality, morbidity, health, reproduction yield, feed and fodder availability;
25. Severity, extent of disaster damage on Soil, Water and Irrigation Infrastructure. Soil erosion, water availability, accessibility and quality. Siltation, damage to canal network, tube wells, open wells, dug wells, channels, ponds etc.
26. Strategies for disaster management planning, priority setting for preparedness strategies in agricultural production system, livestock and fisheries, formulation of a disaster risk reduction plan.
27. Role of IT, remote sensing, GIS and GPS in disaster preparedness.
28. Weather forecasting and early warning systems, flood forecasting agricultural drought monitoring and forecasting.
29. Understating resilience, linking vulnerability reduction and disaster recovery, disaster response and post-disaster recovery.
30. Nature and type of immediate response, disaster management plans, key response functions logistic, recovery rehabilitation reconstruction.
31. Contingency Planning for Disaster Risk Reduction: agronomic, engineering other non-engineering interventions for drought, flood, cyclone and heat/cold waves, agro-met advisories, crop advisories, community nursery, contingent seed bank, mini-kit availability.
32. Strategies for fisheries management in flood prone areas, livestock shelters, feed and fodder banks, mass vaccination of livestock, etc
33. Disaster Management Act and Policies in India, Organizational structure for disaster management at national, state and district levels.
34. Existing schemes and government policies to tackle agricultural disasters. Insurance and loan schemes: criteria and constrains of crop/animal insurance and credit guarantee schemes.
35. Final theory examination