

# **CURRICULUM**



# **B.Sc. (Agriculture) DEGREE PROGRAMME**

## **DEPARTMENT WISE DISTRIBUTION OF COURSES**

### **ABSTRACT**

<b>Sl. No.</b>	<b>Department / Discipline</b>	<b>No. of courses</b>	<b>Credit hours</b>	<b>Total Credits</b>
1.	Agronomy	10	12+10	22
2.	Agricultural Economics	5	5+5	10
3.	Agricultural Extension	4	5+3	8
4.	Agricultural Entomology	3	6+3	9
5.	Agricultural Microbiology	1	2+1	3
6.	Agricultural Engineering	4	5+4	9
7.	Genetics and Plant Breeding	4	8+4	12
8.	Seed Science and Technology	1	2+1	3
9.	Soil Science & Agricultural Chemistry	3	6+3	9
10.	Plant Pathology	4	6+4	10
11.	Horticulture	4	7+4	11
12.	Nematology	1	1+1	2
13.	Biochemistry	1	2+1	3
14.	Crop Physiology	1	2+1	3
15.	Environmental Science	1	1+1	2
16.	Animal Husbandry	1	2+1	3
17.	Computer Science	1	1+1	2
18.	Mathematics	1	0+1	1
19.	Statistics	1	1+1	2
20.	Rural Agricultural Work Experience (RAWEx)	1	0+18	18
21.	Experiential Learning	4	0+20	20
	<b>Total Credit Courses</b>	<b>56</b>	<b>74+88</b>	<b>162</b>
	<b>Non Credit courses</b>			
22.	English	2	0+2	2
23.	NSS /NCC	1	0+1	1
24.	PED	1	0+1	1
25.	Short Tour	1	0+1	1
26.	All India Tour	1	0+2	2
	<b>Total Non-credit courses</b>	<b>6</b>	<b>0+7</b>	<b>7</b>
	<b>GRAND TOTAL</b>	<b>62</b>	<b>74+95</b>	<b>169</b>



## DEPARTMENT WISE DISTRIBUTION OF COURSES

### DEPARTMENT OF AGRONOMY

#### AGRONOMY

Course No.	Course Title	Cr. Hr.	Semester
AGR 101	Principles of Agronomy and Agricultural Heritage	2+1	I
AGR 102	Fundamentals of Agricultural Meteorology	1+1	II
AGR 201	Weed Management	1+1	III
AGR 202	Irrigation Management	1+1	III
AGR 203	Agronomy of Field Crops- I	2+1	IV
AGR 301	Crop Production - I	0+1	V
AGR 302	Agronomy of Field Crops- II	2+1	V
AGR 303	Crop Production – II	0+1	VI
AGR 304	Farming system and Dry Farming	2+1	VI
AGR 305	Organic farming	1+1	VI
	<b>TOTAL</b>	<b>12+10</b>	

#### AGRICULTURAL ENGINEERING

Course No.	Course Title	Cr. Hr.	Semester
AEG 101	Farm Power and Machinery	1+1	II
AEG 201	Fundamentals of Soil and Water Conservation Engineering	2+1	III
AEG 202	Renewable Energy	1+1	IV
AEG 301	Post Harvest Technology and Food Engineering	1+1	V
	<b>TOTAL</b>	<b>5 + 4</b>	

#### ANIMAL HUSBANDRY

Course No.	Course Title	Cr. Hr.	Semester
AMP 101	Livestock and Poultry Production Management	2+1	II

### DEPARTMENT OF PLANT BREEDING AND GENETICS

#### GENETICS AND PLANT BREEDING

Course No.	Course Title	Cr. Hr.	Semester
GPB 101	Principles of genetics	2+1	I
GPB 201	Principles of Plant Breeding	2+1	III
GPB 202	Principles of Plant Biotechnology	2+1	IV
GPB 301	Breeding Field crops	2+1	V
	<b>TOTAL</b>	<b>8 + 4</b>	

#### SEED SCIENCE AND TECHNOLOGY

SST 201	Principles of Seed Science and Technology	2+1	III
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#### CROP PHYSIOLOGY

CRP 101	Principles of Crop Physiology	2+1	I
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**DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY****SOIL SCIENCE AND AGRICULTURAL CHEMISTRY**

Course No.	Course Title	Cr.Hr.	Semester
SAC 101	Introduction to Soil Science	2+1	I
SAC 201	Soil Chemistry and Agrochemicals	2+1	IV
SAC 301	Manures, Fertilizers and Nutrient Management	2+1	VI
	<b>TOTAL</b>	<b>6 + 3</b>	

**BIOCHEMISTRY**

BIC 101	Fundamentals of Biochemistry	2+1	II
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**ENVIRONMENTAL SCIENCE**

ENS 101	Environmental Science	1+1	II
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**DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION****AGRICULTURAL ECONOMICS**

Course No.	Course Title	Cr.Hr.	Semester
AEC 101	Principles of Agricultural Economics	1+1	II
AEC 201	Production Economics and Farm Management	1+1	III
AEC 202	Agricultural Marketing, Trade and Prices	1+1	IV
AEC 301	Agricultural Finance, Banking and Co-operation	1+1	V
AEC 302	Principles of Agribusiness Management	1+1	VI
	<b>TOTAL</b>	<b>5 + 5</b>	

**AGRICULTURAL EXTENSION**

Course No.	Course Title	Cr.Hr.	Semester
AEX 101	Fundamentals of Rural Sociology and Educational Psychology	2+0	II
AEX 201	Dimensions of Agricultural Extension	1+1	IV
AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1+1	V
AEX 302	Entrepreneurship development	1+1	VI
AEX 401	Rural Agricultural Work Experience (RAWE)	0+18	VII
	<b>TOTAL</b>	<b>5 + 21</b>	

**COMPUTER SCIENCE, MATHEMATICS AND STATISTICS**

Course No.	Courses Title	Cr.Hr.	Semester
COM 101	Computer applications in Agriculture	1+1	I
MAT 101	Mathematics for Agriculture	0+1	I
STA 201	Applied Statistics	1+1	IV
	<b>TOTAL</b>	<b>2 + 3</b>	

**DEPARTMENT OF AGRICULTURAL ENTOMOLOGY**  
**AGRICULTURAL ENTOMOLOGY**

Course No.	Course Title	Cr.Hr.	Semester
AEN 201	Fundamentals of Entomology	2+1	III
AEN 301	Pests of Field Crops and Their Management	2+1	V
AEN 302	Pests of Horticultural crops and Their management	2+1	VI
	<b>TOTAL</b>	<b>6 + 3</b>	

**NEMATOLOGY**

Course No.	Course Title	Cr.Hr.	Semester
ANM 201	Introductory Nematology	1+1	III

**DEPARTMENT OF PLANT PATHOLOGY**  
**PLANT PATHOLOGY**

Course No.	Course Title	Cr.Hr.	Semester
PAT 201	Fundamentals of Plant Pathology	2+1	III
PAT 202	Applied Plant Pathology	1+1	IV
PAT 301	Diseases of Field Crops and Their Management	1+1	V
PAT 302	Diseases of Horticultural crops and their management	2+1	VI
	<b>TOTAL</b>	<b>6 + 4</b>	

**AGRICULTURAL MICROBIOLOGY**

Course No.	Course Title	Cr.Hr.	Semester
AGM 101	Agricultural Microbiology	2+1	I

**DEPARTMENT OF HORTICULTURE**

Course No.	Course Title	Cr.Hr.	Semester
HOR 111	Production Technology of Fruit Crops	2+1	II
HOR 211	Production Technology of Vegetables and flowers	2+1	IV
HOR 311	Production Technology of spice, aromatic, medicinal and plantation crops	2+1	V
HOR 312	Post harvest management and value addition of fruits and vegetables	1+1	VI
	<b>TOTAL</b>	<b>7 + 4</b>	

**EXPERIENTIAL LEARNING COURSES**

Course No.	Course Title	Cr.Hr.	Semester
EXP 4XX	Experiential Learning -1	0+5	VIII
EXP 4XX	Experiential Learning -2	0+5	VIII
EXP 4XX	Experiential Learning -3	0+5	VIII
EXP 4XX	Experiential Learning -4	0+5	VIII
	<b>TOTAL</b>	<b>0+20</b>	

**NON-CREDIT COURSES**

<b>Course No.</b>	<b>Course Title</b>	<b>Cr.Hr.</b>	<b>Semester</b>
ENG 101	English for effective communication	0+1	I
ENG 301	Soft skills for Employability	0+1	VI
NCC101 / NSS101	National Cadet Corps / National Service Scheme	0+1	I
PED 101	Physical Education	0+1	I
PJN 301	Short Tour	0+1	V
PJN 401	All India Tour	0+2	VII



## SEMESTER WISE DISTRIBUTION OF COURSES

### SEMESTER I

Course No.	Course Title	Cr. Hr
AGR 101	Principles of Agronomy and Agricultural Heritage	2+1
GPB 101	Principles of Genetics	2+1
SAC 101	Introduction to Soil Science	2+1
AGM 101	Agricultural Microbiology	2+1
CRP 101	Principles of Crop Physiology	2+1
COM 101	Computer applications in Agriculture	1+1
MAT 101	Mathematics for Agriculture	0+1
ENG 101	English for effective communication*	0+1
NCC101/	National Cadet Corps* /	0+1
NSS101	National Service Scheme*	0+1
PED 101	Physical Education*	0+1
	<b>TOTAL</b>	<b>11+10 = 21</b>

\* Non-credit courses

### SEMESTER II

Course No.	Course Title	Cr. Hr
AGR 102	Fundamentals of Agricultural Meteorology	1+1
AEC 101	Principles of Agricultural Economics	1+1
AEX 101	Fundamentals of Rural Sociology and Educational Psychology	2+0
AEG 101	Farm Power and Machinery	1+1
HOR 111	Production Technology of Fruit Crops	2+1
ENS 101	Environmental Science	1+1
BIC 101	Fundamentals of Biochemistry	2+1
AMP 101	Livestock and Poultry Production Management	2+1
NCC101 /	National Cadet Corps* /	0+1*
NSS101	National Service Scheme*	0+1*
PED 101	Physical Education*	0+1*
	<b>TOTAL</b>	<b>12+7 =19</b>

\* Non-credit courses continued from First semester

### SEMESTER III

Course No.	Course Title	Cr. Hr
AGR 201	Weed Management	1+1
AGR 202	Irrigation Management	1+1
GPB 201	Principles of Plant Breeding	2+1
SST 201	Principles of Seed Science and Technology	2+1
AEC 201	Production Economics and Farm Management	1+1
AEN 201	Fundamentals of Entomology	2+1
ANM 201	Introductory Nematology	1+1
AEG 201	Fundamentals of Soil and Water Conservation Engineering	2+1
PAT 201	Fundamentals of Plant Pathology	2+1
NCC101/ NSS101	National Cadet Corps* / National Service Scheme*	0+1*
PED 101	Physical Education*	0+1*
	<b>TOTAL</b>	<b>14+9 = 23</b>

\* Non-credit courses continued from First semester

### SEMESTER IV

Course No.	Course Title	Cr. Hr
AGR 203	Agronomy of Field Crops- I	2+1
GPB 202	Principles of plant Biotechnology	2+1
SAC 201	Soil Chemistry and agrochemicals	2+1
AEC 202	Agricultural Marketing, Trade and Prices	1+1
AEX 201	Dimensions of Agricultural Extension	1+1
AEG 202	Renewable Energy	1+1
PAT 202	Applied Plant Pathology	1+1
HOR 211	Production Technology of Vegetables and flowers	2+1
STA 201	Applied Statistics	1+1
NCC101/ NSS101	National Cadet Corps* / National Service Scheme*	0+1*
PED 101	Physical Education*	0+1*
	<b>TOTAL</b>	<b>13+9 = 22</b>

\* Non-credit courses continued from First semester

## SEMESTER V

Course No.	Course Title	Cr. Hr
AGR 301	Crop Production - I	0+1
AGR 302	Agronomy of Field Crops- II	2+1
GPB 301	Breeding Field crops	2+1
AEC 301	Agricultural Finance, Banking and Co-operation	1+1
AEN 301	Pests of Field Crops and Their Management	2+1
AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1+1
AEG 301	Post Harvest Technology and Food Engineering	1+1
PAT 301	Diseases of Field Crops and Their Management	1+1
HOR 311	Production Technology of spice, aromatic, medicinal and plantation crops	2+1
PJN 301	Short Tour*	0+1
	<b>TOTAL</b>	<b>12+10=22</b>

\* Non-credit course

## SEMESTER VI

Course No.	Course Title	Cr. Hr
AGR 303	Crop Production – II	0+1
AGR 304	Farming System and Dry Farming	2+1
AGR 305	Organic Farming	1+1
SAC 301	Manures, Fertilizers and Nutrient Management	2+1
AEC 302	Principles of Agribusiness Management	1+1
AEN 302	Pests of Horticultural crops and their management	2+1
AEX 302	Entrepreneurship development	1+1
PAT 302	Diseases of Horticultural crops and their management	2+1
HOR 312	Post harvest management and value addition of fruits and vegetables	1+1
ENG 301	Soft skills for Employability*	0+1
	<b>TOTAL</b>	<b>12+10=22</b>

\* Non-credit course

## SEMESTER VII

Course No.	Course Title	Cr. Hr
AEX 401	Rural Agricultural Work Experience (RAWEx)	0+18
PJN 401	All India Tour*	0+2
	<b>TOTAL</b>	<b>0+20=20</b>

\* Non-credit course

## SEMESTER VIII

Course No.	Course Title	Cr. Hr
EXP 4XX	Experiential learning – 1	0+5
EXP 4XX	Experiential learning – 2	0+5
EXP 4XX	Experiential learning – 3	0+5
EXP 4XX	Experiential learning – 4	0+5
	<b>TOTAL</b>	<b>0+20=20</b>

## ABSTRACT

Year	Semester	Theory	Practical	Total
FIRST	I	11	10	21
	II	12	7	19
SECOND	III	14	9	23
	IV	13	9	22
THIRD	V	12	10	22
	VI	12	10	22
FOURTH	VII	0	20	20
	VIII	0	20	20
<b>TOTAL</b>		<b>74</b>	<b>95</b>	<b>169</b>

# **I SEMESTER COURSES**



## **AGR 101 PRINCIPLES OF AGRONOMY AND AGRICULTURAL HERITAGE 2+1**

### **Theory**

#### **Unit I: Agriculture-Evolution and Development**

Agriculture – Definition – Importance and scope - Agriculture as Art, Science and Business – Branches of agriculture - Evolution of man and agriculture – Development of scientific Agriculture - National and International Agricultural Research Institutes - Indian agriculture - Indian economy - National income – Women in agriculture; multifaceted roles and tasks, work stress factors, Nutritional and rural life standards, role in household design making, drudgery reduction for farm women, women friendly agricultural technology. Empowerment of women; Group dynamics for farm women, rural women.

#### **Unit II: History of Agriculture/Agri. Heritage**

History of agricultural development in the world and India. 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 Arthashastra- Sangam literature - Indigenous Technical Knowledge (ITK)- Tamil Almanac and rainfall prediction.

#### **Unit III: Agro ecology**

Agronomy – Definition – Meaning and scope - Agro-climatic zones of India and Tamil Nadu – Agro ecological zones of India and Tamil Nadu - Crops and their classification – Economic and agricultural importance - Major crops of India, Tamil Nadu and Puducherry - Major soils of India, Tamil Nadu and Puducherry – Basic elements of crop production - Factors affecting crop production – climatic - edaphic- biotic - physiographic and socio economic factors. Economic ecology

#### **Unit IV: Tillage, sowing and weeding**

Tillage – Definition - Types- Objectives - Modern concepts of tillage – Main field preparations - Seeds - seed rate- sowing methods - Germination – Factors affecting germination - Crop stand establishment - Planting geometry and its effect on growth and yield - After cultivation – Thinning - Gap filling – Weeds – Definition – Effects of weeds and management of weeds - IWM - Inter cultural operations.

#### **Unit V: Nutrients, irrigation and types of farming**

Manures and fertilizers – Agronomic interventions for enhancing FUE – Irrigation - Time and methods of irrigation - Modern techniques of irrigation - Drainage and its importance - Cropping patterns and cropping systems - intensive cropping - Crop rotation - Sustainable agriculture- integrated farming systems - Farm enterprises - Organic / eco-friendly agriculture - Concepts and principles – Irrigated farming and Dry farming- Concepts and principles .

### **Practical**

Visit to college farm – Crop classification and identification of seeds - working out seed rate - Study of seed treatment practices. Study of tillage implements; ploughing; puddling; green manure crops (including calculations); Practice of methods of fertilizer

applications; Different methods of sowing; Study of seeding equipment's - Study of inter-cultivation implements and practice; Participation in ongoing field operations.

## References

1. Balsubramaniyan, P. and SP. Palaniappan, 2001. Principles and Practices of Agronomy. Agrobios. Jodhpur - 342 002.
2. Panda, S.C. 2005. Agronomy. Agrobios (India), Jodhpur - 342 002.
3. Chandrasekaran, B., K. Annadurai and E. Somasundaram. 2010. A Textbook of Agronomy. New Age International Publishers, New Delhi.
4. ICAR. 1996. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
5. Morachan, Y.B. 1980. Crop Production and Management. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Reddy, S.R. 1999. Principles of Agronomy. Kalyani Publishers, New Delhi
7. Sankaran, S. and V.T. Subbiah Mudaliar. 1997. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
8. Singh, S.S 1998. Principles and Practices of Agronomy. Kalyani Publishers, New Delhi.
9. Yellamananda Reddy, T. and G.H. Sankara Reddi 1997. Principles of Agronomy. Kalyani Publishers, New Delhi.

## GPB 101      PRINCIPLES OF GENETICS      2+1

### Theory

#### Unit I: Mendel's laws and Gene action

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, it's characteristic features and difference between chromosomal and cytoplasmic inheritance;

#### Unit II: Mutation

Mutation and it's characteristic features; Methods of inducing mutations and C I B technique. Gene expression and differential gene activation;

#### Unit III: Genes and Chromosomes

Lac operon and Fine structure of Gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram;

#### Unit IV: Cell Division and Genetic Material

Mitosis and meiosis, their significance and differences between them; DNA and it's structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis;



Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over;

#### **Unit V: Linkage and chromosomal aberrations**

Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas; Structural chromosomal aberrations.

#### **Practical:**

Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of meiosis; Preparation of micro slides and identification of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

#### **References:**

1. Gupta P.K., 1997. Cytogenetics. Rastogi Publications, Meerut
2. Strickberger. M.W. 1996. Genetics. Prentice-Hall of India Pvt. Ltd. New Delhi.
3. Singh, B.D. 2004. Fundamentals of genetics, Kalyani Publishers, Chennai.
4. Verma, P.S. and V.K. Agarwal. 2007. Genetics. S.Chand and Company Ltd./ New Delhi.
5. Stansfield, W.D. 1990. Theory and problems of genetics. Mc-Graw Hill Book Co., New York

### **SAC 101      INTRODUCTION TO SOIL SCIENCE      2 + 1**

#### **Theory**

##### **Unit I: Soil definition and formation**

Soil: Pedological and edaphological concepts, Origin of the earth, Earth's crust; Composition: Formation and classification of Rocks and minerals. Weathering, Soil forming factors and processes. Components of soils; Soil profile.

##### **Unit II: Soil physical properties**

Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, evaluation of soil structure and its significance, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil consistency, soil crusting, Soil compaction, Soil Colour, Soil water- Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, conductivity, Drainage, Methods of determination of soil moisture. Thermal properties of

soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth.

### **Unit III: Soil Chemical properties**

Soil colloids- Properties, types and its significance, Soil pH, EC and buffering capacity and its significance. Soil organic matter, Composition, Decomposability, Humus, Carbon cycle, C: N ratio.

### **Unit IV: Soil organisms**

Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

### **Unit V: Soil Survey**

Soil survey- types and methods, soil classification, soil taxonomy, and soils of India and Puducherry.

### **Practical**

Analytical chemistry -Basic concepts, techniques and calculations – Collection and processing of soil for analysis- Study of a soil profile – Identification of rocks and minerals. Determination of bulk density and particle density and porosity per cent , soil texture and mechanical analysis – Soil colour, Soil moisture determination, Hydraulic conductivity, Infiltration rate. Determination of pH, EC and Organic carbon.

### **References**

1. Brady, N.C., 2002. The Nature and Properties of Soils (13<sup>th</sup> Edition) McMillan Co., New York. Indian Publisher – Eurasia Publishing House (P) Ltd., Ramnagar, New Delhi – 55
2. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, NewDelhi
3. Fundamentals of Soil Science.2009 .ISSS Publication, New Delhi.
4. Daji A.J., (1970) A Text Book of Soil Science - Asia Publishing House, Madras.
5. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science–Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGraw-Hill Book Company INC. NewYork.
7. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersey.

## **AGM 101    AGRICULTURAL MICROBIOLOGY        2+1**

### **Theory**

#### **Unit I: History of Microbiology and Microscopy**

Contributions of Anton Von Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes; Groups of microorganisms;

Bacterial size, shape and arrangement and morphology; Structure and organization of a bacterial cell; Microscopy – principles and types.

### **Unit II: Microbial physiology, metabolism and genetics**

Bacterial growth, reproduction and factors influencing bacterial growth – Growth curve; Nutritional types and metabolic diversity of bacteria; Principles of energy generation and carbon metabolism; fermentation–respiration in bacteria. Bacterial viruses – Lytic and Lysogenic cycles; Genetic recombination.

### **Unit III: Soil Microbiology**

Distribution and importance of soil microorganisms in soil fertility - factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and Importance; Phyllosphere microorganisms - Plant-microbe and microbe-microbe interactions in soil.

### **Unit IV: Microbial transformation of nutrients in soil**

Microbial transformation of nutrients in soil - Carbon, Phosphorous and Sulphur cycle; Nitrogen cycle, Biological nitrogen fixation - symbiotic and non-symbiotic microorganisms, Process of nodulation and nitrogen fixation; Silicate and zinc solubilising bacteria; Mycorrhizae.

### **Unit V: Applied Microbiology**

Types and importance of biofertilizers in agriculture; Mass production and quality control of biofertilizers; Microbiology of water; Food microbiology-microbial spoilage and principles of food preservation; Microbial insecticides and biocontrol agents; Biogas production.

### **Practical**

Microscopy - light microscopes; Staining techniques - simple and differential staining; Sterilization – Principles and techniques, equipment and apparatus used for sterilization; Media preparation; Isolation and enumeration of soil microorganisms; Purification and preservation of microorganisms; morphological and biochemical characters of bacteria. Qualitative analyses of soil microbial profile - Organic matter decomposition – measurement of CO<sub>2</sub> evolution; Isolation of N<sub>2</sub> fixing and phosphate solubilizing microorganisms; Infection by *Arbuscular mycorrhizae*; Winogradsky column - Mass production of bacterial biofertilizers – Mass production of algal and fungal biofertilizers; Demonstration of antibiosis.

### **References**

1. Black, J.G. 2005. Microbiology: Principles and Explorations, John Wiley, USA.
2. Michael Madigan, John Martinko, Kelly S. Bender and Jack Parker. 2014. Brock Biology of Microorganisms. 14th Edition. Benjamin Cummings. England.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5th Edition, WCB Mc Graw Hill, New York.
4. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. & Painter, P.R. 1987. *General Microbiology, Fifth Edition*. MacMillan: [i]-xiv, 1-689. [Reprinted 1989]

5. Pelczar MJ, Chan ECS and Kreig NR. 1998. Microbiology, 5th edition. Tata McGraw Hill.
6. Singh, T. Purohit, S. S. and Parihar, P. Soil Microbiology. 2010. Mrs. Saraswati Purohit. India.
7. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi.
8. Adams, M. R. 2008. Food Microbiology. M. O. Moss Publisher: Royal Society of Chemistry.
9. Frazier. 1958. Food Microbiology. Tata McGraw-Hill Education.

## **CRP 101      PRINCIPLES OF CROP PHYSIOLOGY      2 + 1**

### **Theory**

#### **Unit I: Seed Physiology**

Introduction to Crop Physiology and its Importance in Agriculture. Seed - Morphological, physiological and biochemical changes during seed development, Physiological maturity – Morphological and physiological changes associated with physiological maturity in crop, Harvestable maturity, Seed viability and vigour - Factors affecting seed viability and vigour. Germination - Morphological, physiological and biochemical changes during seed germination, Factors affecting seed germination. Seed dormancy – Definition – types of seed dormancy – Advantages and disadvantages of seed dormancy – methods for breaking seed dormancy - Optimum Fruit ripening – Metamorphic changes – Climateric and non-climateric fruits – Hormonal regulation of fruit ripening.

#### **Unit II: Crop Water Relations**

Physiological importance of water to plants, Soil water availability, Water absorption, Water potential and its components, measurement of water status in plants. Transpiration - significance, Transpiration in relation to crop productivity, Water Use Efficiency, WUE in C<sub>3</sub>, C<sub>4</sub> and CAM plants, Factors affecting WUE.

#### **Unit III: Nutriophysiology**

Definition – classification of plant nutrients – Physiology of nutrient uptake – Functions of plant nutrients – Deficiency and toxicity symptoms of plant nutrients – Foliar nutrition – fertigation - Hydroponics.

#### **Unit IV: Photosynthesis and Respiration**

Energy synthesis, Significance of C<sub>3</sub>, C<sub>4</sub> and CAM pathway, Relationship of Photosynthesis and crop productivity - Translocation of assimilates, Phloem loading, apoplastic and symplastic transport of assimilates, Source and sink concept, Photorespiration, Factors affecting Photosynthesis, Methods of measuring photosynthesis, Photosynthetic efficiency, Dry matter partitioning, Harvest index of crops. Respiration and its significance, Brief account of Growth respiration and maintenance respiration, Alternate respiration – Salt respiration – wound respiration – measurement of respiration.

## **Unit V: Growth and Development**

Definition, Determinate and Indeterminate growth, Monocarpic and Polycarpic species with examples, Growth analysis, Growth characteristics, Definitions and mathematical formulae. Introduction of Photoperiodism and Vernalisation - role in flower induction. Plant Growth Regulators – definition – classification – formative effects of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators and growth retardant, Commercial application of plant growth regulators in agriculture. Senescence and abscission – Definition – Classification - associated physiological and biochemical changes and their significance. Abiotic stresses – water, temperature and salt stress – physiological changes and adaptation

## **Practical**

Preparation of solutions; Growth analysis: Calculation of growth parameters; Methods of measuring water status in roots, stems and leaves; Measurement of water potential by Potato tuber/Chardakov's method; Quantification of chlorophyll content; Measurement of leaf area by various methods; Stomatal frequency and index; Leaf anatomy of C<sub>3</sub> and C<sub>4</sub> plants; Measurement of Transpiration by petiole dip method, Bioassay for cytokinin and GA. Estimation of chlorophyll stability index and proline content.

## **References**

1. Taiz, L. and Zeiger, E., 2010. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA
2. Taiz, L., Zeiger, E. and, Ian M. Moller, 2015. Plant Physiology and Development. Publishers: Sinauer Associates, Inc., Massachusetts, USA
3. Pandey, S. N. and B. K. Sinha, 2006. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Ray Noggle, G. and Fritz, G.J., 1991, Introductory Plant Physiology, Prentice Hall of India Pvt, Ltd., New Delhi.
5. Jain, J. K., 2007. Fundamentals of Plant Physiology. S. Chand & Company Ltd., New Delhi.

## **COM 101    COMPUTER APPLICATIONS IN AGRICULTURE    1+1**

## **Theory**

### **Unit I: Introduction to computers**

Hardware, Software, FOSS, Block diagram of a computer system, Random Access Memory, Hard disks, Input devices, Output devices, Binary number system, Internet, World Wide Web, Email - CC, BCC, Forward, Reply, Linux Distributions, Ubuntu Linux, File management using Nautilus, Terminal, Trash, LibreOffice, Windows Versions, Windows Editions, File management using Windows Explorer, Command Prompt, Recycle bin

## **Unit II: Introduction to Microsoft Office**

Using MsWord - creating, saving, opening, editing document, changing font, font size, font color, bold, italic, underline, align left, right, center, justify, cut, copy, paste, Using MsExcel - creating, saving, opening, editing spreadsheet, Creating graphs, Using MsPowerpoint - Creating slide, Animation, Transition, Using MsAccess - Creating Tables, Forms, Queries and Reports

## **Unit III: Introduction to Programming using C++**

Cout, cin, if, if...else, for loop, single dimension array, two dimension array, switch..case statement

## **Unit IV: Introduction to Statistical Analysis software R**

R Console, Creating vector using `<-c()`, Creating dataset using `<-data.frame()`, Workspace management using `save.image()` and `load()`, Import dataset from tab limited text file to data frame using `read.table()`, Export dataset from data frame to tab limited text file using `write.table()`, Edit dataset using `fix()` function, Stacked and Unstacked data form

## **Unit V: Use of MsExcel / R for Statistical Analysis**

Descriptive Statistics, sum, mean, Standard deviation, Covariance, Correlation Coefficients, Two sample unpaired t test and paired T test, ANOVA, Simple and Multiple Linear regression, Simple plot

## **Practical**

Internet browsing, Working with email, File management using Nautilus in Ubuntu Linux, Trash, LibreOffice, Windows Explorer in Windows, Recycle bin, Using MsWord / LibreOffice Writer / equivalent - creating, editing, saving document, changing font, font size, font color, bold, italic, underline, align left, right, center, justify, cut, copy, paste, Using MsExcel / LibreOffice Calc / equivalent - creating, editing, saving spreadsheet, creating graphs, Using MsPowerpoint / LibreOffice Impress / equivalent - create slide, animation, & transition, Using MsAccess / LibreOffice Base / equivalent - create Tables, Forms, Queries and Reports, Using C++, create programs with cout, cin, if, if...else, for loop, single dimension array, two dimension array, switch..case statement, Using MsExcel / R / equivalent - Sum, Mean, Standard deviation, Descriptive Statistics, Correlation, Covariance, Regression, t test, ANOVA, Simple plot

## **References**

1. Balagurusamy E. 2009. Fundamentals of Computers, McGraw Hill Education.
2. John Paul Mueller. 2012. Windows 8 For Dummies Quick Reference, Wiley.
3. Christer Edwards. 2013. Instant Ubuntu, Packt Publishing.
4. Wallace Wang. 2013. Office 2013 for Dummies, John Wiley & Sons Inc.
5. E.Balagurusamy. 2014. Object Oriented Programming in C++, Tata McGraw Hill Education. Sarah Stowell, Using R for Statistics, Press. Ubuntu Manual - <https://ubuntu-manual.org/>
6. LibreOffice Getting Started Guide - <http://www.libreoffice.org/get-help/documentation/>
7. Gnumeric Manual - <https://help.gnome.org/users/gnumeric/stable/gnumeric.html>

8. Elementary Statistics with R - <http://www.r-tutor.com/elementary-statistics>
9. Design Resources Server, IASRI(ICAR), India - [www.iasri.res.in/design](http://www.iasri.res.in/design)
10. Rajender Parsad, R. Srivastava, V.K. Gupta, Design and Analysis of Agricultural Experiments, IASRI(ICAR), India - <http://www.iasri.res.in/design/ElectronicBook/index.htm>
11. Rajender Parsad, V.K. Gupta, Lal Mohan Bhar, V.K. Bhatia, Advances in Data Analytical Techniques, IASRI(ICAR), India - <http://www.iasri.res.in/ebook/EBADAT/index.htm> FLOSS Manuals - <http://en.flossmanuals.net/>

## **MAT 101 MATHEMATICS FOR AGRICULTURE 0+1**

### **Practical**

Types of matrices – algebra of matrices - Determinants –inverse of a matrix by adjoint method-solving system of equations by Cramer’s rule.

Permutation and Combination -meaning of  $nPr$  and  $nCr$  and simple problems. Progressions - Arithmetic, Geometric and Harmonic progressions. Equations of a straight line. Set theory-set operations, finite and infinite sets, operations of set.

Definition of differentiation-formulae of differentiation (without proof)- methods of differentiation. Geometrical and physical meaning of the first derivative. Higher order derivatives. Function of several variables- Partial differentiation –first and higher order-direct and mixed higher order partial derivatives. Homogeneous function. Euler’s Theorem (without proof).and its applications . Increasing and decreasing function-Maxima and minima of single and several variables without constraints. Physical and Economic optimum-Applications in agriculture.

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.

Fitting of linear, quadratic and exponential curves to data from agricultural field experiments.

### **References**

1. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
2. Mehta, B. C. and G. M. K. Madnani.1982, Mathematics for Economists, Sultan Chand & Sons, New Delhi.
3. Veerarajan, T, 2004. Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Manickavasagam Pillai, T. K and Natarajan, T. 2003. Calculus, Viswanathan Publications, Madras.
5. S.C. Gupta and V.K.Kapoor 2009 Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

**ENG 101      ENGLISH FOR EFFECTIVE COMMUNICATION      0 +1**

**Practical**

Introduction to listening, - kinds of listening, process of listening, - listening mechanism - listening TOEFL, IELTS, BEC.

Reading: skimming, scanning, SQ3R, intensive reading, extensive reading, critical reading, Cloze texts for integrated grammar and vocabulary, including subtle differences between synonyms, Reading comprehension texts for civil service exams, Bank P.O. exams, IELTS, TOEFL and GRE

English phonemes – stress, intonation and rhythm - genres of speaking, techniques of speaking – public speaking (welcome address, vote of thanks, extempore talk)

Mechanics of writing, writing genres, five types of writing, précis paragraph writing, Essay writing- issue- based writing and argument based writing

Note-taking, note- making, summarizing, brainstorming and simulation

**References**

1. Peter Roach 2009. English Phonetics and Phonology. A Practical Course: (4<sup>th</sup> edition), CUP, U.K.
2. Steven Brown and Dorokyn Smith 2006. Active Listening: CUP, U.K.
3. Christian Evans Carter 2010. Mindscapes: Critical Reading Skills: Wordsworth Publishing Company, Belmont, Calif. USA
4. Kory Floyd 2008. Interpersonal Communication: The Whole Story, Tata McGraw Hill Publishers.
5. John Langan. 2007. College Writing Skills with Readings Tata McGraw Hill Pub., USA.
6. Hariharan, S. 2003. English for Agriculture and Allied Sciences: Orient Longman, Hyderabad)
7. Interactive Software on Effective Communication. Learning to Communicate. TOEFL Books published by Orient Longman and Cambridge University Press.

**NCC 101      NATIONAL CADET CORPS      0+1**

General - Military History -Historical – geographical – Customs and Traditions of India -Defence services– Introduction to NCC – NCC Song-Aims of NCC – Principles of NCC-NCC organization- Duties of good citizen – system of NCC training –Drill- Foot drill – Arms drill – Guard of Honour – Ceremonial Drill – Weapon Training and Equipment– Communication-types-National Integration-Leadership-Civil affairs- Civil defence –Disaster management-Social service- Health and Hygiene-Environment and Ecology-Self Defence-Camps and Adventure training-Changing trends in Technology -Personality development-Communication Skills -Specialised subjects-Army or Navy or Air force.



Specialised subject-Navy-Naval Orientation -Naval communication-Navigation-Seamanship -Oceanic wealth-Gunnery-Fire Fighting and Damage control and Safety- Ship and Boat modelling-Submarine-Search and Rescue-Antisubmarine-Swimming

## **NSS 101      NATIONAL SERVICE SCHEME      0+1**

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all – National days – Commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities – National days – commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

## **PED 101      PHYSICAL EDUCATION      0+1**

Exercises for strength, agility, co-ordination, flexibility, co-operation, vital capacity endurance, speed and for various systems of our body and team spirit.

Exercise for Good Posture – Conditioning and calisthenics for various Athletic activities *i.e* (a) Before start – Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing – Lateral Arc, triangle and hands to feet pose (d) Sitting – camel kneel, spinal twist and supine knee bend (e) Relaxation – The corpse pose, quick and deep relaxation. Basic gymnastic exercises – participation of athletic events – running, throwing and jumping events.

### **Skill development in anyone of the following games**

Warming up, suitable exercise, lead up games, advance skill for all the games.

**Basket Ball:** Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics.

**Volley Ball:** Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flying dive, roll, blocking and various types of services.

**Ball Badminton:** Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics.

**Foot ball:** Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics.

**Hockey:** Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick, stopping, various types of passes, dodging, defence and offence tactics.

**Kho-Kho :** Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and pursue and defence skills.

**Chess:** Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

**Kabaddi :** Raid, touch, cant, catch, struggle, various types of defence and offence tactics.

**Cricket :** Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.

**Tennis :** Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

**Table Tennis :** Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics.

**Shuttle Badminton :** Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, back hand serve and defence.

**Gymnastics :** Balanced walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

## **Athletics**

(a) **Sprint :** Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.

(b) **Jumps :** Western roll, belly roll, eastern cut off, pass ferry flop, approach, take off, straddle, hitch-kick, handgrip, clearance, landing, strides etc.

(c) **Throws :** Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fack method parry obaine, discoput, rotation, carry and glide.

(d) **Hurdles :** Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

Rules and regulations of any one of the games and athletic events.

## **Fundamentals of Yoga**

Introduction, Definition, Stages of Yoga, Benefits of Yoga

## **Asanas**

Backward Bending Asanas (10 asanas); Forward Bending Asanas (10 asanas); Twisting Asanas (10 asanas); Inversion Asanas (10 asanas); Seated Asanas (10 asanas); Balancing Asanas (10 asanas); Suryanamaskar

Aspects to be covered in each and every asana : Warm-up and preparation techniques, steps, breathing methods, approach to final postures, variation, modifications, benefits, contraindications, injury prevention.

**Pranayamas**

Nadi Shuddi Pranayama, Anuloma Viloma Pranayama, Seetkari Pranayama, Seetali Pranayama, Sadanta Pranayama, Bhastrika Pranayama, Ujjayi Pranayama, Moorcha Pranayama, Plavini Pranayama

**Mudras**

Aswini Mudra, Yoga Mudra, Maha Mudra, Shanmukhi Mudra, Veepareetha Karani Mudra.



## **II SEMESTER COURSES**



## **Theory**

### **Unit I: Meteorology- Importance and scope**

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 – Agro-climatic zones of India and Tamil Nadu.

### **Unit II: Weather parameters**

Solar radiation – Energy balance - 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: Pressure systems**

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 – Process of condensation- rain- Seasons of India- Tamil Nadu / Puducherry - rainfall variability drought, flood and their effect - Cloud seeding – Evapotranspiration – transpiration - PET

### **Unit IV: Forecasting and impacts**

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

## **Practical**

Agromet 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; Automatic weather station - Evaporimeters - Lysimeters, Dew gauge. Clouds – classification-Preparation of synoptic charts and crop weather calendars. Rainfall probability analysis. Mapping of Agroclimatic Zones.

## **References**

1. Gopalaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.
2. IPPC Fourth Assessment report, 2007 (<http://www.ipcc.ch>)
3. Kakde, J.R., 1985. Agricultural climatology, Metropolitan Book Co. Pvt. Ltd., New Delhi.
4. Lenka, D. 2000. Climate, Weather and Crops in India, Kalyani Publishers, Ludhiana.

5. Mavi, H.S., 1996. Introduction to Agrometeorology, Oxford and IBH Publishing Co., New Delhi.
6. Murthy, V.R.K. 1995. Practical manual on Agricultural Meteorology, Kalyani Publishers, Ludhiana.
7. Prasad Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
8. Radhakrishna Murthy, V. 2002. Basic Principles of Agricultural Meteorology. BS Publications Hyderabad.
9. Venkataraman, S., Krishnan, A. 1992. Crops and Weather. Indian Council of Agricultural Research, Pusa, New Delhi.
10. Yellamanda Reddy, T. and G.H. Sankara Reddi, 2004. Principles of Agronomy, Kalyani Publishers, Ludhiana.
11. Narayanan. AL. 2015. Principles of Agricultural Meteorology, Sri Velan Pathipagam, Chidambaram.

## **AEC 101      PRINCIPLES OF AGRICULTURAL ECONOMICS      1+1**

### **Theory**

#### **Unit I: Nature and Scope of Economics**

Nature and scope of economics: Importance – Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits - Definitions of Economics: Wealth, welfare, scarcity and growth definitions - Divisions of Economics – Micro and Macro economics - Agricultural Economics: definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth, Welfare - Wants: Characteristics and classification.

#### **Unit II: Theory of Consumption**

Utility: Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – Assumptions - Limitations and Applications - Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and Contraction Vs Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand - Engel's law of family expenditure - Consumer's surplus: Definition – Importance.

#### **Unit III: Theory of Production**

Concept of production – Factors of production – Land and its characteristics - Labour – Division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital, types and importance of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur – Types of organization – Supply definition – law of supply – factors influencing supply - elasticity of supply.



#### **Unit IV: Theory of Distribution**

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage - Interest – liquidity preference theory – profit – Risk bearing theory of profit.

#### **Unit V: Macroeconomic Concepts**

National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income- Measurement of National Income - Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - Cannons of taxation, public expenditure: principles - Inflation: Meaning, definition, kinds, Causes and control of inflation – Welfare Economics: Meaning, Pareto's optimality – Millennium Development Goals (MDG).

#### **Practical**

Law of Diminishing Marginal Utility - Law of Equi Marginal Utility - Individual and market demand - Indifference curve analysis and consumer equilibrium - Measurement of arc elasticity and point elasticity of demand - own price elasticity, income and cross elasticity of demand - consumer surplus - Population growth and food grain production - Supply elasticity - Causes of inflation and control measures – Types and functions of money - Computation of National income - Study of structural changes in the economy - welfare indicators.

#### **References**

1. Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi
3. Koutsoyiannis, A. 1983. Modern Microeconomics, The Macmillan Press Ltd., Hongkong
4. Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi.
5. Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi

### **AEX 101      FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY      2+0**

#### **Theory**

##### **Unit I**

Extension Education and Agricultural Extension – Meaning, Definition, Scope and Importance. Sociology and Rural Sociology, Meaning Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies. Social Groups – Meaning, Definition, Classification, Factors considered in formation and organization of groups, Motivation in

group formation and role of Social groups in Agricultural Extension. Social Stratification – Meaning, Definition, Basis for stratification, Forms of Social stratification – Characteristics and Differences between Class & Caste System.

## **Unit II**

Cultural concepts – Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions – Meaning, Definition and their Role in Agricultural Extension. Social Values and Attitudes – Meaning, Definition, Types and Role of Social Values and Attitudes in Agricultural Extension. Social Institutions – Meaning, Definition, Major institutions in Rural society, Functions and their Role in Agricultural Extension. Social Organizations – Meaning, Definition, Types of organizations and Role of Social organizations in Agricultural Extension.

## **Unit III**

Social Control – Meaning, Definition, Need of social control and Means of Social control. Social change – Meaning, Definition, Nature of Social change, Dimensions of social change and factors of social change. Leadership – Meaning, Definition, Classification, Roles of a leader, Different methods of Selection of Professional and Lay leaders. Training of Leaders – Meaning, Definition, Methods of training, Advantages and Limitations in use of local leaders in Agricultural Extension.

## **Unit IV**

Psychology and Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence – Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Personality – Meaning, Definition, Types, Factors influencing the Personality and Role of personality in Agricultural Extension.

## **Unit V**

Principles of human behavior - Teaching – Learning process – Meaning and Definition of Teaching, Learning, Principles of learning and their implication for teaching. Learning experience and Learning situation, Elements of learning situation and its characteristics.

## **References**

1. Chitambar, J.B. 1997. Introductory Rural Sociology, Wiley Eastern Ltd., New Delhi.
2. Vidya Bhushan and Such Deva, D.R. 2003. An Introductory to Sociology. Kitab Mahal, Allahbad.
3. Adivi Reddy, A. 2001. Extension Education. Sree Lakshmi Press, Bapatla–522 101, New Delhi.
4. Kundu C.L and Tutoo D.N. 2001. Education Psychology. Sterling Publishers Pvt. Ltd, New Delhi
5. Mangal S.K. 2000. Educational Psychology. Prakash Brothers, Ludhiana
6. Chatterjee, S. 2000. Advanced Educational Psychology Books and Allied (P) Ltd, Calcutta.
7. Chauhan, S.S. 2001. Advanced Educational Psychology, Vikas Pub House Pvt. Ltd., New Delhi.

## **Theory**

### **Unit I: Farm Power**

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, Selection of tractors and cost of tractor power - Tractor and implement selection for different agricultural operations

### **Unit II: Tillage implements**

Tillage implements - primary and secondary tillage implements - ploughing methods - Field capacity and field efficiency.

### **Unit III: Sowing and planting machinery**

Sowing methods - seed drills, seed cum fertilizer drills - implements for intercultural operations - wet land equipment - Paddy transplanters - field and nursery requirements

### **Unit IV: Plant protection equipments**

Plant protection equipments - sprayer - dusters - their functions, classification - operation and maintenance.

### **Unit V: Harvesting machinery**

Harvesting tools and equipment - reapers and combine - Harvesting machinery for groundnut, tuber crops - Sugarcane harvesters - Equipment for land development and soil conservation - Tools for horticultural crops.

## **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 power tiller - Study of different inter-cultivation equipments - Sprayers and dusters - their operation, repairs and adjustment - Harvester for paddy, sugarcane and horticultural crops - Field capacity and cost analysis

## **References**

1. Jagadishwar Sahay, 1992. Elements of agricultural engineering. Agro book agency, Patna-20.
2. Nakra C.P 1970. Farm Machinery and equipment,: Dhanpat Rai & Son
3. Bindra, O.S. and Harcharan Singh, 1971. Pesticide application equipment. Oxford and IBH pub Co., New Delhi.
4. Srivastava, A.C., 1990. Elements of farm machinery. Oxford IBH pub Co., New Delhi.
5. Michael and T.P. Ojha, 1996. Principles of agricultural engineering. Jain brothers, New Delhi.

## **Theory**

### **Unit I: Importance of fruit crops and classification of climatic zones**

Definition of Horticulture – Importance of Horticulture – Divisions of Horticulture – Climatic Zones of horticultural crops – Area and production of different fruit crops.

### **Unit II: Establishment of Orchard**

Selection of site – Fencing and wind break – planting systems – High density planting – Planning and establishment.

### **Unit III: Methods of propagation, training and pruning and use of plant growth regulators**

Propagation by cuttings and layering – budding and grafting – use of root stock – Methods of training and pruning – Use of PGR's in fruit production.

### **Unit IV: Crop production technologies in major fruit crops**

Climate and soil requirement – varieties – propagation – planting density and systems – cropping systems – after care – Training and pruning – water, nutrient and weed management – special horticultural practices – plant growth regulators – Physiological disorders – maturity indices and post-harvest management in - Mango, Banana, Citrus, Grape, Guava, Sapota, Litchi and Apple.

### **Unit V: Crop production technologies in minor fruit crops**

Climate and soil requirement – varieties – propagation – planting density and systems – cropping systems – after care – Training and pruning – water, nutrient and weed management – special horticultural practices – plant growth regulators – Physiological disorders – maturity indices and post-harvest management in - Pineapple, Custard apple, Pomegranate, Ber, Jack, Aonla, Fig, Phalsa, Cherry, Pear, Plum and Peach.

## **Practical**

Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Plant propagation, seed propagation, scarification, and stratification; Propagation by cuttings (soft wood, hard wood and semi-hardwood) layering (Simple layering, Air layering, Stooling in guava); Layout and planting systems (Traditional system and high density planting methods); Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; Description and identification of varieties of mango, guava, grape, papaya, apple and sapota; Description and identification of varieties of banana, citrus, (lime, lemon, sweet orange, mandarin, grape fruit) pomegranate, ber, pear and cherries; Irrigation methods in fruit crops including drip – Micro irrigation methods of establishment of orchard; Methods of Fertilizer application methods in fruit crops including fertigation technology; Visit to local commercial orchards; Preparation of growth regulators, powder, solution and lanolin paste for propagation; Application of growth regulators for improving fruit set, fruit size, quality, delaying ripening and hastening ripening.

## References

1. Bose, T.K., S.K. Mitra and D. Sanyal. 2001. Fruits: Tropical and Subtropical (2 Volumes) Naya Udyog, Calcutta.
2. Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Ed). 1999. Tropical Horticulture Vol. 1. Naya Prakash, Calcutta.
3. Chadha, K.L. 2001. Handbook of Horticulture, ICAR. Delhi.
4. Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate fruits. Horticulture and Allied Publishers, Calcutta.
5. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.

**ENS 101**

**ENVIRONMENTAL SCIENCE**

**1+1**

## Theory

### Unit I: Introduction to Ecology and Environment

Introduction – Ecology – Environment: components, segments. Ecosystem – concepts, structure, function and types of ecosystem. Energy efficiencies and Energy flow – food chain, food web and ecological pyramids.

### Unit II: Natural resources and Biodiversity

Natural resources – Soil, Water, Air, Mineral, Energy – Renewable and non-renewable; Forest resources; Bio diversity - importance, hot spots and conservation

### Unit III: Environmental Pollution

Pollution: Problems, types and sources; Soil, Water and Air pollution – Sources, effects and control measures; Noise Pollution - Sources, effects and control measures; Radioactive, thermal and nuclear pollution; Global warming and climate change – GHG emission, GH effect, impact on environment and agriculture- mitigation strategies.

### Unit IV: Solid and liquid waste management

Types of wastes - Industrial wastes, Agricultural wastes, Domestic wastes and e-wastes: Characteristics and Environmental Impact - Solid waste management techniques: Principles and practices. Waste water treatment Techniques – Physical, chemical and biological methods. Standards for waste water disposal.

### Unit V: Environmental protection

Disaster management – Floods, earthquakes, cyclones and land slides. Global treaties, conventions – National and state level organizations: State PCB, CPCB — Environmental Laws and Acts – Environmental Education – CDM.

## Practical

Estimation of population indices of an agro-ecosystem – Diversity of flora and fauna in agricultural ecosystem - Laboratory safety and handling of chemicals and Glass wares - Characterization of waste water and collection and sampling methods - Estimation of pH,

EC and total Solids – Dissolved oxygen, biochemical oxygen demand and chemical oxygen demand- acidity, alkalinity, hardness, chlorides and sulfates - Visit to Common effluent treatment plant and degraded ecosystem - Assessment of water quality indicators (bio-indicators - coli forms) - Treatment of waste water : Physical , chemical and biological methods – Monitoring Air Pollution – Solid waste management - Composting of various solid wastes using microorganisms and vermicomposting – Heavy metals in contaminated soil and water ecosystem.

## References

1. Balakrishnamoorthy 2005. Environmental Management .Prentice- Hall of India Private Ltd. New Delhi.
2. Sharma, P.D. 2009, Ecology and Environment, Rastogi Publications, Meerat, India
3. William P. Cunningham and Mary Ann Cunningham, 2007. Principles of Environmental Sciences, Tata McGraw hill Publishing company, New Delhi.
4. Stanley E. Manahan. 1997. Environmental Science and Technology. Lewis Publishers New York.
5. Sharma P.D. 2006.Environmental Microbiology. Narosa Publishers, New Delhi.

## **BIC 101      FUNDAMENTALS OF BIOCHEMISTRY      2+1**

### **Theory**

#### **Unit I: Carbohydrates**

Carbohydrates - occurrence and classification. Structure of monosaccharides, disaccharides and polysaccharides. Physical and chemical properties of carbohydrates - optical isomerism, optical activity, reducing property, reaction with acids and alkalis. Industrial uses.

#### **Unit II: Lipids**

Lipids - occurrence and classification. Important fatty acids and triacyl glycerol. Essential fatty acids . Physical and chemical constants of oils. Rancidity of oils. Waxes and phospholipids - types and importance. Plant pigments - structure and function of chlorophyll and carotenoids. Sterols - basic structure and their importance. Industrial applications of lipids.

#### **Unit III: Proteins and Enzymes**

Amino acids - classification and structure. Essential amino acids, Properties of amino acids - colour reactions, amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins - primary, secondary, tertiary and quaternary. Properties and reactions of proteins. Enzymes - classification and Nomenclature. Mechanism of enzyme action. Factors affecting enzyme action. Competitive, non-competitive and uncompetitive inhibitors. Cofactors and coenzymes. Vitamins and minerals as coenzymes / cofactors. Isozymes. Industrial applications of enzymes.

#### **Unit IV: Metabolism**

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis and TCA cycle . pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Metabolism of lipids - lipases and phospholipases. Fatty acid oxidation and bioenergetics. Biosynthesis of fatty acids and triacyl glycerol. General catabolic pathway 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. Applications of secondary metabolites in food and pharma industries.

#### **Practical**

Qualitative tests for carbohydrates, estimation of reducing sugar, total sugar, starch and amylose. Qualitative tests for amino acids & proteins. Estimation of protein & amino acids. Estimation of free fattyacid and determination of oil content from oil seeds. Estimation of ascorbic acid. Estimation of phenol. Assay of an enzyme - Amylase. Chromatography of amino acids/sugars.

#### **References**

1. Rastogi S.D., 2010, Biochemistry, 3<sup>rd</sup> edn, Tata McGraw-Hill, Delhi
2. Murray,R.K., Granner,D.K., Mayes,P.A.. and Rodwell,V.W., 2003.26<sup>th</sup> edn, Tata McGraw-Hill, New Delhi
3. Nelson DL, Cox MM. 2004. Lehninger Principles of Biochemistry Fourth (Indian edition) MacMillian, Worth Publishers.
4. Voet D,Voet JG and CW Pratt. 2002. Biochemistry. John Wiley & Sons, Inc, Singapore
5. Thayumanavan, B, Krishnaveni, S and Parvathi, K. 2004. Biochemistry for Agricultural Science, Galgotia Publications Pvt Ltd., New Delhi
6. Sadasivam S and Manickam, A. Biochemical Methods, 2009, 3<sup>rd</sup> edn, New Age International
7. Wilson, K. and Walker, J.M. 2000. Principles and techniques of Practical Biochemistry, 5<sup>th</sup> edn. – Cambridge University Press.
8. Conn, E.E. and Stumpf, P.K.1996. Outlines of Biochemistry – Wiley Eastern Ltd., Fifth Edition.
9. Stryer L, Berg T,Tymoczko,J, Biochemistry.,2009 5<sup>th</sup> Ed. Wiley Eastern Ltd, New Delhi
10. Chesworth, JM., Stuchbury, T. and Scaife, JR. 1998. An Introduction to Agricultural Biochemistry. Chapman and Hall.
11. Goodwin, T.W. and Mercer, E.I. 1991. Introduction to Plant Biochemistry. Pergamon Press.

## **AMP 101 LIVESTOCK AND POULTRY PRODUCTION MANAGEMENT 2+1**

### **Theory**

#### **Unit I: Introduction to Livestock Management**

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

#### **Unit II: Dairy Cattle Management**

White and Black cattle breeds-classification - indigenous and exotic – Breed characteristics – Breeding - Cross breeding - Upgrading - Economic traits of cattle - 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 animals and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder – composition of concentrate mixture for different stages – Milk secretion - Milking methods - Clean milk production - Factors affecting milk composition – Diseases of cattle – classification – symptoms – prevention and control measures.

#### **Unit III: Sheep and Goat Management**

Breeds of Sheep and goat – 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 - prevention and control

### **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 - Type and design of animal and poultry houses -Selection of dairy cow and work bullock - Determination of specific gravity, fat percentage and total solids of milk - Common adulterants and Preservatives of milk - Demonstration of cream separation, butter, ice cream and ghee making - 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 plant and commercial layer and broiler farms - Demonstration of incubator and setter.

## References

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry. Oxford Book Company, Calcutta.
2. Gopalakrishnan, C.A., and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, Ghaziabad, Uttar Pradesh.
3. ICAR, 2013. A Hand Book of Animal Husbandry
4. Jull, M.A. 2003. Successful Poultry Management
5. Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS., Chennai.
6. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai
7. Radostitis, O.M., Gray, C.C., Blood, D.C. and Hinchcliff, K.W. 2000. A text book of the diseases of Cattle, Sheep, Pigs, Goats and Horses. IX edition, Book Power- WB Saunders, London.
8. Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production. Vikas Publishing House Private Limited, Ghaziabad, UP
9. Sastry, N.S.R., Thomas, C.K. 2005. Livestock Production Management. Kalyani Publishers, Ludhiana
10. Watson, J.A.S. and Mills, W.J. 2005. Farm animals and their Management.



## **III SEMESTER COURSES**



## **Theory**

### **Unit I: Introduction to Weeds**

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

### **Unit II: Methods of weed control**

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

### **Unit III: Herbicides**

Herbicides: advantages and limitations of herbicide usage in India. Herbicide classification, formulations, methods of application. Introduction to Adjuvants and herbicide antidotes and their use in herbicides.

### **Unit IV: Selectivity and activity of herbicides**

Introduction to selectivity of herbicides; Herbicide absorption and translocation; Mode and mechanisms of action of herbicides. Herbicide mixtures and rotation. Interaction of herbicides with other agro chemicals, Definitions of Herbicide resistance and Herbicide resistant crops.

### **Unit V: Weed management**

Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

## **Practical**

Preparation of herbarium of weeds; Identification of weeds; Survey of weeds in crop fields and other habitats; Biology of nut sedge, bermuda grass and parthenium and Echinochloa; 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; Economics of weed control practices; Tours and visits of problem areas.

## **References**

1. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.
2. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
3. Rao, V. S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi.
4. Jaganathan R., and R.Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.
5. Hance, R.J. and K. Holly. 1990. Weed Control Handbook: Principles. Blackwell Scientific Publications, Oxford, London

## **Theory**

### **Unit I: Irrigation- History and importance**

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

### **Unit II: Soil-water-plant relationship**

Water relations – Soil-plant-water relationship - Soil-plant atmospheric continuum – 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**

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

### **Unit IV: Scheduling of irrigation**

Scheduling of irrigation – Different approaches - Methods of irrigation: surface, sub-surface sprinkler and drip irrigation – Micro irrigation: layout, suitability, merits and scope – Water use efficiency – Methods to improve WUE – Conjunctive use of water – on farm water management – Conveyance and distribution – water budgeting . Water management for different field crops.

### **Unit V: Quality of irrigation water and drainage**

Quality of irrigation water – irrigation management under limited water supply – Agronomic practices for use of poor quality water (saline, effluent and sewage water) for irrigation – tank irrigation, well irrigation – on-farm development – command area development - Agricultural drainage, importance and methods of drainage.

## **Practical**

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

## **References**

1. Lenka, D. 1999. Irrigation and Drainage. Kalyani Publishers.
2. Michael, A.M. 1997. Irrigation: Theory and Practice Vikas Publishers

3. Rao, Y.P and S.R.Bhaskar. 2008. Irrigation technology – theory and practice. Agrotech publishing company, Udhapur.
4. Ramachandrappa, B.K and H.V.Nanjappa.2008. Fertigation technology. Agro-bios, Jodhpur.
5. Thokal, R.T., D.M. Mahale and A.G. Powar. 2004. Drip irrigation system-clogging and its prevention. Pointer publishers, Jaipur.
6. Prihar, S.S. and B.S. Sandhu. 1987. Irrigation to field crops: Principles and Practices. ICAR Publication.
7. Sankara Reddy, G.H. and T. Yellamanda Reddy. 1997. Efficient use of irrigation water. Kalyani Publishers
8. Panda, S.C. 2006. Principles and Practices of water management. Agro-bios Publishers

## **GPB 201    PRINCIPLES OF PLANT BREEDING    2+1**

### **Theory**

#### **Unit I: Introductory Plant Breeding**

Classification of plants, Botanical description, Floral biology, Emasculation and Pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantation crops etc. Aims and objectives of Plant Breeding;

#### **Unit II: Modes of Pollination and Reproduction**

Modes of reproduction, Sexual, Asexual, Apomixis and their classification; Significance in plant breeding; Modes of pollination, genetic consequences, differences between self and cross pollinated crops;

#### **Unit III: Methods of Plant Breeding**

Methods of breeding – introduction and acclimatization. Selection, Mass selection Johansson's pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method and various modified methods;

#### **Unit IV: Heterosis, Self Incompatability and Male sterility**

Incompatibility and male sterility and their utilization in crop improvement; Heterosis, inbreeding depression, various theories of Heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids;

#### **Unit V: Special Breeding Techniques**

Population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding for vegetatively propagated crops; Clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement.

### **Practical:**

Botanical description and floral biology; Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant Breeder's kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing,

emasculatation and crossing techniques; Study of male sterility and incomapribility in field plots; Rice and Sorghum; Maize and Wheat; Bajra and ragi; Sugarcane and coconut; Groundnut, Castor, Sunflower, Safflower and Sesamum; Redgram, Bengalgram and Greengram; Soybean and blackgram; Chillies, Brinjal and Tomato; Bhendi, Onion, Bottle gourd and Ridge gourd; Cotton and Mesta; Jute and Sunhemp

### References:

1. Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Phundhan Singh. 2001. Essentials of plant breeding, Kalyani publishers, New Delhi.
3. Chopra, V. L., 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
4. Sharma, J. R. 1994. Principles and practice of plant breeding Tata McGraw-Hill publishing Co., New Delhi.
5. Allard, R. 1989. Principles of plant breeding. John Wiley and Sons, New Delhi.

## **SST 201      PRINCIPLES OF SEED SCIENCE AND TECHNOLOGY      2+1**

### **Theory**

#### **Unit I : Introduction to Seed Production**

Difference between seed and grain -Importance of Seed Production- Seed quality- Definition, Characters of good quality seed-Seed Replacement Rate-Seed Multiplication Ratio-Deterioration of crop varieties-Factors affecting deterioration and their control-Maintenance of genetic purity during seed production- Classes of seed-Generation system of seed multiplication- Production of nucleus and breeder's seed- Maintenance and multiplication of seeds in varieties and hybrids of self and cross-pollinated crops.

#### **Unit II : Seed Production**

Foundation and certified seed production of rice and wheat (varieties and hybrids) - maize (varieties, hybrids, synthetics and composites) - sorghum and bajra (varieties, hybrids, synthetics and composites) - cotton and sunflower (varieties and hybrids) – ground nut-castor (varieties and hybrids)- tomato and brinjal (varieties and hybrids) - chillies and bhendi (varieties and hybrids) – onion and gourds.

#### **Unit III : Post Harvest Handling and Management**

Seed Drying: principle and methods of seed drying - Seed processing : Establishment of seed processing unit- air screen machine and its working principle, different upgrading equipments and their use- Gravity separator-Disc separator-Spiral separator-Colour sorter-Establishing a Seed Testing Laboratory- Seed testing procedures for quality assessment-Seed treatment: Importance – types- equipments used (Slurry and Mist-O-matic treater)-Seed Enhancement techniques-seed dormancy and breaking treatments-Seed hardening-Coating and Pelleting- Seed packing.



#### **Unit IV : Seed storage and Marketing**

Stages of seed storage, factors affecting seed longevity during storage - conditions required for good storage - General principles of seed storage - constructional features for good seed warehouse-measures for pest and disease control -temperature control-Mid storage correction-Seed marketing - Seed demand forecasting - Marketing structure-marketing organization- sales promotion- pricing policy- Factors affecting seed marketing-Seed production planning.

#### **Unit V : Seed quality control**

Seed certification- Phases - procedure - field inspection and field counts etc.- Seed Act and Seed Rules - Central Seed Committee, Central Seed Certification Board - State Seed Certification Agency - Central and State Seed Testing Laboratories - Duties and powers of Seed Inspectors - Offences and penalties - Seed Control Order, 1983 - New Policy on Seed Development, 1988 – New Seed Bill, 2004 and other issues related to seed quality regulation- Intellectual Property Rights – Protection of Plant Varieties and Farmers' Rights Act, 2004 - Varietal Identification through Grow-Out Test, Electrophoresis and DNA Finger Printing.

#### **Practical**

Identification of seed and seed structure in Field crops and Horticultural crops - Seed sampling : principles and procedures - Physical Purity analysis – Seed Germination test - Seed Moisture determination – Seed Viability test - Seed Vigour tests - Seed enhancement techniques: Dormancy and breaking methods –Egg floatation -Delinting- Hardening - Coating-Pelleting-Seed extraction in vegetables - Grow out tests and electrophoresis for varietal identification- Seed health test - Visit to varietal and hybrid Seed production plots of field and horticultural crops and Varietal identification - Visit to Seed processing plant - Visit to Seed testing laboratory- Seed production planning for certified, foundation and breeder seed production.

#### **References**

1. Agrawal, R.L. 2003. Seed Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Copeland, L. O. and McDonald, M. 2001. Principles of Seed Science and Technology. 4th ed. 2001, XIV.
3. Joshi, A.K. and B.D. Singh. 2004. Seed Science and Technology. Kalyani Publishers, Ludhiana.
4. Khare, D. and Bhale, M. S. 2005. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Singhal, N.C. 2003. Hybrid seed production in field crops. Kalyani Publishers, Ludhiana.

## **AEC 201      PRODUCTION ECONOMICS AND FARM MANAGEMENT   1+1**

### **Theory**

#### **Unit I: Nature and Scope**

Production Economics : Meaning- Definition – Nature and Scope - Farm Management: Definition - Objectives of Farm Management - Production Economics Vs Farm Management - Farm Management Decisions - Decision making process – Operational and strategic decisions - Scope of farm management - Types and systems of farming : types - specialized and diversified-mixed – systems of farming – peasant farming – state farming – capitalistic – collective- co- operative farming.

#### **Unit II: 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 cost – Economics of scale - Determination of optimum input and output - physical and economic optimum – Law of diminishing marginal returns (LDMR) – Importance of LDMR – postpone of LDMR – Injection of capital and capital components.

#### **Unit III: Factor- Factor Relationship**

Factor-factor relationship : Meaning- isoquant – definition and types - isoquant map - marginal rate of technical substitution - factor intensity - isoclines- ridge line - returns to scale – elasticity of factor substitution- iso-cost line – principle of factor substitution and least cost combination of inputs – Importance of least cost combination – Expansion path - Effect of input price changes on the least cost combination.

#### **Unit IV: Product-Product Relationship**

Product-product relationship: Meaning – production possibility curve – marginal rate of product transformation - Enterprise relationship: joint products – complementary – supplementary – competitive products – iso-revenue line – optimum combination of products – Importance of optimum combination of products – principle of equi-marginal returns – Principle of opportunity cost.

#### **Unit V: Farm Planning and Budgeting**

Farm planning: importance – characteristics of good farm plan – farm planning procedure – Budgeting: definition and types – complete budgeting – partial budgeting – enterprise budgeting – cash flow budgeting – limitations of budgeting – Linear programming: Assumptions – Linear programming model defined – 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 – 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.

## References

1. Sankayan, P.L. Introduction to Farm Management, (New Delhi:Tata Mc Graw Hill Publishing Company Ltd) 1983
2. Johl SS & Kapoor TR. (2012). Fundamentals of Farm Business Management. Kalyani Publ.India
3. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ. 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. (2012) Agricultural Production Economics. Macmillan, New York.
6. Heady, E.O. and H.R. Jensen (1954). Farm Management Economics, Prentice-Hall, Englewood Cliffs
7. Jensen, H.R. (1977). 'Farm Management and Production Economics, 1946-70', A Survey of Agricultural Economics Literature, University of Minnesota Press, Minneapolis, Vol. 1, pp. 1-89.
8. Kay, Ronald D., and William M. Edwards, and Patricia Duffy; (2004) Farm Management, Fifth Edition, McGraw-Hill, Inc., New York.
9. Panda SC. (2007). Farm Management & Agricultural Marketing. Kalyani Publ. Ludhiana India

## AEN 201 FUNDAMENTALS OF ENTOMOLOGY 2+1

### Theory

#### Unit I: History and importance

Entomology as a science - its importance in Agriculture 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 organization of insect body wall - structure and function, cuticular appendages, moulting. Body regions - insect head, thorax and abdomen, their structures and appendages

#### Unit III: Anatomy and physiology

Elementary knowledge of digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects. Sense organs and their functions, Exocrine and endocrine glands. Life cycle of insects- immature stages - types of reproduction – metamorphosis-growth and development. Productive insects-honeybees, lac insect and silkworm

#### **Unit IV: Taxonomy of Apterygota and Exopterygota**

Taxonomy, Classification and nomenclature of insects, Biotypes. Distinguishing characters of agriculturally important orders and families of Apterygota- Collembola and Thysanura, Exopterygota - Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Siphunculata and Thysanoptera.

#### **Unit V: Taxonomy of Endopterygota**

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

#### **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 / cockroach – Productive insects-honeybees, lac insect and silkworm - Observing the characters of agriculturally important orders and families.

#### **References**

1. Borror, D.J., D.M. DeLong and C.A. Triple Horn. 1976. An introduction to the study of insects (IV Edition). Holt, Rinehart and Winston, New York, London and Sydney.
2. Cedric Gillott. 2005. Entomology (Third Edition). Springer, Netherlands.
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. Richards O.W. and R.G. Davies 1977. Imm's General Text Book of Entomology Vol.I and II. Chapman and Hall Publication, London.

### **ANM 201      INTRODUCTORY NEMATOLOGY      1+1**

#### **Theory**

##### **Unit I: History and Importance of Nematodes**

Introduction – Brief history and development of Nematology in India and abroad – Position of nematodes in animal kingdom – Importance of nematodes to plants – Economic loss in crop plants. Animal Nematodes. Beneficial nematodes (entomopathogenic nematodes – *Steinernema* and *Heterorhabditis*).

##### **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 plant parasitic nematodes based on feeding habits.

Identification of economically important plant nematodes up to generic level with the help of keys and description.

### **Unit III: Symptoms, interaction and bio-ecology of nematodes**

Symptoms of nematode damage – interaction with other microorganisms (fungi, bacteria and viruses) – Biology and ecology of important plant parasitic nematodes. (*Meloidogyne*, *Heterodera*, *Rotylenchulus*, *Tylenchulus* and *Radopholus*).

### **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, crop rotation, antinemic plants, other land management practices); host plant resistance to nematodes; biological control (nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR and predators); chemical control – soil fumigants and nematode management. Integrated nematode management.

### **Unit V: Nematode pests of crops**

Major nematode parasites and their management in cereals (rice and wheat), millets (sorghum, and maize), pulses (redgram, blackgram, greengram and cowpea), oilseeds (castor, groundnut and gingelly), fibre crops (cotton), vegetables (tomato, brinjal, bhendi, chilli and potato), fruits (banana, citrus, grapevine and papaya), spices and plantation crops (turmeric, pepper, betelvine and coconut), flower crops (crossandra, jasmine and tuberose) and medicinal and aromatic plants, (medicinal coleus, diascoria, geranium and patchouli).

### **Practical**

Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb's decanting–sieving and Barman funnel technique and Modified Barman funnel Technique, counting and estimation of plant parasitic nematodes; Extraction of cyst nematodes from soil by Fenwick can and other methods. Preparation of temporary and permanent mounts; Study of perineal patterns for identification of *Meloidogyne* species; Study of Cone top structure for identification of cyst nematodes. Morphology of orders Tylenchida (*Hoplolaimus*), and Dorylaimida (*Xiphinema*) Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomatology – *Meloidogyne*, *Pratylenchus*, *Hirschmanniella*, *Heterodera*, *Globodera*, *Tylenchulus*, *Radopholus*, *Rotylenchulus*, and *Helicotylenchus*. Study of life stages of *Meloidogyne*, *Rotylenchulus* and *Radopholus*. Experimental techniques used in pathogenicity studies with root knot nematode. Study of different types of nematicides, application methods and calculation of dosages.

### **References**

1. Walia, R. K. and Bajaj, H. K. 2003. Text Book on Introductory Plant Nematology, ICAR, New Delhi.
2. Parvatha Reddy, P. 1987. A Treatise on Phytonematology, Agricole Publication, New Delhi. P 381.

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## **AEG 201      FUNDAMENTALS OF SOIL AND WATER CONSERVATION ENGINEERING    2 + 1**

### **Theory**

#### **Unit I: Surveying**

Surveying and Levelling – Chain, Compass and Plane Table survey – leveling – Instrument - 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 - Landslides – Wind erosion - factors influencing wind erosion - mechanics of wind erosion – suspension, saltation, surface creep

#### **Unit III: Soil conservation**

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 – gully control structures – permanent and temporary structures. Farm ponds – percolation ponds - Watershed 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 – 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. Leveling – fly levels – determination of difference in elevation. Contouring – area and volume computation. Design of contour bund and graded bund. Visit to erosion affected areas. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement - Layout of Sprinkler and Drip systems. Agricultural drainage. Study of different types of wells and its selection. Study of reciprocating pump, centrifugal pump, submersible pumps & jet pumps- Selection of pumps.

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## **PAT 201      FUNDAMENTALS OF PLANT PATHOLOGY    2 + 1**

### **Theory**

#### **Unit I: Plant Pathogenic Organisms**

Introduction - Definition - Plant Pathology - History of Plant Pathology-Etiology of plant diseases- Biotic and abiotic agents- Plant Pathogens-Protozoa, Fungi, Bacteria, *Candidatus* Phytoplasma, Fastidious vascular bacteria, Spiroplasma, Viruses, Viroids, Algae and Phanerogamic parasitic plants – Abiotic disorders

#### **Unit II: General Characters of Fungi and their Pathogenesis**

General characters of fungi - Somatic structures - Types of fungal mycelia - Resting structures – Asexual and sexual reproduction - Fruiting bodies -Physiological specialization - Spread and survival -Pathogenesis - Mode of infection - Disease cycle-Symptoms of fungal diseases -Role of enzymes and toxins in pathogenesis.

### Unit III: Classification of Kingdom: *Protozoa, Chromista and Fungi*

Taxonomy –Phylogenetic classification of fungi – Fungal systematic - I.Kingdom:*Protozoa*, Phylum: *Plasmodiophoromycota*, Class: *Plasmodiophoromycetes* (*Plasmodiophorales*) *Flagellate Protozoa – Phytophthora*. II. Kingdom: *Chromista*, Phylum: *Oomycota*, Class: *Oomycetes* (*Pythiales* and *Peronosporales*). III. Kingdom: *Fungi*. Phylum: *Chytridiomycota*, Class: *Chytridiomycetes* (*Chytridiales*) Phylum: *Zygomycota*, Class: *Zygomycetes* (*Mucorales*).

### Unit IV: Phylum: *Ascomycota* and *Basidiomycota*

Phylum: *Ascomycota*, Classes: *Taphrinomycetes* (*Taphrinales*), *Dothideomycetes* (*Dothidiales* and *Pleosporales*) *Eurotiomycetes* (*Euriotiales*), *Leotiomycetes* (*Erysiphales*) and *Sordariomycetes* (*Hypocreales*); Phylum: *Basidiomycota*, Classes: *Agaricomycetes* (*Agaricales*, *Corticiales*, *Cantharellales* and *Polyporales*), *Pucciniomycetes* (*Pucciniales*) and *Ustilaginimycetes* (*Exobasidiales*, *Ustilaginales* and *Tilletiales*).

### Unit V: Bacteria, Viruses, Viroids, Algae and Phanerogamic parasites

Classification of bacteria -General characters, survival, spread, pathogenesis and symptoms of phytopathogenic bacteria - General characters and symptoms of *Candidatus* Phytoplasma, Fastidious vascular bacteria, Spiroplasma, Viruses, Viroids, Algae and Phanerogamic parasites.

### Practical

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Plasmopara*, *Mucor*, *Rhizopus*, *Taphrina*, *Capnodium*, *Cochliobolus*, *Mycosphaerella*, *Alternaria*, *Botryosphaeria*, *Venturia*, *Eurotium*, *Talaromyces*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula*, *Claviceps*, *Gibberella*, *Verticillium*, *Sarocladium*, *Glomerella*, *Pestalotia*, *Magnaporthe*, *Macrophomina*, *Puccinia*, *Uromyces*, *Hemileia*, *Sporisorium*, *Tolyposporium*, *Ustilago*, *Ganoderma*, *Exobasidium*, *Athelium* and *Thanetophorus*. Taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella*, *Morchella* and *Tuber*. Symptoms produced by Bacteria, *Candidatus* Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae and Phanerogamic parasitic plants

### References

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## **IV SEMESTER COURSES**



**Theory****Unit I: Cereals -I**

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

**Unit II: Cereals -II**

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

**Unit III: Millets**

Millets: Sorghum, Pearl millet, Finger millet, Minor millets, Foxtail millet, little millet, Kodo millet, common millet and barnyard millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

**Unit IV: Pulses**

Pulses: Red gram, Black gram, Green gram, Bengal gram, Horse gram, Cowpea, Soybean and Lentil, Peas and French bean- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

**Unit V: Oil Seeds**

Oil seeds: Ground nut, sesame, sunflower, castor, soybean, Rape seed and mustard, safflower, Linseed, Niger - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

**Practical**

Identification of crops and crop varieties -Calculations on seed rate, Seeding equipments - Seed treatment techniques -Rice nursery preparation, mainfield preparation and transplanting -Nursery preparation, mainfield preparation and transplanting of cumbu and ragi -Mainfield preparation and direct sowing of Sorghum, Maize, Wheat and millets- Mainfield preparation and sowing of pulses and oilseeds-Effect of sowing depth on germination of crop- Effect of seed size on germination and seedling vigour of any one pulse/oilseed -Estimation of population -Identification of weeds and weed control in rice, maize. pulse and oilseed crops - Manuring – Basal and Top dressing in rice, maize, sorghum, millets; pulses and oilseeds -Study of growth and yield contributing characters -Study of maturity indices, harvesting and yield estimation of above crops; Economic analysis of cultivation of cereal, pulses and oilseeds -Study of cropping patterns -Visit to important agronomic experimental plots.

**References**

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2. Chidda Singh. 1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi
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## **GPB 202      PRINCIPLES OF PLANT BIOTECHNOLOGY    2+1**

### **Theory**

#### **Unit I: Basic Concepts in Plant Biotechnology**

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement: Totipotency and Morphogenesis.

#### **Unit II: Techniques in Plant Tissue Culture**

Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures, Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements.

#### **Unit III: Plant Tissue Culture in Crop Improvement**

Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement.

#### **Unit IV: Applications of Genetic Engineering in Crop Improvement**

Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing.

#### **Unit V: Molecular Markers in Crop Improvement**

DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement.

## **Practical:**

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoresis techniques.

## **References**

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice. Elsevier Publication.
2. Gupta, P.K. 2005. Elements of Biotechnology. Rastogi Publication, India.
3. Malacinski, M. and D. Friefelder. 2003. Essentials of molecular biology. IV Ed. Jones and Bartlett publishers, Boston
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## **SAC 201**

## **SOIL CHEMISTRY AND AGROCHEMICALS**

**2+1**

### **Theory**

#### **Unit I: Soil Chemistry**

Soil chemistry - scope and importance. Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis, structure and properties. Sources of charges – positive and negative charges. Adsorption of ions, Ion exchange, CEC and AEC - Factors influencing ion exchange and its significance. Electrical double layer – Helmholtz, Gouy-Chapman and Stern theories

#### **Unit II: Soil Organic Matter**

Soil organic matter, Composition, Decomposability, Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Significance of organic matter in crop production.

#### **Unit III: Problem soils**

Problem soils – acid, acid sulphate, salt affected and calcareous soils - characteristics, nutrient availabilities. Reclamation – mechanical, chemical and biological methods. Chemistry of submerged soils. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture.

#### **Unit IV: Pesticides – Classification and formulation**

Pesticide – definition. Classification of pesticides. Formulations – dusts, wettable powders, emulsifiable concentrate, granules. Botanical insecticides (Neem), Pyrethrum, Synthetic pyrethroids.

## **Unit V: Properties of Pesticides**

Synthetic organic insecticides, Major classes, Properties and uses of some important insecticides under each class. Herbicides – Major classes – Properties and uses of 2, 4-D, atrazine, glyphosate, butachlor benthocarb; Fungicides – Major classes – Properties and uses of carbendazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act. Fertilizer and insecticides and their effect on soil, water and air.

## **Practical**

Analysis of problem soils – lime requirement of acid soil – Estimation of CEC, exchangeable cations and ESP – Gypsum requirement of sodic soils. Analysis of irrigation waters – pH, EC, TSS anions and cations – quality appraisal of irrigation waters. Field visit to problem soil area. Analysis of pesticides – Physical tests – Sieving test – Bulk density, wettability, suspensibility – Chemical test – Acidity & Alkalinity - Argentimetric and iodometric titrations –their use in the analysis of active ingredients in pesticides. Visit to pesticide formulation unit and pesticide testing laboratory.

## **References**

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**AEC 202**

**AGRICULTURAL MARKETING, TRADE AND PRICES**

**1+1**

## **Theory**

### **Unit I: Agricultural Marketing – Nature and Scope**

Market and Marketing: definitions, components and dimensions of a market. Agricultural Marketing: Concepts and definitions, scope and subject matter. Classification



of markets – Approaches to study market – Role of market functionaries - market forces and price determination. Marketing of agricultural Vs manufactured goods. Producer surplus of agricultural commodities: Definition, producer surplus. Marketable and marketed surplus: Definition, importance and factors affecting marketable surplus.

### **Unit II: Marketing Functions and SCP Paradigm**

Marketing functions: buying and selling- packaging and transportation --grading and standardization--storage and warehousing -- processing and value addition. Market Structure--Conduct--Performance paradigm (SCP) – Market Structure meaning, components, dynamics of conduct and performance.

### **Unit III: Marketing Efficiency and Marketing Institutions**

Marketing channels: definition and channels for different products. Market integration: definition and types. Marketing efficiency: meaning and definition. Marketing costs, margins and price spread. Factors affecting marketing costs. Reasons for higher marketing costs. Ways of reducing marketing costs. Concepts of Supply Chain Management and value enhancement. Marketing of agricultural inputs. Role and Objectives of marketing institutions: State and Central-objectives -Cooperatives, Commodity groups, State trading, Ware housing, FCI, PDS, - Quality Control, AGMARK.

### **Unit IV: International Trade and Role of Institutions**

Theories of Trade: Absolute and Comparative Advantage - Status of Agricultural exports/ imports from India and their share. Barriers to trade – tariff and non tariff measures. Role of institutions like GATT and WTO in promoting trade in agricultural products. Free Trade Agreements -Implications of AoA- Market access, Domestic support and export subsidies. New EXIM policy of India – Advantages of AEZs. – Export promotion organization: APEDA, MPEDA, Commodity boards .

### **Unit V: Agricultural Prices and Risk Analysis**

Price characteristics of agricultural products. Objectives of price policy – Role of CACP – Concept of MSP, FRP (SMP) & SAP. Risk in marketing - meaning and importance- types of risk- speculation and hedging - futures trading – Role of Contract farming in risk mitigation. Index numbers.

### **Practical**

Farm Survey - Preparation of survey schedules - Farmers' marketing practices - Regulated market and its role in marketing of farm produce - Cooperative marketing society – Farmers' Market - Estimation of marketed and marketable surplus - Identification of marketing channels - Price spread estimation for agricultural / horticultural / livestock products - 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 – Functions of NAFED - AGMARK Laboratory/Grading institutions - Commodity Boards - Export oriented units - Index numbers.

## References

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## **AEX 201      DIMENSIONS OF AGRICULTURAL EXTENSION      1+1**

### **Theory**

#### **Unit I:**

Education – Meaning, Definition, Types – Formal, Informal and Non-Formal education and their Characteristics. Extension Education and Agricultural Extension – Meaning, Definition, Concepts, Objectives and Principles.

#### **Unit II:**

Rural development – Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development. Developmental programmes of pre-independence era – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme. Development programmes of Post independence era, Firka Development, Etawah Pilot project and Nilokheri Experiment. Community Development Programme – Meaning, Definition, Concepts, Philosophy, Principles, Objectives, Differences between Community Development and Extension Education, National Extension service.

#### **Unit III:**

Panchayat Raj system – Meaning of Democratic – Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system, Powers, Functions and Organizational setup. Agricultural Development Programmes with reference to year of start, objectives & salient features – Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP). Social Justice and Poverty alleviation programmes –Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY).

#### **Unit IV:**

Importance of women in Agriculture - Women Development programmes – Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh

(RMK), Integrated Child Development Scheme (ICDS) and Mahila Samridhi Yojana (MSY). National Mission for Women – objectives and salient features.

#### **Unit V:**

Reorganized extension system (T&V System) – Salient features, Fort night Meetings, Monthly workshops, Linkages, Merits and Demerits, Emergence of Broad Based Extension (BBE). ATMA, ATIC, NATP, NAIP. Extension infrastructure of ICAR & GOI.

#### **Practical**

Visits to Department of Agriculture, DRDA/BDO to study the ongoing development programmes. Visits to village to study the functioning of Gram Panchayat (GP). Participation in RE Interface Sessions of ATMA. Visit to study SHGs, NGOs - Organizing PRA techniques in a village to identify the agricultural problems.

#### **References**

1. Adivi Reddy A. 2001. Extension Education. Sree Laxmi Press, Bapatla, A.P.
2. Muthiah Manoharan P. and Arunachalam R. 2003. Agricultural Extension. Himalaya Publishing House, Mumbai.
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### **AEG 202      RENEWABLE ENERGY      1 + 1**

#### **Theory**

##### **Unit I: Energy scenario**

Introduction - energy crisis - energy sources - classification - availability - renewable energy sources - significance - potential and achievements in India. Energy requirements of important agricultural crops.

##### **Unit II: Methods of energy conversion and Biogas Technology**

Methods of energy conversion - thermo - chemical and biochemical conversion methods - combustion, pyrolysis and gasification - applications - biogas and ethanol production - applications. Biogas technology - science of production - feed stocks - factors affecting biogas production - types and capacity of biogas plants - KVIC, Janata and Deen

Bandhu model biogas plants - construction and working principles - comparison features of biogas plants. Applications of biogas - biogas requirements - biogas appliances - environmental considerations - enrichment and uses of biodigested slurry (BDS).

### **Unit III: Thermochemical conversion methods**

Principles of combustion, pyrolysis and gasification - types of gasifiers - producer gas and its utilization. Briquettes - types of briquetting machines - uses of briquettes - shredders.

### **Unit IV: Applications of solar energy**

Solar energy - solar flat plate and focusing plate collectors - solar air heaters - solar space heating and cooling - solar energy applications/ solar energy gadgets - solar cookers - solar water heating systems - solar grain dryers - solar refrigeration system - solar ponds - solar photo voltaic systems - solar lantern - solar street lights - solar fencing - solar pumping systems.

### **Unit V: Wind energy, energy plantation and bio-fuels**

Wind energy - types of wind mills - constructional details and applications. Energy crops - definition and use of energy plantation - availability - selection of species - calorific value and rating index - calculation of area needed for power production from energy crops. Energy from agricultural wastes - liquid bio fuels - bio diesel and ethanol from agricultural produce - its production and uses.

### **Practical**

Constructional details of KVIC and Deen Bandu type biogas plants - Constructional details of different types of gasifiers and testing. Briquette preparation from biomass - to study and find the efficiency of solar cooker - solar still - solar dryers - solar photovoltaic pumping system and domestic solar water heater; solar lantern - solar street light- wind mills - Field visit - Improved chulhas - Liquid bio fuels, bio ethanol and bio methanol - Bio - diesel production.

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4. Energy technology - Non conventional, renewable and conventional, Rao, S. and B.B. Parulekar, 2002. Khanna Publishers, New Delhi, India.
5. Renewable Energy Resources , John Twidell and Tony Weir - (Paperback - 24 Nov 2005).
6. Biotechnology and other Alternate Technology, Chakravarthy A 1989. Oxford and IBH Publishing Co. Ltd. New Delhi.
7. Renewable Energy Sources and Conversion Technology, Bansal N.K.et al 1990. Tata McGraw Hill publishing Co.Ltd., New Delhi.
8. Non Conventional Energy Sources, Rai GD 1996. Khanna publishers, New Delhi.

9. Biomass Briquetting and utilization, Srivastava et al 1995 Jain Brothers New Delhi 110 005.

## **PAT 202      APPLIED PLANT PATHOLOGY    1+1**

### **Theory**

#### **Unit I: Epidemiology, Disease Assessment and forecasting**

Epidemiology of crop diseases -Role of host, pathogen and weather in disease development -Disease surveillance and assessment- Disease forecasting and remote sensing

#### **Unit II: Principles of Crop Disease Management**

Avoidance - Exclusion -Plant quarantine; Eradication - Cultural, physical, chemical methods; Protection - Cultural, physical, chemical methods; Immunization- Types and mechanism of resistance -'R' genes -Cross protection

#### **Unit III: Fungicides and Antibiotics**

Fungicides – Characteristics of an ideal fungicide - Classification and groups of fungicides -Antibiotics- Formulation of fungicides-Methods of application of fungicides to manage seed, soil, foliar and post-harvest diseases -Compatibility and phytotoxicity-Precautions and safety measures in handling.

#### **Unit IV: Biocontrol, Biotechnological approaches and Integrated Disease Management**

Biological control-Role-Biocontrol agents (Fungi, VAM and PGPR) - Characters and mechanisms of biocontrol and PGPR- Methods of application -Botanicals and antiviral principles - Methods of application –Application of biotechnology in crop disease management- Integrated Disease Management (IDM)– Concepts, advantages and importance.

#### **Unit V: Diagnostic Techniques and Mushroom Production**

Diagnostic techniques for detecting plant pathogen - Biological diagnosis, Chemodiagnosis and Serodiagnosis - Seed health testing - Mushroom Importance-Nutritive and pharmaceutical values -Cultivation techniques of oyster, milky, button and paddy straw mushrooms

### **Practical**

Various groups of fungicides and antibiotics - Preparation of Bordeaux mixture, Bordeaux paste and fungicidal spray solution -Phytotoxicity- Methods of application - seed treatment, Soil and foliar application-Special methods of application -corm injection, root feeding, capsule application and acid delinting Post harvest treatment of fungicide - Production of immunized seedlings in citrus - Mass production of *Trichoderma*, *Pseudomonas* and *Bacillus* spp and methods of application. Preparation of plant extracts, oil emulsions and anti-viral principles. Survey and assessment of crop diseases. Biological and chemical diagnosis of plant diseases. Cultivation techniques of oyster, milky, button and paddy straw mushrooms

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14. Chaube H.S. and Pandhir 2005. Crop diseases and their management. Prentice hall of India Pvt. Ltd. New Delhi
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16. Upadhyay RK & Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.
17. Hewitt, H.G. 1998. Fungicides in Crop Protection. CABI, Wallington.
18. Bahl, N. 2000. Handbook of Mushrooms (4<sup>th</sup> Edition), Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
19. Narayanasamy, P. 2011. Microbial plant pathogens detections and disease diagnosis Vol. I. Springer publication.

## **HOR 211      PRODUCTION TECHNOLOGY OF VEGETABLES AND FLOWERS    2+1**

### **Theory**

#### **Unit I: Vegetable production**

Importance of vegetable growing – area and production of vegetables in India -  
Nutritive value of vegetables – classification of vegetables – types of vegetable growing –  
vegetable forcing – kitchen garden – market garden – truck garden and nutrition garden

## **Unit II: Production technology of vegetable crops**

Climate and soil – varieties and hybrids – seeds and sowing – nutrient management – irrigation and fertigation management – weed management – cropping systems in vegetable crops - vegetable production under protected structures – maturity indices and harvest of Tomato, chilli, capsicum, okra, brinjal, bhendi, onion, gourds, peas, french beans and dolichos bean, potato, cassava, sweet potato, carrot, radish, turnip, beetroot, cabbage, cauliflower, amaranthus, palak, coccinia, curry leaf and moringa

## **Unit III: Production technology of commercial flower crops**

Importance, scope, constraints and future prospects – area and production – Soil and climate – varieties – propagation – nursery practices – planting methods – pinching, training and pruning - nutrient and water management – role of growth regulators – harvest– post-harvest management – grading and packaging of rose, jasmine, chrysanthemum, tuberose, crossandra and marigold.

## **Unit IV: Ornamental gardening**

Importance and Planning of ornamental gardens - Types and styles of ornamental gardens - Use of trees and shrubs - Use of climbers and palms - Use of houseplants and seasonal flowers in the gardens - Ornamental Horticulture – importance of gardening – Designing garden – components of gardening

## **Unit V: Landscape gardening - lawn making**

Basic principles of landscaping – Lawn and Lawn making – use of important trees, shrubs and climbers – annuals – biennials and herbaceous perennials in gardening.

## **Practical**

Preparation of nursery beds, seed treatment and sowing – preparation of main field and sowing / transplanting – laying out of nutrition garden - manures and manuring – irrigation methods - practices in use of plant growth regulators - identification of physiological disorders - identification of varieties and hybrids - visit to green house/polyhouse units. Identification of varieties – propagation - seed treatment – sowing - planting - training and pruning – shade management - fixing maturity standards – harvesting - visit to spice gardens. Study of post harvest handling and processing of vegetables and spices.

## **References**

1. Mandal, R.C. 2006. Tropical root and tuber crops. Agrobios (India)
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3. Mini, C. and Krishnakumar, K. 2004. Leaf Vegetables. Agro tech Publishing Academy, Udaipur
4. Thamburaj, S. and Narendra Singh. 2001. Vegetables, Tuber crops and Spices, Directorate of information and publications of agriculture, ICAR, NewDelhi.
5. Bhattacharjee, S.K and De L.C. 2003. Advanced Commercial Floriculture Vol. (1) Aavishkar publishers, Distributors, Jaipur.

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12. Kumar, N. Introduction to Horticulture. 2010. Oxford and IBH Publications, New Delhi.

**STA 201**

**APPLIED STATISTICS**

**1+1**

## **Theory**

### **Unit I: Introduction to statistics**

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation.

### **Unit II: Sampling**

Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error.

### **Unit III: Tests of significance**

Tests of Significance- Types of Errors, Null hypothesis and Alternate hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means (Single Sample and Two Samples); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples (with equal variance) and Paired t test. F test for variances; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity.

### **Unit IV: Correlation and regression**

Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r'. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations.

### **Unit V: Experimental designs**

Experimental Designs: Basic principles of designs, Completely Randomized Design (CRD), Layout and analysis with equal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.



## **Practical**

Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped data; Computation of Mode for Un-Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped data; SND test for Means, Single Sample; SND test for Means; Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r'; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

## **References**

1. NageswaraRao, G. 2007. Statistics for Agricultural Science. BS Publications, Hyderabad.
2. Rangaswamy, R. 1995. A Text Book of Agricultural Statistics. New Age International (P) Limited, New Delhi.
3. Gupta, S.C. and V.K. Kapoor. 2006. Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
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# **V SEMESTER COURSES**



## **AGR 301 CROP PRODUCTION – I**

**0+1**

1. Each student will be allotted a minimum land area of 2.5 cents/ 5.0 cents.
2. He/ she will do all field operations in the allotted land from field preparation to harvest and processing.

### **Practical**

Field preparation, seed treatment, raising a nursery, sowing, nutrient management, weed management and management of insect pests and disease of crops, harvesting, threshing, drying, winnowing, storage and marketing of produce. Exposure to mechanized rice cultivation-Preparation of balance sheet including cost of cultivation, net returns per student and as well as team of group of students.

### **References**

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini. 1998. Scientific Crop Production in India. Rama Publishing House, Meerut.
2. Chidida Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. ICAR 2006. Hand book of Agriculture. Indian Council of Agriculture, New Delhi.
4. Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
5. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.

## **AGR 302 AGRONOMY OF FIELD CROPS – II**

**2+1**

### **Theory**

#### **Unit I: Sugar crops**

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

#### **Unit II: Fibre crops**

Fibre crops: Cotton, Jute, Mesta and Sunnhemp: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

#### **Unit III: Forage Crops and Green Manure Crops**

Forage Crops: Sorghum, Maize, Pearl millet, Oats, Bajra-Napier Hybrid grass, Guinea grass, Cenchrus grass, Cluster bean, Cowpea, Lucerne, Hedge Lucerne, Berseem and Desmodium- Economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Green Manure crops: Daincha, Sunnhemp, *S.rostrata*, *Glyricidia*, *Tephrosia* - Origin, geographic distribution, economic importance, soil and climatic requirement, Varieties, cultural practices and yield.

#### **Unit IV: Medicinal and Aromatic crops**

Medicinal and Aromatic crops: Isabgol, Posta, Mint, Lemon Grass, Citronella and Palmarosa - Origin, geographic distribution, economic importance, soil and climatic requirement, Varieties, cultural practices, yield and post harvest handling

#### **Unit V: Tuber crops and Narcotics**

Tuber crops and Narcotics: Tapioca, Potato and Tobacco - Origin, geographic distribution, economic importance, soil and climatic requirement, Varieties, cultural practices and yield.

#### **Practical**

Identification of sugar crops, fibre crops, forage crops, Green Manures crops, medicinal and aromatics crops, tuber crops and narcotics - Calculation of seed rate - Seed treatment techniques -Nursery preparation and management for sugarcane, cotton and tobacco - Propagation techniques for medicinal & aromatics crops - Main field preparation - Sowing and manuring – 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- Economic analysis of cultivation of important crops – Visit to institutes and industries – Farmers' fields.

#### **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. Chidda Singh, Prem Singh and Rajbir Singh 2003. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
4. Singh. S.S. 1997. Crop management under irrigated and rainfed conditions. Kalyani Publishers, New Delhi
5. Gopalachari. N.C. 1984. Tobacco. Indian Council of Agrl. Research, New Delhi.
6. Hand Book of Agriculture. 2006. Indian Council of Agrl. Research, New Delhi.
7. Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
8. Hunsigi, G. 1993. Production of Sugarcane – Theory and Practice, Springer Verlag, Berlin.
9. Monograph on Cotton. 1996. Indian Council of Agricultural Research, New Delhi.
10. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
11. Bhattacharjee, S.K and De L.C (2005) Medicinal Herbs & Flowers, Aarishkar, Jaipur.
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16. Farooqi, M., M. M. Khan and M. Vasundhara. 2004. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore – 561229.
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## **GPB 301 BREEDING FIELD CROPS 2+1**

### **Theory**

#### **Unit I: Concepts in Crop Breeding and Hardy – Weinberg law**

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg Law.

#### **Unit II: Origin and Distribution of cereals, Pulses and oil seeds**

Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra, ragi); Pulses (redgram, greengram, blackgram, soybean); Oilseeds (Groundnut, sesame, sunflower, safflower, castor, mustard) etc. Fibers (Cotton, kenaf, roselle, jute) etc.

#### **Unit III: Origin and Distribution of Fodder and commercial crops**

Forage and Fodder crops (Guinea grass, cumbu Napier Hybrids, Lucern, Forage cow pea, Subabul); Narcotic crops – Masticatories and fumitories (Tobacco, Beetle vine, Arecanut); Beverages - Coffee and Tea.

#### **Unit IV: Breeding Procedure for Crop Improvement**

Major breeding procedures for development of hybrids / varieties of various crops; Plant Genetic Resources their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; Genetic basis of adaptability to unfavourable environments.

#### **Unit V: Biometrics and IPR**

Definition of biometrics, assessment of variability i.e., additive, dominance and epistasis and their differentiation; Genotype x Environment interaction and influence on yield/performance, IPR and its related issues.

### **Practical:**

Emasculation and Hybridization techniques; Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods; Handling of segregating generations, back cross methods; Field lay out of experiments; Field trials, maintenance of records and registers; Estimation of Heterosis and inbreeding depression;

Estimation of Heritability, GCA and SCA; Estimation of variability parameters; Parentage of released varieties/hybrids; Problems on Hardy, Weinberg Law; Study of quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow out test plots; Visit to various research stations; Visit to other institutions

### **References:**

1. Singh, B.D. 2007. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Phoelman, J.N. and Borthakur, 1969. Breeding Asian field crops Oxford & IBH Publishing Co., New Delhi.
3. Harihar Ram and Hari Govind Singh, 1994. Crop breeding and Genetics. Kalyani Publishers, New Delhi.
4. Chopra, V.L. 1994. Plant Breeding. Theory and Practice. Oxford and IBH Publishing Co., New Delhi
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## **AEC 301      AGRICULTURAL FINANCE, BANKING AND CO-OPERATION      1+1**

### **Theory**

#### **Unit I: Agricultural Finance – Nature and Scope**

Agricultural finance - importance – nature and scope - definition. Agricultural credit – meaning, definition, need, classification. Sources of credit – Role of institutional and non-institutional agencies - advantages and disadvantages. Rural indebtedness. History and development of rural credit in India.

#### **Unit II: Financial Institutions**

Institutional agencies – Commercial banks- nationalization, AD Branches – Area Approach – Priority Sector Lending, Regional Rural Banks, Lead bank, Kisan Credit Card (KCC) Scheme, Scale of finance. DIR Scheme – Relief Measures and Loan Waiver Scheme. Higher financial institutions – RBI, NABARD, AFC, ADB, World Bank, Insurance and Credit Guarantee Corporation of India. Rural credit policies. Microfinance - its role in poverty alleviation – Self-Help Groups – Non-Governmental Organizations.

#### **Unit III: Co-operation**

Co-operation – philosophy and principles. History of Indian Co-operative credit movement – pre and post independence periods. Co-operation in different plan periods. Co-operative credit institutions – structure - short term and long term credit - functions. Strength and weakness of co-operative credit system. Policies for revitalizing co-operative credit - salient features of Vaithyanathan Committee on revival of rural co-operative credit institutions. Reorganization of Co-operative credit structure in Andhra Pradesh and single window system. Successful co-operative credit systems in Gujarat, Maharashtra, Punjab, etc. Special Co-operatives – LAMPS, FSS – objectives, role and functions.



#### **Unit IV: Banking and Insurance**

Negotiable Instruments – meaning, importance, types. Central bank – functions. Credit control – objectives and methods – CRR, SLR, Repo rate. Credit rationing - Dear money and cheap money. Non- Banking Financial Institutions (NBFI). Credit creation - Financial Inclusion - credit widening and credit deepening. Assessment of crop losses, determination of compensation. Crop Insurance –schemes, coverage, advantages and limitations in application, estimation of crop yields. Livestock Insurance Schemes.

#### **Unit V: Farm Financial Analysis**

Principles of Credit - 5C's, 3R's and 7 P's of credit. Repayment plans. Project Management – feasibility – preparation - time value of money - compounding and discounting – concept of agricultural project proposal/appraisal of agricultural development projects - undiscounted and discounted measures. Evaluation of farm credit proposal. Farm Financial Statements – Balance Sheet, Income Statement, Cash flow Statement – Financial Ratio Analysis.

#### **Practical**

Visit to Farm - estimation of credit needs, identification of problems and suggestions in the use of farm credit. Visit to a Primary Agricultural Co-operative Credit Society and DCCB to study their functions. Visit to a Commercial Bank Branch to study its functions. Visit to Lead bank to study the preparation and implementation of credit plans. Visit to NABARD to study its role and functions. Time value of money – compounding and discounting. Project preparation and appraisal - undiscounted and discounted methods. Visit to SHGs. Study of crop insurance products. Banking procedure for availing loan. Repayment plans.

#### **References**

1. Muniraj, R. 1987. Farm Finance for Development, Oxford & IBH, New Delhi.
2. Subba Reddy, S. and P. Raghu Ram 2000. Agricultural Finance and Management, Oxford & IBH, New Delhi.
3. W.F. Lee. M.D. Boehlje, A.G. Nelson and W.G. Murray, (1998), Agricultural Finance, Kalyani Publishers, New Delhi.
4. C.B. Mammoria and R.D. Saxena 1973. Cooperation in India, Kitab Mahal, Allahabad.
5. V.E. Patnaik and A.K. Roy, (1988), Cooperation and Cooperative Management, Kalyani Publishers, Ludhiana.

### **AEN 301      PESTS OF FIELD CROPS AND THEIR MANAGEMENT      2+1**

#### **Theory**

##### **Unit I: Insect Ecology and Components of Pest Management**

Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest – definition, categories of pests, factors governing pest outbreaks. Losses caused by pests –

Concept of Economic Threshold Level and Economic Injury Level, pest surveillance and forecasting. Principles and Components of pest management

### **Unit II: Methods of Pest Control**

Cultural, Physical, Mechanical and Legal methods of pest control. Biological control– parasitoids and predators, viruses, bacteria, fungi, protozoa and nematodes and their role of in insect management. Host plant resistance – Types and mechanisms of resistance, role of host plant resistance in IPM. Chemical control – Classification of pesticides , formulations, role of insecticides in pest management. Biorational pest management - Semiochemicals – pheromones, allomones , kairomones and synomones - role of pheromones in pest management. Insect growth regulators – moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management- Biotechnology in pest management.

### **Unit III: Pests of Cereals, Millets and Pulses**

Distribution, Bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, tenai, mesta and pulses (redgram, green gram, black gram, bengal gram, cowpea.).

### **Unit IV: Pests of Oilseeds, Cotton and Sugarcane**

Distribution, Bionomics, symptoms of damage and management strategies of insects and non-insect pests of groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean, mustard, Cotton and Sugarcane.

### **Unit V: Pests of Green Manures, Forage Crops, Tobacco, Stored Products Pests and Non Insect Pests**

Pests of green manures (Sunnhemp, Sesbania, Daicha. Glyricidia), forage crops (Lucere and Subabul). Pests of stored products. Rodents and birds of agricultural importance and their management. Locusts and their management.

### **Practical**

Study of symptoms and types of damage caused by insect pests. Assessment of insect population and damage. Study and identification of different types of parasitoids, predators and entomopathogens. Behavioral approaches in pest management – Pheromones, light traps, sticky traps and other traps. Study of pesticides – different groups and formulations. Pesticide application equipment – types and uses. - Preparations of spray fluids and botanicals for field application. Identification of symptoms of damage and life stages of important pests of different field crops: cereals, millets, pulses, oilseeds, cotton, sugarcane, green manures, forage crops and stored product pests. Non insect pests.

### **References**

1. Ayyar, T.V.R. 1963. Hand Book of Economic Entomology for South India. Govt. Press, Madras.
2. David, B.V.2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
3. Dhaliwal, G.S. and Ramesh Arora. 1998. Principles of Insect Pest Management. Kalyani Publishers, New Delhi.

4. Hill, D.S. 1985. Agricultural Pests of Tropics and their Control, Cambridge University Press, London.
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6. Nayar,K.K., T.N.Ananthakristman and B.V.David 1985. General and Applied Entomology. Tata McGraw Hill Publishing Company Ltd, New Delhi
7. Nair, M.R.G.K. 1986. Insects and Mites of Crops in India. Indian council of Agricultural Research, New Delhi.
8. Regupathy, A., S. Palanisamy, N. Chandramohan and K. Gunathilagaraj. 2008. A Guide on Crop Pests. Sooriya Desktop Publishers, Coimbatore.
9. Srivastava, K.P. 2003. A text book of Applied Entomology. Vol. I & II. Kalyani Publishers.

## **AEX 301      EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY      1+1**

### **Theory**

#### **Unit I:**

Communication – meaning, definition, models, elements and their characteristics, types and barriers in communication. extension programme planning – meaning, definitions of planning, programme, project, importance, principles and steps in programme development process, monitoring and evaluation of extension programmes.

#### **Unit II:**

Extension teaching methods – meaning, definition, functions and classification individual contact methods – farm and home visit, result demonstration, field trials – meaning, objectives, steps, merits and demerits. group contact methods – group discussion, method demonstration, field trips – meaning, objectives, steps, merits and demerits. mass contact methods – campaign, exhibition, kisan mela, radio & television – meaning, importance, steps, merits and demerits. factors influencing in selection of extension teaching methods and combination (media mix) of teaching methods.

#### **Unit III:**

Ict in extension – internet, cyber cafes, video conferences, kisan call centers, consultancy clinics, mobile technology, expert systems

#### **Unit IV:**

Diffusion – meaning and elements. attributes of innovations. adoption of innovations – meaning, definition, models of adoption process, innovation – decision process – elements, adopter categories and their characteristics, factors influencing adoption process.

#### **Unit V:**

Capacity building of extension personnel and farmers – meaning, definition, types of training, training to farmers, farm women and rural youth – ftc and KVK.

## **Practical**

Simulated exercises on communication. Identifying the problems, fixing the priorities and selecting a most important problem for preparation of a project. developing a project based on identified problems in a selected village. organizing group discussion sessions and method demonstration. visit to tot centre - KVK/community radio stations. planning and writing of scripts for radio and television. audio visual aids – meaning, importance and classification. planning & selection. evaluation and presentation of visual aids. preparation of visual aids – charts, posters, power point slides. planning and preparation of agricultural information materials – leaflet, folder pamphlet, news stories, success stories.

## **References**

1. Ray, G.L., 1999. Extension communication and management, Naya prokash, 206, Bidhan sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of innovations, The Free Press, New York
3. Sandhu, A.S. 1996. Extension programme planning, oxford & IBH publishing co. New Delhi
4. Sandhu, A.S. 1996. Agricultural communication: process and methods, oxford & IBH publishing co Pvt. Ltd, New Delhi

## **AEG 301 POST HARVEST TECHNOLOGY AND FOOD ENGINEERING 1+1**

### **Theory**

#### **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 - applications and effect of moisture content on properties.

#### **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 cleaner- reciprocating and rotary types - construction and operation-care and maintenance - 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 - operational safety and maintenance – 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 – traditional and modern rice milling - parboiling, dehushing, polishing, modern rice mill machineries – wheat milling – process flow chart – roller flour mill - construction and operation - pulse milling - wet, dry and CFTRI methods of pulse milling – equipments – 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 and agricultural process industry – selection of plant location - layouts – types - preparation of process chart and machinery layout.

#### **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 - exercises on location analysis and preparation of plant layout for food processing industry – visit to food processing industry.

#### **References**

1. Henderson, S.M. and R.L.Perry. 1995. Agricultural process engineering, John Willey and Sons, New York. p.234.
2. Pillaiyar, P. 1988. Rice- Postproduction Manual. Wiley Eastern Limited, New Delhi.
3. McCabe, W.L. and J.C.Smith. 2001. Unit operations in chemical engineering. McGraw Hill Kogakusha Ltd., Tokyo. p.1028.
4. Multon, J. L., A.M.Reimbert, D.Marsh and A.J.Eydt. 1989. Preservation and storage of grains, seeds and their byproducts. CBS Publishers and Distributors, Delhi.
5. Sahay. K.M. and Singh,K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.
6. Chakraverty, A. 2000. Third Edition. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi.
7. Srivastava,U.K. and Patel, N.K. 1994. Managing Food Processing Industries. Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
8. Verma, L.R and V.K.Joshi.2000 Post Harvest Technology of Fruits and Vegetables Vol I & II, Published by Indus Publishing Company, New Delhi.

## **Theory**

### **Unit I: Diseases of Cereals and Millets**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of rice, wheat, sorghum, maize, pearl millet, finger millet and other minor millets.

### **Unit II: Diseases of Pulses**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of pigeonpea, chickpea, urdbean, mungbean, cowpea, lablab and soybean

### **Unit III: Diseases of Oil seeds**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of groundnut, gingelly, sunflower, castor, linseed, mustard and jatropha

### **Unit IV: Diseases of Cash crops**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of cotton, jute, sugarcane, sugarbeet, tobacco, mulberry, betelvine and turmeric.

### **Unit V: Post Harvest Spoilage of Grains**

Microorganism involved in spoilage - Field and storage fungi - Storage conditions in relation to development of spoilage - Types of spoilage caused by microorganism - Mycotoxins - Prevention and control of post-harvest spoilage

## **Practical**

Study of disease symptoms and host-parasite relationship of *Cereals and millets* - Rice, wheat, sorghum, maize, pearl millet, finger millet and minor millets, *Pulses* - Pigeonpea, chickpea, urdbean, mungbean, lablab, cowpea and soybean, *Oilseeds* - Groundnut, gingelly, castor, sunflower, linseed, mustard, jatropha and *Cash crops* - Cotton, jute, sugarcane, sugar beet, tobacco, mulberry, betel vine and turmeric and storage diseases.

## **References**

1. Agrios, G. N. 2008. Plant Pathology, 5<sup>th</sup> edition, Academic Press, New York.
2. Chaube H.S and Pandhir 2005. Crop diseases and their management. Prentice hall of India Pvt.Ltd. New Delhi
3. Mehrotra, R.S. and Agarwal, A. 2006. Plant Pathology (6<sup>th</sup> edition), Tata McGraw Hill Publishing Company Ltd., New Delhi, India
4. Prakasam, V., Valluvaparidasan, V., Raguchander, T. and K.Prabakar. 1997. Field crop diseases, AE Publication, Coimbatore.
5. Rangaswami, G. and Mahadevan A. 2004. Diseases of Crop Plants in India (4<sup>th</sup> edition). Prentice Hall of India Pvt.Ltd., New Delhi

6. Singh, R.S. 2013. Introduction to Principles of Plant Pathology (4th edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
7. Dickson, J.G. 1997. Diseases of field crops, Daya Publishing House, New Delhi.
8. Gupta V.K and Paul V.S 2004 Fungi and Plant diseases. Kalyani Publishers. New Delhi

## **HOR 311      PRODUCTION TECHNOLOGY OF SPICE, AROMATIC, MEDICINAL AND PLANTATIONS CROPS      2+1**

### **Theory**

#### **Unit-I: Crop production techniques in spice crops**

Introduction-classification of spices – scope and importance –current status of area and production - Soil and Climate- varieties and related species – propagation and planting – training and pruning practices - weed and water management – Nutrient management- drip and fertigation – Harvesting and processing for the following crops

Black Pepper, Cardamom, Turmeric, Ginger, Coriander, Cumin, Fenugreek

#### **Unit-II: Crop production techniques in aromatic crops**

Introduction – scope and importance –current status of area and production - Soil and Climate- varieties and related species – propagation and planting – weed and water management – Nutrient management- Harvesting – Postharvest Handling – distillation of essential oil for the following crops

Lemon grass, Citronella, Palmarose, Vetiver, Geranium, Dawana

#### **Unit-III: Crop production techniques in plantation crops**

Plantation crops – scope and importance –current status of area and production - Soil and Climate- varieties – propagation and planting – cropping system – training and pruning – shade management - weed and water management – Nutrient management- maturity indices – Harvesting and Processing for the following crops

Coconut, arecanut, betelvine, cashew, cocoa, coffee, oilpalm

#### **Unit-IV: Crop production techniques in medicinal plants - I**

Medicinal plants – scope and importance –current status of area and production - Soil and Climate- varieties and related species – propagation and planting – weed and water management – Nutrient management- Harvesting – Postharvest Handling – extraction of secondary metabolites for the following crops

Dioscorea, Rauvolfia, Opium, Ocimum, Periwinkle, Aloe, Guggul, Belladonna

#### **Unit-V: Crop production techniques in medicinal plants - II**

Medicinal plants – scope and importance –current status of area and production - Soil and Climate- varieties and related species – propagation and planting – weed and water management – Nutrient management- Harvesting – Postharvest Handling – extraction of secondary metabolites for the following crops.

Nuxvomica, *Solanum khasianum*, Aonla, Senna, Plantago, Stevia, Coleus and Acorus

## Practical

Botanical description and identification of varieties in aromatic plants (Lemon grass, Citronella, Palmarose, Vetiver, Geranium, Dawana) – spices (Black Pepper, Cardamom, Turmeric, Ginger, Coriander, Cumin, Fenugreek) - plantation crops (Coconut, arecanut, betelvine, cashew, cocoa, coffee, oilpalm) - medicinal plants (Nuxvomica, *Solanum khasiamum*, aonla, senna, plantago, stevia, coleus and Acorus) – Propagation techniques in spice crop - planting methods in turmeric and ginger - plantation crops- aromatic crops and medicinal plants - Selection of mother palm and seed nuts in coconut and oil palm - Distillation procedures for aromatic crops. Harvesting procedures in aromatic plants - Processing and curing of spices (ginger, turmeric and black pepper) Training methods in betel vine - Rejuvenation practices in cashewnut – Products and value added products of spices and plantation crops - Procedures for oleoresin extraction - Visit to local commercial plantations, Aromatic & medicinal plant nurseries and seed spices field.

## References

1. Bhattacharjee, S.K and De L.C. 2005. Medicinal Herbs & Flowers, Aarishkar, Jaipur.
2. Bhattacharjee, S.K. 2004. Hand book of medicinal plants, Pointer publications, Jaipur.
3. Ravindrasharma. 2004. Agro techniques of Medicinal plants. Daya publishing, New Delhi.
4. Trivedi, P.C. 2004. Medicinal Plants: Utilization and Conservation, Aavishkar Publisher, Distributors, Jaipur.
5. Atal. C. K. and B. M. Kapur. 1992. Cultivation and utilisation of medicinal plants RRL. CSIR, Jammu – Tawi.
6. Chadha, K.L. 1994. Advances in Horticulture, Vol.10. Malhotra Publishing house, New Delhi.
7. Chadha, K.L.1994. Advances in Horticulture, Vol.11. Malhotra Publishing house, New Delhi.
8. Farooqi, M., M. M. Khan and M. Vasundhara. 2004. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore – 561229.
9. Kumar, N. Introduction to Horticulture. 2010. Oxford and IBH Publications, New Delhi.
10. Kumar, N. Introduction to Spices, Plantation, Medicinal and Aromatic crops. 1995. Oxford and IBH Publications, New Delhi.

## PJN 301      SHORT TOUR      0+1

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



## **VI SEMESTER COURSES**



## **AGR 303 CROP PRODUCTION – II**

**0+1**

1. Each student will be allotted a minimum land area of 2.5 cents.
2. He/ she will do all field operations in the allotted land from field preparation to harvest and processing.

### **Practical**

Management techniques for irrigated dry (ID) crop: Field preparation, seed treatment, raising a nursery, sowing, nutrient management, weed management and management of insect pests and disease of crops, harvesting, threshing, drying, winnowing, storage and marketing of produce. Exposure to mechanized irrigated dry crop cultivation- Preparation of balance sheet including cost of cultivation, net returns per student and as well as team of group of students.

### **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. Crop Production Guide. 2005. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
4. Rajendra Prasad. 2004. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.
5. M.S. Prasad, Y.S. Ramakrishna and Y.V.R. Reddy. 2006. Maize Production In India. International Book Distributors Publishers, New Delhi
6. M S Prasad, Y. V. R. Reddy, Y. S. Ramakrishna, L. L. Somani, N. N. Reddy and B.M. K. Reddy. 2008. Maize Production Technology. Agrotech Publishers, New Delhi

## **AGR 304 FARMING SYSTEM AND DRY FARMING**

**2+1**

### **Theory**

#### **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 - Indices for evaluation of cropping systems - Land use - yield advantages - Economic evaluation

#### **Unit II: Farming systems**

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping – scope and advantages of Integrated Farming system – evaluation indicators of integrated farming

system - Integrated farming system models for different agro eco-systems - LEIA & HEIA- concepts and principles.

### **Unit III: Dryland farming and rainfed farming**

Dryland farming and rainfed farming - Significance of dry farming in India- History of dry land agriculture- Distribution of Arid and semiarid regions in World, India and Tamil Nadu – Major crops of Dryland in India and Tamil Nadu - Characteristics - constraints

### **Unit IV: Drought and its management**

Drought – Definition - Types and effects of Drought on crop production - Drought management - Contingent crop planning – Mid season correction – Mulching – anti-transpirants - Soil moisture conservation techniques and approaches - Water harvesting, storage and recycling - Integrated dry land technologies – Mechanization - Watershed management

### **Unit V: Resource management in drylands**

Resource management under constraint situation – Cost reduction strategies in crop production – cropping system, farming system and dry farming – Non-monetary inputs and low cost technologies - Labour management – Resource recycling – Residue management – crop and livestock – Conservation agriculture – principles, concept and scope- Sustainable Agriculture- introduction, definition-goal.

### **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 - Zonation of Dry farming regions of Tamil Nadu, India and World - study of tools and implements and machineries for tillage, sowing and after cultivation - assessing their efficiencies -study of drought management technologies in dryland agriculture - Preparation of contingency crop plan for aberrant rainfall situations – Visit to watershed area to study the impact of various soil and moisture conservation methods.

### **References**

1. Govindan K. and V. Thirumurugan. 2003. Principles and practice of Dryland Agriculture, Kalyani Publishers, Chennai.
2. Pratap Singh, S.M.Mathur and Jaspal Singh 1995. Technology for dryland agriculture. Himanshu Publication, Udaipur.
3. Rengasamy P. 1990. Dry farming Technology in India. Agri publishing Academy, New Delhi.
4. Saxena N.P. 2003. Management of agricultural drought. Oxford and IBH publishing Co pvt. Ltd., New Delhi.

5. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House. Delhi.
6. Devasenapathy, P., T. Ramesh and B. Gangwar 2007. Efficiency indices for agriculture management research. New India Publishing agency, Delhi.
7. Jayanthi, C., N. Sakthivel, N. Sankaran and T.M. Thiyagarajan. 2003. Integrated Farming system – A Path to Sustainable Agriculture. TNAU Publication.
8. S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.
9. Palaniappan, SP and K. Sivaraman. 1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.

## **AGR 305      ORGANIC FARMING      1+1**

### **Theory**

#### **Unit I: Types of farming and impacts of green revolution farming**

Types of farming – Impacts of green revolution farming – Fate of chemicals in agro ecosystem

#### **Unit II: Organic farming - Concepts and principles**

Ecology and Principles of ecology. Biodiversity: importance and measure to preserve biodiversity. Organic farming: Definition - Scope - principles and concepts - history of organic farming - global scenario – pre requisites for Organic farming: Integrated Farming System approach – organic carbon: status and improvement strategies – conservation tillage.

#### **Unit III: Nutrient sources in organic farming**

Organic sources of nutrients – 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. Panchagavya and other organic solutions – Preparation and usage

#### **Unit IV: Pest and disease management in organic farming**

Bio intensive pest and diseases management - physical, cultural, mechanical and biological methods – non-chemical weed management methods: preventive, physical, cultural, mechanical and biological control measures - good crop husbandry practices

#### **Unit V: Certification, exports and ITK**

Organic certification – NPOP guidelines - Certification agencies in India – crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities. Indigenous Technical Knowledge (ITK) in organic agriculture – rationale and principles – soil, nutrient, weed, water, pest and disease management – benefits and problems in organic farming: promotional activities – economic evaluation of organic production systems

## Practical

Raising of field crop – 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 analysis of inputs and products - grading, packaging, post-harvest management – visit to organic farms, market outlets and organic certification centers.

## References

1. Nicholas lampkin 1994. Organic farming. Farming press London.
2. Arunkumarsharma 2008. A Hand book of organic farming. Agrobios Publishers.
3. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.
4. Veeresh, G.K. 2010. Organic farming, Cambridge university press.
5. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008. Scientific Publishers.
6. Stockdale, E *et al.*, 2000. Agronomic and environmental implications of organic farming systems. Advances in Agronomy, 70, 261-327

## **SAC 301      MANURES, FERTILIZERS AND NUTRIENT MANAGEMENT      2+1**

### Theory

#### Unit I: Essential Nutrients

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

#### Unit II: Nutrient Dynamics

Nutrients – sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron and molybdenum in soils.

#### Unit III: Fertilizers

Fertilizers – Definition and classification, sources, properties and reactions of macro and micro nutrient fertilizers in soil. Manufacture of urea, ammonium sulphate,  $\text{NH}_4\text{NO}_3$ ,  $\text{NH}_4\text{SO}_4$ , SSP, enriched SSP, DAP, MOP and SOP. Complex, mixed fertilizers, and Micro nutrient mixtures- preparation, methods of fertilizer application – Fertigation, characteristics and compatibility of fertilizers - Fertilizer Control Order (FCO).

#### Unit IV: Manures

Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermicomposting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges

## **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. Long term effect of fertilization on soil.

## **Practical**

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.

## **References**

1. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson, 2005. Soil Fertility and Fertilizers - An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, NJ.
2. Mengel, K. and E.A. Kirkby. 1987. Principles of Plant Nutrition, 4th ed. International Potash Institute, Worblaufen-Bern, Switzerland.
3. Horst. 1995. Mineral Nutrition of Higher Plants, 2nd edition. Marschner, Academic Press Inc. San Diego, CA.
4. Yawalkar, K.S., J.P. Agarwal and S. Bokde. 1972. Manures and Fertilizers Third revised edition Agri Horticultural Publishing House, Nagpur.
5. Cooke G.W., 1972. Fertilizers for maximizing yield, Grenada Publishing Ltd, London.
6. Russell. E.J. 1973. Soil conditions and plant growth, Tenth edition English Language Book Society, London.
7. Westerman, R.L. (ed.) 1990. Soil Testing and Plant Analysis, 3rd. edition. Soil Science Society of America, Inc., Madison, WI.
8. Tandon, H.L.S. 1994. Fertilizer, Organic Manures, Recyclable Wastes and
9. Biofertilizers Fertilizer Development and Consultation Organization, New Delhi

## **AEC 302      PRINCIPLES OF AGRIBUSINESS MANAGEMENT      1+1**

## **Theory**

### **Unit I: Agribusiness**

Agribusiness – Definition – Structure of Agribusiness (input, farm and product sectors) Agribusiness Management - Special features of Agribusiness - Importance of Agribusiness in Indian Economy.

### **Unit II: Management**

Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organization – Sole Proprietorship – Partnership – Private and Public Limited, Cooperatives.

### **Unit III: Management functions I**

Planning – Definition – Types of plans - Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget - Steps in planning – Characteristics of Sound plan. Objectives – MBO Organizing – Principles of Organizing – Concept of Departmentation - Delegation- Centralization – Decentralization.

### **Unit IV: Management Functions II**

Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's "Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management

### **Unit V: Management Functions III**

Controlling – Concept - Steps – Types – Importance – Process. Functional areas of business – Operations, Human Resources, Finance and Marketing – Scope and meaning. Laws and Policies related to Agri-Business.

### **Practical**

Exercise on Operations Management in agribusiness firms - Logistics Management - Inventory Management - Inventory types, costs and Economic Order Quantity- ABC analysis - Procurement systems and vendor rating methods - Exercise on Supply Chain Management. Market Research and Segmentation-Demand forecasting methods - Farmers survey – Buying behaviour of agricultural inputs - Market Promotion measures-Pricing methods. Exercises on Human Resource Planning and Management. Assessing and acquiring finance for agribusiness firms - Visit to agri hi-tech bank branch / commercial banks/ RRB/ NABARD. Procedure and constraints in establishing agro based industries-New agribusiness venture proposal preparation.

### **References**

1. Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New Delhi.
2. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, 'Production and Operations Management - Manufacturing and service, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.
4. Philip Kotler, Marketing Management, Pearson Education, India, 2003.
5. Chandra Prasanna. 2000. Financial Management - Theory and Practice. Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
6. R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.



## **AEN 302 PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT 2+1**

### **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, Crucifers, Cucurbits, Moringa and Amaranthus.

#### **Unit II: Pests of Fruit crops**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Sapota, Citrus, Banana, Grapevine, Guava, Jack, Custardapple, Pomegranate, Pine apple, Papaya, Ber, Apple and Aonla

#### **Unit III: Pests of Tuber crops**

Distribution, bionomics, symptoms of damage and management strategies of insect of Potato, Sweet potato, Yam and Tapioca

#### **Unit IV: Pests of Spices and Plantation Crops**

Distribution, bionomics, symptoms of damage and management strategies of insect of Chillies, Onion, Garlic, Ginger, Turmeric, Coriander and Curry leaf. Coconut, Arecanut, Coffee, Tea, Cashew, Rubber, Cocoa, Cardamom, Pepper and Betelvine

#### **Unit V: Pests of Ornamentals, Medicinal Plants and Tree Crops**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Gloriosa, Coleus, Phyllanthus, Aswagantha, Neem, Teak, Sandalwood, Eucalyptus.

### **Practical**

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, spices, ornamentals, tubers, plantation crops, medicinal plants lawn, turf, cut flowers, tree crops, dry fruits, nuts and other Horticultural products. Establishment and maintenance of honeybee colonies

### **References**

1. Ayyar, T.V.R. 1963, Hand Book of Economics Entomology for South India. Govt. Press Madras.
2. David, B.V. 2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
3. Butani, D.K. 2009. Insects and Fruits. Periodical Expert Book Agency, New Delhi.
2. Butani, D.K. and M.G.Jotwani, 1984. Insects of Vegetables. Periodical Expert Book Agency, New Delhi.
3. Srivastava, K.P. and D.K.Butani, 1998. Pest Management in Vegetables (Part I & II) Research Periodicals and Book Publishing House, India.

**Theory****Unit I:**

Concept of entrepreneurship; entrepreneurial and managerial characteristics; Assessing overall business environment in the Indian economy. Globalisation and the emerging business / entrepreneurial environment. Overview of Indian social, political and economic systems and their implications on agricultural entrepreneurs.

**Unit II:**

Managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; SWOT analysis, Generation, incubation and commercialization of ideas and innovations.

**Unit III:**

Entrepreneurship development programs; Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to agriculture sector.

**Unit IV:**

Venture capital. Contract farming and joint ventures, public, private partnerships. Overview of agri inputs industry. Social Responsibility of Business.

**Unit V:**

Organisational communication- definition, objectives, importance, process, methods and barriers. Leadership – Definition, styles, difference between leaders and Managers.

**Practical**

Listening and note taking, writing skills, oral presentation skills; Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting, individual and group presentations. Analysing cases, Practicing SWOT analysis. Visiting Agri clinics/Agri based industries/Agri Financing Institutions. Sample Project formulation and report preparation.

**References**

1. Gupta, C.B. 2001. Management: Theory and Practice. Sultan Chand and Sons, New Delhi.
2. Khanka, S.S. 1999. Entrepreneurial Development. S. Chand and Co., New Delhi.
3. Sagar Mondal and G.L. Ray. 2009. Text Book of Entrepreneurship and Rural Development, Kalyani Publishers, Ludhiana.
4. Vasant Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publishing House, New Delhi.
5. Vasant Desai. 2000. Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, New Delhi.

## **PAT 302 DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT 2+1**

### **Theory**

#### **Unit I: Diseases of Fruit Crops**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of tropical fruits - mango, banana, citrus, grapes, guava, sapota, pomegranate, papaya, pineapple, annona, jack, ber, aonla and temperate fruits - Apple, pear, plum and peach and post harvest diseases of fruits

#### **Unit II: Diseases of Vegetable Crops**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of tomato, brinjal, bhendi, potato, cucurbits, crucifers, beans, peas, sweet potato, carrot, beetroot, cassava, yam and colacasia and post harvest diseases of vegetables

#### **Unit III: Diseases of Spices and condiments**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of onion, garlic, chillies, pepper, coriander, ginger, cardamom, cinnamon, nutmeg and clove.

#### **Unit IV: Diseases of Plantation crops**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of diseases of tea, coffee, coconut, arecanut, oilpalm, rubber, cocoa and vanilla.

#### **Unit V: Diseases of Flower crops and Medicinal plants**

Symptoms, etiology, mode of spread, survival, epidemiology and integrated management practices of important diseases of flower crops - Jasmine, rose, crossandra, chrysanthemum, marigold, carnation, dahlia, zinnia and tuberose and medicinal plants - *Gloriosa*, *Stevia*, *Coleus* and *Aloe*

### **Practical**

Study of symptoms and host parasite relationship of the following crops : Tropical fruits - Mango, banana, citrus, grapes, guava, sapota, pomegranate, papaya, pineapple, annona, jack, ber, aonla and Temperate fruits - Apple, pear, plum and peach; Vegetables - Tomato, brinjal, bhendi, potato, cucurbits, crucifers, beans, peas, sweet potato, carrot, beetroot, cassava, yam and colacasia and post harvest diseases of vegetables; Spices and Condiments - Onion, garlic, chillies, pepper, coriander, ginger, cardamom, cinnamon, nutmeg and clove; Plantation crops - tea, coffee, coconut, arecanut, oilpalm, rubber, cocoa and vanilla; Flower crops – Rose, jasmine, crossandra, chrysanthemum, marigold, carnation, dahlia, zinnia and tuberose and Medicinal plants - *Gloriosa*, *Stevia*, *Coleus* and *Aloe*.

### **References**

1. Agrios, G. N. 2008. Plant Pathology, 5<sup>th</sup> edition, Academic Press, New York.
2. Chaube H.S and Pandhir 2005. Crop diseases and their management. Prentice hall of India Pvt. Ltd. New Delhi

3. Mehrotra, R.S. and Agarwal, A. 2006. Plant Pathology (6<sup>th</sup> edition), Tata McGraw Hill Publishing Company Ltd., New Delhi, India
4. Das Gupta M.K. and Mandel W.C. 1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Co. Pvt. Limited, New Delhi.
5. Neeta Sharma and Mashkoo Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Company, India
6. Parvatha Reddy P. 2008. Diseases of Horticultural Crops, Scientific Publishers, India
7. Pathak V.N. 1980. Diseases of Fruit crops - Oxford and IBH publishing Co. Pvt. Limited, New Delhi
8. Rangaswami, G. and Mahadevan A. 2004. Diseases of Crop Plants in India (4<sup>th</sup> edition). Prentice Hall of India Pvt. Ltd., New Delhi
9. [Naqvi](#) S. A. M. H. 2004 Diseases of Fruits and Vegetables Volume I. Diagnosis and Management ISBN: 978-1-4020-1822-0.
10. Singh, R.S. 1994. Diseases of vegetable crops, Oxford & IBM Publishing Co. Pvt. Ltd, New Delhi
11. Sohi, H.S, 1992. Diseases of Ornamental plants in India, ICAR, New Delhi.
12. Srikant Kulkarni and Yashoda, R. Hegde. 2002. Diseases of Plantation Crops and their management, Agrotech, Udaipur.

## **HOR 312 POST HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES 1+1**

### **Theory**

#### **Unit I: Post-harvest losses**

Post Harvest Losses and Post Harvest Management – Definition and importance - Post harvest technology scenario of horticultural crops in India – Factors of post harvest losses- Maturity indices and harvesting methods of fruits and vegetables – Harvesting for specific market requirement.

#### **Unit II: Management of Post harvest losses**

Preharvest factors affecting post harvest quality and shelf life of fruits and vegetables – pre and post harvest treatments for enhancing shelf life – grading - pre cooling and pre storage treatments- maturity and ripening of fruits – physiological and biochemical changes associated with ripening – role of ethylene and ethylene management .

#### **Unit III: Packaging and storage**

Packaging and cushioning materials – advanced packaging technologies for fruits and vegetables – crop specific packaging to meet export standards in mango, banana, grapes, mandarin and sweet orange - Storage methods – traditional and advanced methods of storage (controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structure) – physiological disorders during storage.

#### **Unit IV: Post harvest pests and Diseases**

Browning in fruits and vegetables - Post harvest disease and insect management Hot water treatment, irradiation, vapour heat treatment, chemical treatment and use of bio agents.

#### **Unit V: Preservation**

Principles and methods of preservation - Preservation through canning, bottling, freezing, dehydration and drying – enzymatic and non-enzymatic spoilage of preserved products – permitted preservatives and colours.

#### **Practical**

Practice in judging the maturity of various fruits and vegetables. Construction of zero energy cool chambers for on farm storage. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic acid content in fruits and vegetables. Packing methods and types of packing and importance of ventilation. Pre cooling packing methods for export or international trade. Methods of prolonging storage life. Effect of ethylene on ripening of banana, mango and sapota. Identification of equipment and machinery used in preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles, sauces and ketchup. Visit to local processing units. Visit to local market yards and cold storage units. Visit to local market and packing industries.

#### **Reference**

1. Cruess, W.V. 2000. Commercial fruit and vegetable products. Agrobios (India), Jodhpur
2. Loasecke, H.W.V. 2001. Drying and dehydration of foods. Agrobios (India), Jodhpur
3. Pandey, P.H. 2002. Post Harvest Technologies of fruits and vegetables. Principles and practices. Saroj Publishers and Distributors, Allahabad.
4. Saraswathy S., T.L. Preethi, S. Balasubramanyan, J. Suresh, N. Revathy and S.Natarajan. 2008. Post Harvest Management of Horticultural Crops.
5. Srivastava, R.P and Sanjeev Kumar. 1994. Fruit and vegetable preservation. Principles and practices. International book Distributing Co., Lucknow.
6. Sudheer, K.P. and V. Indira. 2007. Post Harvest Technology of Horticultural Crops. New Delhi Publishing Agency, India.
7. Sumanbhatti and Uma Varma. 1995. Fruit and vegetable processing. CBS publishers and distributors, New Delhi
8. Thompson, A.K. 1996. Post harvest technology of fruits and vegetables. Blackwell science, Inc. Cambridge.
9. Verma, L.R and V.K. Joshi 2000. Post harvest technology of fruits and vegetables (Vol I and II) Indus publishing company, New Delhi.

## **Practical**

Soft skills and hard skills – career skills and corporate skills – lateral thinking - ego styles – different types – on being a professional.

Attitude - Psychological and Sociological definitions – types of attitude (positive and negative) and consequences – suggestions to keep a good attitude. Emotional Intelligence - Introduction and Definitions – four branch model of EQ and its detailed explanation - five point scale to measure EI – suggestions to improve EI. Inter personal skills - Study of character traits - discussion of formal interpersonal skills like greeting, enquiring, answering, complimenting and acknowledging. Self Development/Empowerment - Self awareness and motivation – Maslow's theory of hierarchy and needs - Self analysis through SWOC and Johari Window – Elements and seven rules of motivation – Goal setting based on principle of SMART – Strategies of self motivation – Knowledge enhancing through reading of Newspapers, magazines and journals.

Objectives of communication – Types of communication – Formal Vs informal communication – LSRW components of communication – Barriers to communication - Purpose and significance of listening – Process of listening –Different types of listening - How to be a good listener – Guidelines for effective listening – Barriers to listening – Tips to overcome the barriers - Purpose and significance of Reading – Benefits of reading – Process/Types of reading – Understanding/Inferring/Note making – SQ3R technique – How to be a good reader –Barriers/Distractions to good reading – Tips to overcome the barriers - Purpose and significance of speaking clearly –Verbal code and visual code - Benefits of good speaking - Process/ components of good speech – Informative speaking & its types – persuasive speaking & its types –Presentation skills – Barriers of speaking - Tips to overcome the barriers - Purpose and significance of writing – features of good writing – How to develop writing skills – choice construction, paragraph design, etc. – letter writing skills – formal & informal – parts of a good letter – layout & format of a letter –preparing a curriculum vitae – report writing – preparing a conference paper – writing a book review - editing – punctuation, spelling, grammar and vocabulary - The right environment – formal greetings - telephone courtesies – effective listening skills – interpersonal skills – concluding formality.

Definitions of interview – two types of group interview – preliminary requirements for success – telephone interview – specially designed interviews. Five stages of interview – how to answer the questions - Definition – contexts – why and how? – techniques for successful participation – skills required – simulation – based - group discussion.

Corporate Skills - Definition - basic requirements – ( responsibility - self – knowledge - knowledge of, and rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work ) leadership with primates – leadership and vision. Select definitions – functions of negotiation – two kinds of negotiation – phases of the process – rules – steps to improve negotiation skills. Basic

skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management. Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke –different kinds of stroke – stress in interview.

## References

1. Hariharan,S. , S. N. Sundararajan, and S.P.Shanmugapriya.(2010). Soft Skills. MJP Publishers, Chennai.
2. Alex. (2009). Soft skills: Know yourself and know the world. S. Chand & Co. Publishing House, New Delhi.
3. Beverly Jaeger. (2004). Making Work Work for the Highly Sensitive Person. Tata McGraw – Hill, USA.
4. Dipali Biswas. (2009). Enhancing Soft Skills. Shoraff Publishers and Distributors.
5. Gloria. J. Galanes, Kathreine Adams, John. K. and Brilhart. (2004). Effective Group Discussion. Tata McGraw – Hill, New Delhi.
6. Jagadeesan. G. and Santhanakrishnan, R. (2007). Soft Skills Development. ICFAI University Press. New Delhi.
7. Martin Avis. (2010). Effective Time Management Skills for Everyone. Avis Consultancy, London, U.K.
8. Mayer, J.D., Salovey, P and Caruso, D.R. (2000). Models of Emotional Intelligence. R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge.
9. Patsy McCarthy and Caroline Hatcher. (2002). Presentation Skill: The Essential Guide for Students. Sage Publications, CA.
10. Peggy Claus. (2007): The Hard Truth about Soft Skills. Harper Collins Publishers, New York, USA.
11. Peter. J. Gosling. (2002), Scientists Guide to Poster Presentations, Kluwar Academic Pub, N.Y, USA.
12. Richard Ellis. (2009). Communication Skills; Step ladders to success for professionals. Intellect Books, Chicago, USA.
13. Robert, A. Day. (2000). How to Write a Scientific Paper. ELBS, U.K.
14. Sarvesh Gulati. (2006). Corporate Soft Skills. Rupa Publishers, New Delhi.
15. Soleman. D. (1998). Working with Emotional Inteligence Bloomsbury Publishing, London.





## **VII SEMESTER COURSES**



**Practical:**

During RAWE programme, the students will be placed in villages, Department of Agriculture / KVKs / Research Stations, industries and non-government organizations (NGOs) for a period of 16 weeks as given below.

Sl. No.	Programme	Duration (weeks)
1.	Orientation	1
2.	Village attachment	8
3.	Attachment with Department of Agriculture / KVK	2
4.	Attachment with industries	2
5.	Attachment with NGOs	2
6.	Project report preparation, exhibition and evaluation	1
	<b>TOTAL</b>	<b>16</b>

**Component I: Village attachment**

- Study of rural situation – village settlement pattern, demography, climate, land utilization pattern, resources inventory, infrastructural facilities, rural institutions, organizations, groups, customs, beliefs and value systems
- Study of cropping pattern, cropping systems, extent of adoption of latest technologies and constraints –Yield gap – constraints in production
- Understanding social participation, leadership pattern, scientific orientation and role of women and youth in agricultural development
- Extension methods and Audio Visual Aids – Practicing individual, group and mass contact methods
- Studying the existing indigenous technical knowledge and its importance for technology generation.
- Knowing the communication pattern in villages
- Gathering the farm women's association / farmers association / commodity groups and knowing their functioning and use their services for dissemination
- Conducting need based skill demonstrations in the village
- Developing Whole Village Development Plan
- Contacting individual farmers to assess the differential farming system practiced by marginal, small, medium, big farmers and Farm Women
- Preparation of Individual farm plan

**Component II: Attachment with Department of Agriculture / KVK**

- Study of Agricultural Department – Organization pattern, role and functions of Department of Agriculture and other allied departments

- Study of on-going agricultural development programmes of the agricultural and allied institutions.
- Participating in the extension activities of the agricultural and allied institutions.

### **Component III: Attachment with Industries**

The students will undergo internship in any one of the following industries / companies.

- Food processing industries / units
- Sugar mills / Rice mills
- Seed industries / companies
- Fertilizer industries
- Pesticide industries
- Other agro-based industries

### **Component IV: Attachment with NGO**

- Study of NGO – Roles and objectives – organization pattern – sources of funding – extension activities of NGO – Contacting target groups
- Study of SHG, Agri business, Agri clinic and documentation of success stories of the farmers
- Participating in the extension activities of the NGO's.

## **PJN 401      ALL INDIA TOUR    0+2**

The students will visit various National and International Institutions related to Agriculture, Horticulture, Forestry and other allied fields in various regions of the country. The students will gain first hand knowledge about different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities in different parts of the country. The duration of the tour will be 15 days (institutional visits and intermediate journey) exclusive of onward and return journey.

## **VIII SEMESTER COURSES**



## **EXP 401      AGRICULTURAL PROJECT ANALYSES   0+5**

### **Offering Department: Agricultural Economics**

#### **Objective**

To enable the students understand the concepts and techniques of evaluation of agricultural development programs and projects

#### **Activities**

Agricultural Projects – Meaning, Definition and concepts – types of agricultural projects – project cycle – criteria for selection of agricultural projects – Methodological issues in financial and economic evaluation of agricultural projects – project appraisal techniques – undiscounted and discounted measures – analysis of risks in projects – visit to NABARD – govt. sponsored schemes – preparation of bankable business projects.

#### **Deliverables**

Students who complete this course will gain enough confidence and technical knowledge on various aspects of agricultural project preparation and economics appraisal of agricultural projects

#### **Suggested Reading**

1. Agricultural Finance and Management, S.Subba Reddy and P. Raghuram, Oxford and IBH publishing Co Pvt Ltd, New Delhi (2013)
2. Giltinger P.J. Economic analysis of agricultural projects, John Hopkins University Press, New York (2000)

## **EXP 402      FARM PLANNING AND BUDGETING   0+5**

### **Offering Department: Agricultural Economics**

#### **Objective**

To expose the students to the concept, significance and uses of farm planning and budgeting.

#### **Activities**

Farm planning: importance, types, essential elements of farm planning, stages of farm planning, characteristic of good farm plan, Farm planning procedure. Visit the farm and prepare the farm plan based on the concepts of farm plan.

Farm Budgeting: definition and types- partial budgeting ,complete budgeting, enterprise budgeting- cash flow budgeting- limitation of budgeting. Visit the farm and workout the partial and complete budgeting.

Linear programming: Assumptions – Linear programming model defined – graphical solution - advantages and limitations – Risk and uncertainty: definition – types of risk and uncertainty – safeguards against risk and uncertainty.

Computation of cost concepts: collect the data from the farmers and workout the cost of cultivation and depreciation: depreciation, Methods of computation of depreciation; Analysis of Net worth statement, balance sheet, IRR, NPW.

### **Deliverables**

Students who complete this course will be able to plan and budget for establishing commercial farms.

### **Suggested Reading**

1. Sankayan, P.L. Introduction to Farm Management, (New Delhi:Tata Mc Graw Hill Publishing Company Ltd) 1983
2. Johl SS & Kapoor TR. (2012). Fundamentals of Farm Business Management. Kalyani Publ.India
3. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ. New Delhi
4. Raju, V.T. and D.V.S.Roa (2009) Economics of farm Production and Management. Oxford & IBH Publishing Co.PVT.Ltd, New Delhi.
5. Heady, E.O. and H.R. Jensen (1954). Farm Management Economics, Prentice-Hall, Englewood Cliffs
6. Kay, Ronald D., and William M. Edwards, and Patricia Duffy ; (2004) Farm Management, Fifth Edition, McGraw-Hill, Inc., New York.

## **EXP 403      NATURAL RESOURCE ECONOMICS AND MANAGEMENT      0+5**

### **Offering Department: Agricultural Economics**

#### **Objective**

To understand the issues and economic principles related to natural resource economics and management.

#### **Activities**

Natural resources – concept, importance, classification – natural resource scarcity and mitigation – land: carrying capacity, common property land resources – institutional changes and implications; water: water resource potential, utilization, irrigation efficiency – dryland agriculture : potential, policies and programs – resource degradation – types, causes – occurrence of wastelands – environmental problems – integrated approach for ecological balance – sustainable agriculture.



## **Deliverables**

Students who complete this course will be able to analyse the causes, consequences and ways of dealing with natural resources problems.

## **Suggested Reading**

1. Kerr JM, DK Marothia, Katar Singh, C Ramasamy and WR Bentley (1997) Natural Resource Economics : Theory and applications in India, Oxford and IBH publishing company, New Delhi.
2. Rudes Dutt and Sundaram KPM, Indian Economy, Sultan Chand & Co, New Delhi (2000)
3. Sengupta R, Ecology & Economy : An Indian Perspective Oxford University Press, New Delhi (2000)
4. Rabindra N. Bhattacharya, Environment Economics: An Indian Perspective Oxford University Press, New Delhi (2000)

**EXP 404      AGRICULTURAL MARKETING MANAGEMENT      0+5**

**Offering Department: Agricultural Economics**

## **Objective**

To impart adequate knowledge and analytical skills in addressing the issues of Agri.marketing and enhance expertise in managing Agri.marketing.

## **Activities**

Introduction: Marketing-Conceptual framework-Marketing Environment: Internal and External-Marketing Interface with other functional areas.

Marketing Strategy: Marketing strategy formulations- Key drivers of marketing strategies-Consumer marketing- Competitor analysis-Strategic marketing mix components.

Marketing mix decisions: Product planning and Development-Product life cycle-New product development and management-Market Segmentation-Targeting and Positioning-Pricing objectives, policies and methods.

Marketing Research and Trends in marketing: Marketing Information System-Product Advertising-Promotion-Consumer Behaviour-Ethics in Marketing-Online marketing trends.

## **Deliverables**

The student who completes this course will increase his/her skill and expertise in managing / marketing of agricultural commodities.

## **Suggested Reading**

1. Philip Kotler and Kevin Lane, Marketing Management, PHI Learning/ Pearson Education 13TH Edition, 2008.
2. Paul Baisan et al, Marketing, Oxford University Press, 2008.
3. Duglas, J.Darymple, Marketing Management, John Wiley & Sons, 2008.
4. Boyd Walker, Marketing Mngement, Mc Graw Hill,2002.

## **EXP 405      BEHAVIOURAL SKILLS      0+5**

### **Offering Department: Agricultural Extension**

#### **Objective**

To empower the students in order to strengthen them from within to emerge as competent individuals in any given situation and to make them better prepared to meet the challenging demands of the outside world and especially the corporate sector and thereby, to perform and excel well in their preferred career.

#### **Activities**

Understanding self: Employing self inventory Scale and Johari's Window- Building self Esteem – Assessing self confidence level – Building self confidence – Assessing Self Motivation level – developing self motivation.

Managing Self: Emotional Intelligence – Self awareness – Self development – Social awareness – Relationship Management.

Interpersonal skills: Understanding IP traits – Learning the mannerisms of IP situations – Practicing the ways of improving the IP skills.

Communication skills: Learning the basics – working towards better communication – Understanding and using body language – Understanding and using gestures – Learning to listen – Asking Questions - Exchanging information – Making contact –Passing on information – Using phone – Using IT tools – Writing letter.

Leadership skills: Assessing leadership skills – Learning to lead – Leading others – Improving leading effectiveness.

Team Building and Managing skills: Understanding how team works – Setting up a team – Improving team efficiency – Rating team leadership skills.

People management skills: Developing basic people skills – Understanding people's need – Building confidence in people – Gaining trust and Commitment.

#### **Deliverables**

By the completion of the Behavioural skills course, the students should be able to:

1. Develop all-round personalities with a mature outlook to function effectively in different circumstances.
2. Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills and demonstrate effective communication and people management skills

### **Suggested Reading**

1. Mayer, J.D., Salovey, P and Caruso, D.R. (2000). Models of Emotional Intelligence. R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge.
2. Jagadeesan. G. and Santhanakrishnan, R. (2007). Soft Skills Development. ICFAI University Press. New Delhi.
3. Sarvesh Gulati. (2006). Corporate Soft Skills. Rupa Publishers, New Delhi.
4. Soleman. D. (1998). Working with Emotional Intelligence Bloomsbury Publishing, London.
5. Richard Ellis. (2009). Communication Skills; Step ladders to success for professionals. Intellect Books, Chicago, USA.
6. Robert Heller (2008) Communicate Effectively, The Winner's Manual, DK Publishers, London.
7. Robert Heller (2008) Managing Teams, The Winner's Manual, DK Publishers, London.
8. Robert Heller (2008) Effective Leadership, The Winner's Manual, DK Publishers, London.
9. Hariharan, S., Sundararajan, N and Shanmugapriya, S.P. (2010). Soft Skills, MJP Publishers, Chennai.
10. Dipali Biswas. (2009). Enhancing Soft Skills. Shoraff Publishers and Distributors.
11. Alex. (2009). Soft skills: Know yourself and know the world. S. Chand & Co. Publishing House, New Delhi.

**EXP 406      CYBER EXTENSION      0+5**

### **Offering Department: Agricultural Extension**

#### **Objectives**

1. To learn the advanced developments in the field of communication and its applicability in agricultural extension.
2. To have an access to the recent developments in the area of agricultural communication like E-mail, Internet, E-journals, e-choupal, digital library etc.,
3. To enable students to gain hands-on-experience in planning, designing the cyber extension tools
4. To study various ICT projects which are successful in delivering the services to the clientele fulfilling the objective of Transfer of Technology

#### **Activities**

Applicability of internets in transfer of technology - Access to various kinds of available websites on agriculture and rural development - ICTs projects, case studies in India- and developing world - ICT use in the field of extension - Creation of website on agricultural communication -

Creation of multimedia modules - Expert systems on selected crops and enterprises - Access to e-journals, availability in Internet - Access to video conferencing - Access to various on – line consultancy services - Access to global agriculture knowledge network and various CD-ROMS on Agriculture - Visit to Village Resource Centres (VRC) - Project on preparing Self learning Multi media CDs on package of practices, diseases and pest management.

### **Deliverables**

Students will gain knowledge and skills in understanding the concepts of Cyber extension and how these tools can be used for Agricultural Extension. Besides, he studies various cyber extension projects which are successful in delivering the services to the clientele fulfilling the objective of Transfer of Technology. They will get hands on training in preparation of various teaching aids like leaflet, folders, web pages, ,power point, video conferencing, multimedia etc.,

### **Suggested Reading**

1. Leon, A and M. Leon. 2004. Introduction to Information System. Vijay Nicol (P) Ltd., Chennai.
2. Saravanan, R. 2010. ICTs for Agricultural Extension. New India Publishing Agency, New Delhi.
3. Srinivasan, K 2002. Agri portal – A Powerful Tool for Transfer of Technology In:Uthamasamy et al.(Eds). New Dimensions in Transfer of Technology – Directorate of Extension Education TNAU, Coimbatore.
4. Swanson, S.E, Bentz, R.P. and A.J.Sofranko, 2003. Improving Agricultural Extension – A Reference Manual, FAO, Rome.
5. Uma Joshi, 2005. Information Communication Technologies for Development and Women Empowerment. Dominant Publishers and distributors, New Delhi.

## **EXP 407      INTEGRATED FARMING SYSTEM      0+5**

### **Offering Department: Agronomy**

### **Objective**

To enable students to gain hands-on-experience in commercial Integrated Farming System and to train the students in establishing a commercial IFS unit.

### **Activities**

Farming systems models- Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises– scope and advantages of Integrated Farming system –Study of models of Integrated Farming System-Wetland-Garden land- Dryland-Various components of IFS- related enterprise. Visit to different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas - study on evaluation indicators on farming system - on farm field visit.

### **Deliverables**

The student who completes this course will be able to establish and run integrated farm with various enterprises.

## **Suggested Reading**

1. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House. Delhi.
2. Jayanthi, C., N. Sakthivel, N. Sankaran and T.M. Thiyagarajan. 2003. Integrated Farming system – A Path to Sustainable Agriculture. TNAU Publication.
3. S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.
4. Palaniappan, SP and K. Sivaraman. 1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.

## **EXP 408      DAIRY FARMING      0+5**

### **Offering Department: Animal Husbandry**

## **Objective**

To develop students as entrepreneurs and managers by providing hands on experience in all the aspects of dairy farming.

## **Activities**

Introduction- Significance of milch animals in food and economy – Cattle Breeds – Selection of dairy cows - Breeding – Cross breeding – upgrading – economic traits – Estrous cycle – signs of estrous – Artificial insemination – Housing management - farm site selection and floor space requirement for calves, heifer, pregnant and lactating - Systems of housing – Restraining methods – Disbudding, dehorning – dentition and ageing -Care and management of new born calf, heifers, pregnant and lactating animals – Nutrition - Desirable characteristics of a ration - Classification of feed stuffs - Model composition of concentrate mixture of young and adult stock - Age wise feed and fodder requirement - Importance of green fodder - Milking methods-Clean milk production – factors affecting milk yield and composition – Pasteurization - determination of specific gravity, fat percentage and total milk solids- Common adulterants and preservatives of milk – Cream separation, butter, ice-cream and ghee making – Disease classification - Viral Diseases - Foot and mouth and Rinderpest - Bacterial diseases - Anthrax, Hemorrhagic Septicemia, Black quarter – Metabolic - Tympanites, Acidosis, Ketosis and Milk fever - General control and preventive measures of diseases – marketing - Dairy farm economics - Visit to modern dairy - plant and dairy farms.

## **Deliverables**

The student who completes this course will be able to establish and run a commercial dairy farm.

## **Suggested Reading**

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry. Oxford Book Company, Calcutta.

2. Gopalakrishnan, C.A. and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh, ICAR, 2013. A Hand Book of Animal Husbandry
3. Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production. Vikas Publishing House Private Limited, Ghaziabad, UP
4. Sastry, N.S.R., Thomas, C.K. 2005. Livestock Production Management. Kalyani Publishers, Ludhiana
5. Watson, J.A.S. and Mills, W.J.(2005). Farm animals and their Management.

## **EXP 409      CAPRINE PRODUCTION AND MANAGEMENT      0+5**

### **Offering Department: Animal Husbandry**

#### **Objective**

To develop students as entrepreneurs and managers by providing hands on experience in all the aspects of goat production.

#### **Activities**

Introduction- Significance of goats in food and economy - Breeds- breed classification with relation to agro climatic zones – adaptation and behavioral characteristics.- Breeding – Selection and culling – mating – controlled breeding- Housing management- Farm site selection- space requirements - design of goat house- General management – Care and management of kids and adults - Nutrition - Identification of feed and fodder – feed formulations - Judging – dentition- economic traits of goats - Disease management - factors responsible for mortality and morbidity - diseases of goats - Disease prevention – Vaccination Schedule – Ecto and endo parasite control – Bio-security measures – Environmental hygiene - Marketing - goat farming economics – Visits to farms, abattoir and markets (shandies)

#### **Deliverable**

The student who completes this course will be able to establish and run commercial goat farm.

#### **Suggested Reading**

1. Banerjee, G.C.2010.The Text Book of Animal Husbandry. Oxford Book Company, Calcutta
2. Gopalakrishnan, C.A. and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development, Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh.
3. ICAR, 2013. A Hand Book of Animal Husbandry
4. Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production, Vikas Publishing House Private Limited, Ghaziabad, UP

5. Sastry, N.S.R., Thomas, C.K. 2005. Livestock Production Management. Kalyani Publishers, Ludhiana
6. Yousef, M.K. Praeger, New York. 1982. Animal production in the tropics.

## **EXP 410      COMMERCIAL BROILER AND LAYER PRODUCTION      0+5**

### **Offering Department: Animal Husbandry**

#### **Objective**

To develop students as entrepreneurs and managers by providing hands on experience in all the aspects of broiler and layer farming.

#### **Activities**

Current status and scope of broiler and layer production in India - Commercial strains of broilers and layers.- Housing management – Location and layout of commercial broiler and layer farm– Preparation of poultry house - Equipments used in broiler and layer farms - Different systems of Management - Deep litter, cage and raised housing - Litter management - Preparation of brooder house – Brooder Management – Chick management – Grower management – Layer management – broiler management - Summer and Winter management - Common procedures followed in broiler and layer farms - Feeding – Feeding Management of broilers and layers – Types of feed – Feed ingredients – Quality assessment of feed ingredients and feed – feed additives - Nutrient requirement of different stages of broilers and layers – Feed formulations – Hatchery Management – egg and chick quality assessment - Flock Health Management - Common disease of broilers and layers – Control and Prevention – Medication and Vaccination–Postmortem inspection –Waste management -Disposal of dead birds and Manure management- Biosecurity measures.- Processing and Marketing - Record maintenance- Marketing - Integration – layer and broiler farm economics - Visit to commercial broiler and layer farms, feed plant, hatchery unit and processing plant.

#### **Deliverable**

The student who completes this course will be able to establish and run commercial broiler and layer farms.

#### **Suggested Reading**

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry.Oxford Book Company, Calcutta.
2. Gopalakrishnan, C.A.,and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh.
3. ICAR, 2013. A Hand Book of Animal Husbandry
4. Jull,M.A.(2003) Successful Poultry Management

5. Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS., Chennai.
6. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai

## **EXP 411      PLANT TISSUE CULTURE      0+5**

### **Offering Department: Plant Breeding and Genetics**

#### **Objective**

To enable students to gain hands-on-experience in commercial micro-propagation and to train the students in establishing a commercial plant tissue culture unit.

#### **Activities**

Design for a commercial tissue culture laboratory – Stock solution and medium preparation – liquid and semi solid – Surface sterilization of different explants – Stage 1 – Aseptic culture establishment – Stage 2 – Multiple shoot induction and sub culturing for further multiplication – Stage 3 – Shoot elongation and Rooting of micro-shoots – *Invitro* and *in vivo* – Stage 4 – Hardening and field establishment of micropropagated plants – Visit to commercial Units – Project preparation – Target crops – Banana, Sugarcane, Bamboo, Rose, Chrysanthemum, Gerbera, Orchids or any other commercially important crop and rare medicinal plants.

#### **Deliverables**

Students who completes this course will gain enough confidence and technical skills to establish a plant tissue culture unit.

#### **Suggested Reading**

1. Razdan, M. K. 2003. Introduction to Plant Tissue Culture. Enfield: Science Publishers Inc. USA
2. Dixon, R. A. 2003. Plant Cell Culture – A Practical Approach, IRL Press. Oxford. London
3. Gamborg, O. L and Phillips, G. C. 2004. Plant Cell Tissue and Organ Culture – Fundamental methods. Narosa Publishing House, New Delhi.
4. George, E. F., Hall, M. A and DeKlerk, G. J. 2008. Plant Propagation by Tissue Culture. Volume 1. The Background. 3<sup>rd</sup> edition. Springer. Netherlands
5. Trigano, R. N and Gray, D. J. 2000. Plant Tissue Culture – Concepts and Laboratory exercises. Second edition. CRC press. London



**EXP 412      MOLECULAR BREEDING      0+5**

**Offering Department: Plant Breeding and Genetics**

**Objective**

To enable students to gain Knowledge and hands-on-experience in use of advance molecular techniques for crop improvement.

**Activities**

Isolation of DNA - DNA markers - PCR based system - STS, Micro satellite markers. Hybridization based system - RFLP, AFLP enzyme digestion, membrane transfer, auto radiography, scoring system and analysis of data. Introduction to MAPMAKER. Molecular mapping. Mapping population – recombinant inbred lines, near isogenic lines, doubled haploid lines. Scoring system –dominant and co dominant marker, LOD score. Single and multi gene analysis - construction of linkage maps. QTL analysis. Marker-assisted selection foreground and background selection.

**Deliverables**

Students who complete this course will gain enough knowledge, confidence and technical skills in handling various molecular techniques.

**Suggested Reading**

1. Yunbi Xu. 2012. Molecular Plant Breeding. CABI, Enfield: Science Publishers Inc. USA
2. Guo-Liang Jiang. 2010. Molecular Markers and Marker-Assisted Breeding in Plants. Enfield: Science Publishers Inc. USA
3. Yamada, Toshihiko, Spangenberg. 2009. Molecular Breeding of Forage and Turf. German (Eds.)
4. Y. Xu. 2010. Molecular Plant Breeding, CAB International, UK
5. Caetano-Anolles, G. and Gresshoff, P.M. 1997. DNA Markers: Protocols Applications and Overviews. WILEY - VCH, New York, USA

**EXP 413      COMMERICAL SEED PRODUCTION      0+5**

**Offering Department: Seed Science and Technology**

**Objective**

To enable students to gain hand-on experience in commercial seed production and also to train the students to start a commercial seed production unit / farm.

**Activities**

Hand-on-experience in Seed Enhancement techniques-sowing-nursery management – Transplanting – Thinning – Maturing – Herbicide application – Mother crop nutrition – Plant protection – Hybrid seed production – Supplementary pollination – Roguing –

Preharvest sanitation sprayings – Seed certification – Harvesting – Threshing – Seed Extraction – Seed Drying – Seed processing – Seed treatment – Seed Marketing – Seed storage – Visit to seed production plots – Visits to seed industries – Visit to seed certification Agency – Working out of B:C Ratio-Project preparation – Target crops – Rice (variety and hybrid) – Maize (variety and hybrid) – Black gram – Green gram – Sesame – Fodder crops maize and bajra – Green manure crops – Daincha – Manila Agathi – Sunn hemp or any other commercially import crops.

### **Deliverables**

Students who complete this course will gain enough confidence and technical skills to start a seed business.

### **Suggested Reading**

1. Agrawal, R.L. 2003. Seed Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Singhal, N.C. 2003. Hybrid seed production in field crops. Kalyani Publishers, Ludhiana.

## **EXP 414**

## **COMPOSTING TECHNOLOGY**

**0+5**

### **Offering Department: Soil Science and Agricultural Chemistry**

### **Objective**

To enable students to gain hands on experience in composting techniques and to train the students in establishing a commercial large scale composting unit.

### **Activities**

Identification of raw materials, availability, types and segregation of wastes – Characterization – Preparation of Indore, Bangalore, Coimbatore method of composting – Windrow compost making – Vermicomposting – Acceleration of composting and enrichment of compost with bio-inoculants- Instrumentation techniques in compost analysis – Monitoring the changes during composting – Compost maturity analysis – Physical, Chemical and biological maturity tests – Quality standards – Economics of compost making and marketing – Field visit to small scale compost units – Agro-industrial composting sites and municipal waste composting – Preparation of large scale composting project.

### **Deliverable**

The student who completes this course will gain enough skills and confidence to run commercial composting unit.

### **Suggested Reading**

1. Rynk Robert, Maarten van de Kamp, George B Wilson, Mark E. Singley, Tom L. Richard, John J. Kolega, Francis R. Gouin, Lucien Laliberty, Jr. David Kay, Dennis W. Murphy, Harry A. J. Hoitink, William F. Brinton. 1992. *On-farm* composting

Handbook. Natural Resources, Agriculture and Engineering Service (NRAES) Publication #NRAES – 54

2. Hoitink Harry and Harold Keener (eds) 1993. Science and engineering of Composting Design. Environmental, Microbiological and utilization aspects. Proceedings of 1992 Composting research symposium, Worthington, OH Renaissance Publications.

## **EXP 415      MANAGEMENT OF PROBLEMATIC SOILS AND WATER      0+5**

### **Offering Department: Soil Science and Agricultural Chemistry**

#### **Objective**

To educate students about basic concepts of problem soils and poor quality water and their management in relation to crop production.

#### **Activities**

Identification of problem soils viz., acid, saline and sodic soils – study the factors responsible for the formation of problem soils - Morphological features, characterization and management of salt-affected soils. Determination pH, EC, CEC, exchangeable cations - Lime and gypsum requirements of acid and sodic soils.

Determination of physical parameters in soils with physical constraints -bulk density, porosity, aggregate stability, hydraulic conductivity and infiltration rate and their management.

Analysis of poor quality water and Determination of pH, EC - Total solids, Total dissolved solids and Total suspended solids - cations and anions in irrigation water - Estimation of BOD and COD and etc., in poor quality waters - quality appraisal in irrigation water.- management of poor quality water.

#### **Deliverable**

The student who completes this course will gain enough confidence in managing crop production activities with problematic soil and water resources.

#### **Suggested Reading**

1. Bear FE. 1964. Chemistry of the Soil. Oxford and IBH. Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science and Biometeorology. Utah State Univ. 949
2. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford and IBH.
3. Baver LD, Gardner WH and Gardner WR. 1972. Soil Physics. John Wiley and Sons.
4. Hanks and Ascheroff. 1980. Applied Soil Physics. Springer Verlag.
5. Hillel D. 1980. Applications of Soil Physics. Academic Press.
6. Hillel D. 1980. Environmental Soil Physics. Academic Press.
7. Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSS, New Delhi.

8. Kirkham D and Powers WL. 1972. Advanced Soil Physics. Wiley Interscience.
9. Lal R and Shukla MK. 2004. Principles of Soil Physics. Marcel Dekker.
10. Oswal MC. 1994. Soil Physics. Oxford and IBH.

## **EXP 416 FARM ADVISORY ON SOIL HEALTH, WATER QUALITY AND PLANT NUTRITION 0+5**

**Offering Department: Soil Science and Agricultural Chemistry**

### **Objective**

This course aims to acquire skill in identifying farm level soil constraints and to offer suitable management technologies in the selected farm holdings. To prescribe balanced fertilization schedule, to assess the suitability of water for irrigation and to infuse confidence in offering farm advisory services.

### **Activities**

Identification and Selection of farm holdings - Collection of soil samples, Assessment of soil quality indices and interpretation - Identifying soil constraints and Development of Soil Constraint Management Package (SCMP) - Assessment of the Land suitability for different crops - Water sample collection, quality assessment and assessing the land suitability for irrigation. Issue of Soil Health Card and Fertilizer prescription using DSSIFER software - Diagnosis of nutrient deficiencies using VDK software and corrective measures - Formulating the most viable farm plan for the selected farm holdings

### **Deliverables**

Students who complete this course will gain enough confidence and technical knowledge in establishing soil and plant health clinic.

### **Suggested Reading**

1. Hesse, P.R. 1971. A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London Indian Society of Soil Science 1996. Soil management in relation to land degradation and environment. Bulletin No.17. ISSS, New Delhi.
2. Sehgal, J. 2005. A text book of Pedology- Concepts and applications. Kalyani Publishers, Ludhiana
3. USDA 1954. Diagnosis and Improvements of Saline and Alkali Soils. (Ed) L.A. Richards. Handbook NO.60. USDA Washington DC.
4. Werner Bergmann, Ed. 1992. Nutritional Disorders of Plants - Development, Visual and analytical Diagnosis. Gustav Fischer Verlag Stuttgart. New York

**Offering Department: Agricultural Entomology**

**Objective**

To enable students to gain hands on experience in bee keeping and production of honey.

**Activities**

Hive bees suited for commercial bee keeping - Indian bees - Italian bees - special attributes - Bee behaviour in relation to management; - selection of apiary site- arrangement of bee hives- Bee keeping equipment - Preparation of comb foundation sheet- Techniques of hive inspection - Hiving a natural colony - Artificial queen rearing -Establishment of bee nurseries - Developing bee floral calender -Bee pasturage of commercial value - Management of bee colonies -honey flow season - dearth period - bees and pesticides - Identification and management of bee enemies and diseases -Migratory bee keeping - techniques of migration - Bee products of economic value - honey - bee wax - pollen - propolis - royal jelly -value added products of honey - Honey extraction - processing -packing - problems during honey storage - Honey analysis - Quality parameters for honey export - Honey marketing - wax rendering-Bee keeping for pollination - concept of renting bee colonies-Selection and management of bee colonies for pollination Visit to commercial apiaries - bee nursery - honey processing unit - honey grading laboratory.

Cost analysis and project preparation: Principles of enterprise management - preparation of Agricultural project reports - Project analysis and financial management - Agricultural finance - Source of finance - Acquisition - Ratio analysis - principles of costing - Economics of farm enterprise.

**Deliverables**

Students who complete this course will gain enough confidence as an entrepreneur in bee keeping and production of honey.

**Suggested Reading**

1. Ayyar, T V R. 1963. Handbook of Economic Entomology for South India - Govt. Press,516p.
2. David, B.V and T Kumaraswami. 1982. Elements of Economic Entomology - Popular Book Depot., Madras, 636p.
3. Grout, R A. 1963. The Hive and the Honey bee - Dadant and Sons Inc., Hamilton. Illinois. 556 p.
4. Jean Prost, P and Paul Medori 1994. Apiculture, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, 659 p.
5. Singh, S. 1975. Bee keeping in India - Indian Council of Agricultural Research, New Delhi 214 p.

**Offering Department: Agricultural Entomology**

**Objective**

To enable students to gain hands on experience in silkworm rearing and production of silk

**Activities**

Sericulture-selection of suitable mulberry varieties for chawki rearing . cultivation practices for producing chawki leaves - Identification of nutrient deficiency symptoms and pests and diseases of mulberry -pruning and harvesting in relation to feeding of chawki worm -Searing house — model house - low cost rearing house — dsinfectants - disinfection techniques - rearing appliances for .chawki rearing - Visit to grainage - egg production techniques - egg incubation -egg transportation -mother moth examination - acid treatment of eggs -physiological changes in egg by acid treatment -egg storage - hibernnation schedule - Mass multiplication techniques for predator, hyperparasites and antagonistic fungi of sericulture importance

Visit to cocoon market - fixing up of cocoon price - selection of cocoon as raw material - auction procedures - Visit to silk reeling centre - practicing various activities like stifling, cooking, reeling, rereeling, twisting, winding, bleaching, dyeing and weaving for developing entrepreneurship skill in reeling section

Cost analysis and project preparation - Principles of enterprise management - Preparation of agricultural project report - Project analysis and financial management - Agricultural finance - source of finance - Acquisition - Ratio analysis - Principles of costing - Economics of farm enterprise.

**Deliverables**

Students who complete this course will gain enough confidence as an entrepreneur in silkworm rearing and production of silk.

**Suggested Reading**

1. Aruga, H. 1994. Principles of Sericulture. Oxford & IBHPublishing Co. Pvt. Ltd., New Delhi, 376 p.
2. Krishnaswami, S., M.N. Narasimhanna, S.K. Suryanarayan and S. Kumararaj 1978. Sericulture Manual 2 - Silkworm Rearing.FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organization of the United Nations, Rome, 131 p.
3. Mahadevappa, D. 1998. Illustrated Text book on Sericulture Translated from Japanese. Oxford & IBH Publishing Co. Pvt. Ltd,New Delhi, 148p.

**EXP 419      IPM FOR FIELD AND STORAGE PESTS      0+5**

**Offering Department: Agricultural Entomology**

**Objective**

To enable students to gain hands on experience in identifying field and storage problems and their management

**Activities**

Types of pests. Study of the different types of symptoms of pests -population and damage levels, loss assessment. Agro ecosystem analysis – recording of data on weather parameters, other factors contributing to yield and yield attributes – finalizing and adoption of the IPM strategies in major crops.

Studies on the pests of stored products – biology, nature of damage, management-prophylactic, curative methods. Methods of domestic and commercial management of insect infestation on stored commodities. Storage structures-underground and above ground structures- rural, improved and modern. Post harvest management of field crop pests- fruit flies, stone weevil – visit to farmer's fields and FCI godown.

**Deliverables**

Students who complete this course will gain enough confidence identifying field and storage pest problems and their management.

**Suggested Reading**

1. Dhaliwal, G.S. and Arora, R. 2001. Integrated Pest Management – Concepts and Approaches Kalyani publishers, New Delhi.
2. Dhaliwal. G. S. and Heinrichs, E. A. 1998. Critical Issues in Integrated Pest Management. Common wealth publishes, New Delhi.
3. Pedigo, T. P. 1996. Entomology and Pest Management. Prentice – Hall of India, New Delhi
4. Ghosh. S. K. Durbey S. L. 2003. Integrated Management of Stored Grain Pests. International Book Distributing Company.
5. Metcalf . L. C and Flint. W. P. 1973. Destructive and Useful Insects. Tata McGraw Hill New Delhi.
6. Rao, P. A ., Mathur, K. C and Pasalu. L. C. 1987. Rice Storage and Insect Pest Management. B.R publishers. New Delhi.

**EXP 420      URBAN ENTOMOLOGY AND PEST MANAGEMENT      0+5**

**Offering Department: Agricultural Entomology**

**Objective**

To enable students to gain hands on experience in urban pests and their management

## **Activities**

Identification of major urban pests, vectors - storage pests in urban conditions - Identification of termite species and their habitats - Termites and ant eradication and preventive control –visit to termite control operation in buildings -rodent control techniques - storage pest control and fumigation - Moth and insect management in libraries and food storage - Pest control techniques in cattle, pet animals and poultry -Studies on insecticides and appliances for urban pest management - Visit to storage and cattle shed facilities - construction sites and vector management operations- visit to VCRC Puducherry.

## **Deliverables**

Students who complete this course will gain enough confidence as an entrepreneur in relation to public health management

## **Suggested Reading**

1. Ayyar, T.V.R. 1940. Hand book of economic entomology for south india. Govt. press, Madras.
2. David, B.V. 2001. Elements of Economic Entomology, Popular book dept, Madras.
3. Gupta, R. 2002. Household pests and their management. National book trust, New Delhi
4. Mohan, S and P.C. Sundara babu, 2001. Stored product pests and their management, TNAU, Coimbatore.

## **EXP 421      IDM FOR CROP DISEASES      0+5** **Offering Department: Plant Pathology**

## **Objective**

To emphasize the importance and need of IDM in the management of diseases of important crops

## **Activities**

Tools of disease management - components of integrated disease management- their limitations and implications - Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM; demonstration of IDM in rice, rice fallow, pulses, cotton, sesame, groundnut, vegetable crops and fruit crops as project work

## **Deliverables**

Students who complete this course will gain confidence to do consultancy service in IDM packages to farmers at field level.

## **Suggested Readings**

1. Gupta, V.K. and Sharma, R.C. 1995. Integrated Disease Management and Plant Health (Eds). Scientific Publisher, Jodhpur.



2. Mayee, C.D., Manoharachary, C., Tilak, K.V.B.R., Mukadam, D.S. and Deshpande Jayashree (Eds.). 2004. Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publ. House, New Delhi.
3. Sharma RC & Sharma JN. (Eds). 1995. Integrated Plant Disease Management. Scientific Publisher, Jodhpur

## **EXP 422      MUSHROOM CULTIVATION      0+5**

### **Offering Department: Plant Pathology**

#### **Objective**

To develop mushroom cultivation skills for entrepreneurial activity.

#### **Activities**

Cultivation techniques of oyster, milky, paddy straw and button mushrooms – Problems in cultivation - Post harvest technology - Cost analysis and Project preparation- Agricultural Finance.

#### **Deliverables**

Students who complete this course will gain technical competence to run spawn and mushroom production unit independently.

#### **Suggested Readings**

1. Aneja, K. R. 1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation Mushroom (2nd Edition). Wishwa Prakashan, New Delhi.
2. Bahl, N. 2000. Handbook on Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Chadha, K.L. and S.R. Sharma. 1995. Mushroom Bio-technology - Advances in Horticulture. vol. 13. Malhotra Publishing House, New Delhi.
4. Kapoor, J.N. 1989. Mushroom cultivation. Indian Council of Agricultural Research, New Delhi.
5. Krishnamoorthy, A.S., S. Nakkeeran., V. Prakasam and T. Marimuthu. 2000. Kalan Valarppu Oru Uyiriyal Thozhil Nutpam (Tamil). Pratheeba Publ. Coimbatore.
6. Marimuthu, T., A.S. Krishnamoorthy., K. Sivaprakasam and R. Jeyarajan. 1989. Oyster mushroom production. The Vijay books, Sivakasi.
7. Nair, M.C., C. Gokulapalan and Lulu Das 1994. Advances in Mushroom Biotechnology. Scientific Publishers, Jodhpur.
8. Quimio, T.H. 2002. Tropical Mushroom Cultivation. Publ. National Book Store, Cacho Hermanos Inc., Mandalutong, Philippines.

**Offering Department: Agricultural Entomology and Plant  
Pathology**

**Objective**

To develop biocontrol agent and biopesticides production skills for entrepreneurial activity

**Activities**

Requirements of a biocontrol unit - rearing of host insects for parasitoids and pathogens - rearing of prey insects for predators -rearing of egg parasitoid *Trichogramma*- Rearing of egg- larval parasitoid *Chelonus*- Larval parasitoids *Goniozus*, *Bracon* and *Eriborus*- pupal parasitoids *Tetrastichus israeli*, *Thchospilus pupivora*, *Brachymeria*, *Acerophagous papayae*- rearing of predators - Coccinellids - *Cryptolaemus montrouzieri*, *Scymnus coccivora* - Rearing of *Chrysoperla carnea*- Mass production of entomopathogens - production of nuclear polyhedrosis virus of *Helicoverpa armigera* and *Spodoptera litura*- granulosus virus of sugarcane early shoot borer *Chilo infuscatellus*, *Metarhiziumanisopliae*, *Beauveria bassiana* and *Verticillium lecanii*- Standardization of insect pathogens - Field utilization techniques of biocontrol agents - Improving the efficacy of biocontrol agents.

Isolation and mass multiplication of fungal biocontrol agents (*Trichoderma* and VAM ) and PGPR (*Pseudomonas fluorescens* and *Bacillus subtilis*) - Delivery systems - Quality parameter studies- Cost analysis and Project preparation - Specifications for establishing biocontrol laboratory - Agricultural Finance - Preparation of botanical pesticides and antiviral principles - Delivery systems

Cost analysis and project preparation : Principles of enterprise management - preparation of agricultural project reports - project analysis and financial management - agricultural finance - source of finance - acquisition - ratio analysis - principles of costing - economics of farm enterprise- visit to biocontrol laboratory at KVK, Puducherry.

**Deliverables**

Students who complete this course will gain technical competence to start biocontrol agent production unit independently.

**Suggested Readings**

1. Burges, H D 1981 Microbial control of pests and plant diseases, Academic Press, New York, 949
2. Clausen.C. P 1940. Entomophagous insects Hafner Publishing Co. New York, 688 p
3. De Bach P and E.T Schlinger (eds ). 1964 Biological control of insect pests and weeds. Chapman and Hall, London, 844 p
4. Huffaker. C.B. (ed.) 1974. Biological control. Plenum Publishing Corporation, United States of America, 511 p

5. Aneja, K. R. 1996. Experiments in Microbiology, Plant Pathology, Tissue culture and cultivation Mushroom (2nd Edition). Wishwa Prakashan, New Delhi, 451 pp.
6. Campbell, R. 1989. Biological control of Microbial plant pathogens, Cambridge Univ. Press, Cambridge.
7. Cook, R.J. and Baker, K.F. 1983. The Nature and Practice of Biological Control of Plant Pathogens. American Phytopathological society, St. Paul, Minnesota, USA, 539 pp.
8. Hall, F.R. and J.W. Barry (1995) Biorational Pest control agents – Formulation and Delivery, American Chemical Society, Washington, DC, USA.
9. Hornby, D. (1990) Biological control of soil-borne plant pathogens, CAB international, Wallingford, U.K

## **EXP 424      BIOINOCULANTS PRODUCTION TECHNOLOGY      0+5**

### **Offering Department: Agricultural Microbiology**

#### **Objective**

Understanding the principles of bioinoculants production technology; to update the knowledge on bioinoculants technology with current scenario and to impart entrepreneurship to the undergraduate students.

#### **Activities**

Production of various bioinoculants: nitrogenous bioinoculants - *Rhizobium*, *Azospirillum*, *Azotobacter*, *Glucanoacetobacter diazotrophicus*, *Azolla*, *Blue Green Algae*; phosphatic bioinoculants - phosphate solubilisers AM fungi; PGPR- PPFM, *Pseudomonas* fluorescence. BIS/FCO standards for commercial bioinoculants production and quality testing of various bioinoculants. Application of bioinoculants to crops. Evaluation of plant response to bioinoculants application. Establishment of bioinoculants production unit: facilities and equipments required for laboratory scale, pilot scale and large scale production and marketing of products and project preparation.

1. To understand and gain practical knowledge on various techniques related to bioinoculants production and application methods.
2. To build confidence on planning entrepreneurial tasks for bioinoculants production.

#### **Deliverables**

The student who completes this course will gain skill and technical knowledge to start bio-inoculants production unit.

#### **Suggested Readings**

1. Motsara, M.R., Bhattacharyya, P., and Beena Srivatsava. 2004. Biofertiliser Technology, Marketing and Usage – A source book- Cum -Glossary
2. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi

3. Deaker R, Kecskés ML, Rose MT, Khanok-on A, Ganisan K, Tran Thi Kim Cuc, Vu Thuy Nga, Phan Thi Cong, Nguyen Thanh Hien and Kennedy IR 2011. *Practical methods for the quality control of inoculant biofertilisers*. ACIAR Monograph No.147. Australian Centre for International Agricultural Research: Canberra. 101 pp. (ISBN 978 1 921738 83 8)
4. Deshmukh AM, Khobragade RM, Dixit Jaipur PP 2007. Handbook of Biofertilizers and Biopesticides /edited , Oxford Book Company, xviii, 308 p., tables, figs., ISBN 81-89473-15-0.
5. NIIR (2012) The Complete Technology Book on Biofertilizer and Organic Farming (2nd Revised Edition). NIIR Project Consultancy Services, New Delhi. P. 608. (ISBN: 9789381039076)
6. Rai MK (2006) Handbook of Microbial Biofertilizers. Food Products Press. New York. P. 543. (ISBN 13: 978-1-56022-269-9).
7. Trivedi PC (2008) Biofertilizers. Pointer Publications, New Delhi. P.374. (ISBN: 9788171325429)

## **EXP 425      COMMERCIAL NURSERY TECHNOLOGY      0+5**

### **Offering Department: Horticulture**

#### **Objective**

To enhance the technical expertise related to propagation of commercial horticultural crops and to inculcate entrepreneurial capacity by providing hands on training and practical exposure for the students to effectively manage horticultural nurseries.

#### **Activities**

Types of nurseries and economical importance – Tools and implements – Different types of media – Practices in preparation of media for fruit plants – Flowering annuals, foliage and indoor plants – Containers for propagation – Seed propagation – Visit to community nurseries producing hybrid vegetable seedlings in pro trays – Visit to shade net houses to study cost of erection of net house – Calculating requirement and working out cost economics – Mother plant block or scion block establishment – Hands on training in preparation of various types of cuttings, layering, budding and grafting – Raising of root stocks - After care of propagated plants - Commercial propagation of horticultural crops – Mango, Sapota, Aonla, Guava, Jasmine, foliage ornamental plants, important flowering climbers, ornamental trees – Maintenance of records in nursery – Project preparation for the establishment of commercial nursery.

#### **Deliverables**

Students who complete this course will gain confidence and technical skills to establish a commercial nursery.

### **Suggested Readings**

1. Hartmann, H.T. and Kester, D.E. 2010. Plant Propagation: Principles and Practices.
2. John Mason. 2004. Nursery Management.
3. Ray, P.K. 2012. Plant Nursery Management: How to Start and Operate a Plant Nursery.
4. Sharma, R.R. and Srivastav, M. 2004. Plant Propagation and Nursery Management.

**EXP 426      ORNAMENTAL GARDENING AND LANDSCAPING      0+5**

### **Offering Department: Horticulture**

#### **Objective**

To equip students in identifying various landscape elements and application in landscape designing

#### **Activities**

History and scope of gardening – Garden of India – Types of garden – Principles of gardening – Styles of gardening – Study of garden components – (Annuals, Shrubs, Trees, Climbers, Ferns, Bulbous plants, Cacti and Succulents, Palms, Lawn Making) – Management of plant components – Visits to Institutional, Industrial and public garden – Bio aesthetic planning – Landscaping places of public importance – Flower arrangement – Bonsai making.

#### **Deliverables**

Students on completing the course will become professionals in landscaping home and other gardens of public importance

### **Suggested Readings**

1. Arora, J.S. Introductory Ornamental Horticulture
2. Nambisan, K.M.P. 1992. Design and elements of landscape gardening. Oxford and IBH Publications, New Delhi.
3. Pal, B.P. 1960. Beautiful climbers of India. ICAR, New Delhi
4. Randhava, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrow's Printers and Publishers. Karol Bagh, New Delhi
5. Randhava, G.S and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi

**Offering Department: Horticulture****Objectives**

1. Understanding the principles and theoretical aspects of protected cultivation of high value vegetable crops
2. Developing skills in erection of protected structures and cultivation of vegetable crops

**Activities**

Study of various protected structures, importance and function – Location, planning and various components of green house – Layout and erection of different types of structures – Green house heating, cooling, shading and ventilation system – CO<sub>2</sub> generation and monitoring – Lighting systems – Growing of vegetables crops i.e. Tomato, Cucumber, Capsicum, Lettuce – Containers and substrates – Soil Sterilization – Drip and fertigation system – Water and nutrient management – Weed management – Special horticultural practices i.e. training and pruning – IPM & IDM – Harvest indices – Harvesting techniques, post harvest handling techniques – visit to commercial vegetables production units – Project preparation to establish a commercial green house.

**Deliverables**

Students who complete this course will gain confidence and technical skills to establish a commercial green house.

**Suggested Readings**

1. Nelson, P.V.1991. Green house operation and management, Bali Publication.
2. Chandra, S and So, V 2000. Cultivating vegetables in green house. India horticulture 45:17-18
3. Prasad, S and Kumar, U. 2003. Green house technology for controlled environment. Narosa Publication House