



# **UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR**

## **SYLLABUS**

**Courses for Undergraduate  
Programme  
Of**

**B.Sc. (Hons.) Agriculture**

**SEMESTER SYSTEM  
2016-17**

# UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR



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## **B.Sc.(Hons.)Agriculture**

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## **For**

### **B.Sc. (Hons.) Agriculture**

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## SCHEDULE OF COURSES FOR B.Sc. (Hons.) AGRICULTURE

<b>ICORE COURSES</b>		
<b>AGRICULTURAL ECONOMICS</b>		
AEC 101	Fundamentals of Agricultural Economics	2(2+0)
AEC 201	Farm Management, Production & Resource Economics	2(1+1)
AEC 202	Agricultural Finance and Co-Operation	3(2+1)
AEC 301	Agricultural Marketing, Trade & Prices	3(2+1)
	<b>Total</b>	<b>10 (7+3)</b>
<b>AGRICULTURAL ENGINEERING</b>		
AEG 101	Soil and Water Conservation Engineering	2(1+1)
AEG 201	Farm Machinery and Power	2(1+1)
AEG 202	Protected Cultivation and Secondary Agriculture	2(1+1)
AEG 301	Renewable Energy and Green Technology	2(1+1)
	<b>Total</b>	<b>8 (4+4)</b>
<b>AGRICULTURAL ENTOMOLOGY</b>		
AET 101	Fundamentals of Entomology	3(2+1)
AET 201	Principles of Integrated Pest Management	3(2+1)
AET 301	Pests of Crops and Stored Grain and their Management	3(2+1)
AET 302	Management of Productive Insects	1(0+1)
	<b>Total</b>	<b>10 (6+4)</b>
<b>AGRICULTURAL EXTENSION EDUCATION</b>		
AEX 101	Constitution of India, Rural Sociology & Educational Psychology	2(1+1)
AEX103	Fundamentals of Agricultural Extension Education	3(2+1)
AEX 201	Communication Skills and Personality Development	2(1+1)
AEX 301	Entrepreneurship Development and Business Communication	2(1+1)
	<b>Total</b>	<b>9 (5+4)</b>
<b>STATISTICS, COMPUTER APPLICATION AND I.P.R.</b>		
AST 201	Agri- Informatics	1(0+1)
AST 202	Statistical Methods	3(2+1)
AST 301	Intellectual Property Rights	1(1+0)
	<b>Total</b>	<b>5 (3+2)</b>
<b>AGRONOMY</b>		
AGR 101	Fundamentals of Agronomy	4(3+1)
AGR 102	Introductory Agro-meteorology & Climate Change	2(1+1)
AGR 201	Crop Production Technology – I ( <i>Kharif</i> crops)	3(2+1)
AGR 202	Practical Crop Production - I ( <i>Kharif</i> crops)	1(0+1)
AGR 203	Crop Production Technology – II ( <i>Rabi</i> crops)	2(1+1)
AGR 204	Practical Crop Production - II ( <i>Rabi</i> crops)	1(0+1)
AGR 205	Geoinformatics and Nanotechnology for Precision Farming	2(1+1)
AGR 301	Experimental Techniques in Agricultural Research	1(0+1)
AGR 302	Principles of Organic Farming	1(0+1)
AGR 303	Rainfed Agriculture & Watershed Management	2(1+1)
AGR 304	Farming System & Sustainable Agriculture	1(1+0)
	<b>Total</b>	<b>20 (10+10)</b>

	<b>BIOCHEMISTRY / BIOTECHNOLOGY/PHYSIOLOGY / MICROBIOLOGY/ ENVIRONMENTAL SCI./FORESTRY</b>	
BCH 101	Fundamentals of Plant Biochemistry	2(1+1)
BTH 302	Fundamentals of Plant Biotechnology	1(1+0)
CPH 101	Fundamentals of Crop Physiology	3(2+1)
AMB201	Agricultural Microbiology	3(2+1)
ENS 202	Environmental Studies & Disaster Management	2(1+1)
FOR 101	Introduction to Forestry	2(1+1)
	<b>Total</b>	<b>13 (8+5)</b>
	<b>GENETICS &amp; PLANT BREEDING</b>	
GPB 101	Fundamentals of Genetics and Cytogenetics	3(2+1)
GPB 201	Fundamentals of Plant Breeding	3(2+1)
GPB 301	Crop Improvement-I ( <i>Kharif</i> crops)	2(1+1)
GPB 302	Crop Improvement-II ( <i>Rabi</i> crops)	2(1+1)
	<b>Total</b>	<b>10 (6+4)</b>
	<b>HORTICULTURE</b>	
HRT 101	Fundamentals of Horticulture	2(1+1)
HRT 201	Production Technology for Vegetables and Spices	2(1+1)
HRT 202	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
HRT 301	Production Technology for Fruit and Plantation Crops	2(1+1)
HRT 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
	<b>Total</b>	<b>10 (5+5)</b>
	<b>PLANT PATHOLOGY</b>	
PAT 101	Fundamentals of Plant Pathology	3(2+1)
PAT 301	Principles of Integrated Disease Management	2(1+1)
PAT 302	Diseases of Crops and their Management -I	3(2+1)
PAT 303	Diseases of Crops and their Management-II	3(2+1)
	<b>Total</b>	<b>11 (7+4)</b>
	<b>SEED SCIENCE &amp; TECHNOLOGY</b>	
SST 201	Principles of Seed Technology	3(1+2)
	<b>Total</b>	<b>3 (1+2)</b>
	<b>SOIL SCIENCE AND AGRICULTURAL CHEMISTRY</b>	
SAC 101	Fundamentals of Soil Science	3(2+1)
SAC 202	Problematic soils and their Management	2(1+1)
SAC 301	Manures, Fertilizers and Soil Fertility Management	3(2+1)
	<b>Total</b>	<b>8 (5+3)</b>
	<b>ANIMAL PRODUCTION</b>	
ASC 201	Livestock and poultry Management	3(2+1)
ASC 301	Livestock and poultry health care	1(0+1)
FSH 101	Fisheries Science	1(0+1)
	<b>Total</b>	<b>5 (2+3)</b>
	<b>FOOD SCIENCE</b>	
FSN 101	Principles of Food Science & Nutrition	1(1+0)
	<b>Language</b>	
ENG 101	Comprehension & Spoken English	2(1+1)
	<b>Total of Core Courses</b>	<b>125</b>

<b>II. ELECTIVES (Any three)</b>		<b>9 (6+3)</b>
<b>III. Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &amp; AIA)- Student READY Programme</b>		
	RAWE & AIA	20
	Experiential Learning (EPL)/HOT	20
	<b>Total</b>	<b>40</b>
	<b>Total –Gradial Courses(Core Courses+Electives+Student READY)</b>	<b>174</b>
<b>IV. NON-GRADIAL COURSES</b>		
NCC101/ PED 101	NCC/Physical Education & Yoga Practices -I	1(0+1)
NCC102/ PED 102	NCC/Physical Education & Yoga Practices -II	1(0+1)
NSS 201	National Service Scheme	1(0+1)
NSS 202	National Service Scheme	1(0+1)
AEX 102	Human Values & Ethics	1(1+0)
TOR 401	All India Study Tour	1(0+1)
KAN 101 /KNK 101	Kannada Krishi Bhag-1 /Kannada Bhashe	1(0+1)
KAN 102 /KNK 102	Kannada Krishi Bhag-2 /Kannada Sanskriti	1(0+1)
<b>Total</b>		<b>9 (1+ 8)</b>
<b>Total (Gradial + Nongradial)</b>		<b>182</b>
<b>V. REMEDIAL COURSES</b>		
REB 101	Introductory Biology	2(1+1)
	OR	
REM 101	Elementary Mathematics	2(2+0)
<b>Total</b>		<b>2</b>
<b>Grand Total</b>		<b>184</b>

### Abstract of Credit Hours

Sl. No.	Courses	Proposed
I.	Core Courses	125
II.	Electives	09
III.	Student READY:	
	RAWE + AIA	20
	ELP	20
IV.	Non-gradial Courses	08
<b>Total</b>		<b>182</b>
V.	Remedial Courses	02
<b>Grand Total</b>		<b>184</b>

**Elective Courses:** A student can select three elective courses out of the following which are offered during 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> semesters.

<b>Sl. No.</b>	<b>Course Title</b>	<b>Course Number</b>	<b>Credit Hours.</b>
01	Agribusiness Management	ELC 201	3(2+1)
02	Agrochemicals	ELC 202	3(2+1)
03	Commercial Plant Breeding	ELC 203	3(1+2)
04	Landscaping	ELC 301	3(2+1)
05	Food Safety and Standards	ELC 302	3(2+1)
06	Biopesticides & Biofertilizers	ELC 303	3(2+1)
07	Protected Cultivation	ELC 304	3(2+1)
08	Micro propagation Technologies	ELC 305	3(1+2)
09	Hi-tech. Horticulture	ELC 306	3(2+1)
10	Weed Management	ELC 307	3(2+1)
11	System Simulation and Agro-advisory	ELC 308	3(2+1)
12	Agricultural Journalism	ELC 309	3(2+1)
<b>Total</b>		<b>9</b>	

**Modules for Skill Development and Entrepreneurship:** A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII semester.

#### **Experiential Learning Courses/ Programme (ELP)**

<b>Sl. No.</b>	<b>Course Title</b>	<b>Course Number</b>	<b>Credit Hours.</b>
01	Agriculture Waste Management	ELP 401	0+10
02	Commercial Beekeeping	ELP 402	0+10
03	Commercial Horticulture	ELP 403	0+10
04	Commercial Sericulture	ELP 404	0+10
05	Floriculture and Landscaping	ELP 405	0+10
06	Food Processing	ELP 406	0+10
07	Hybrid Seed Production Technology	ELP 407	0+10
08	Mushroom Cultivation Technology	ELP 408	0+10
09	Organic Production Technology	ELP 409	0+10
10	Poultry Production Technology	ELP 410	0+10
11	Production Technology for Bio-agents and Bio-fertilizers	ELP 411	0+10
12	Seed Production Technology	ELP 412	0+10
13	Soil, Plant, Water and Seed Testing	ELP 413	0+10
<b>Total</b>		<b>20</b>	

**SUGGESTED PERMANENT SHCEDULE OF SEMESTER WISE DISTRIBUTION  
OF COURSESES FOR B.Sc. (Hons) AGRICULTURE**

Sl. No.	Course No	Title of Course	Credit Hours
<b>I YEAR I SEMESTER</b>			
1	HRT 101	Fundamentals of Horticulture	2 (1+1)
2	BCH 101	Fundamentals of Plant Biochemistry	2 (1+1)
3	FSH 101	Fisheries Science	1 (0+1)
4	SAC 101	Fundamentals of Soil Science	3 (2+1)
5	AEC 101	Fundamentals of Agricultural Economics	2 (2+0)
6	ENG 101	Comprehension & Communication Skills in English	2 (1+1)
7	AGR 101	Fundamentals of Agronomy	4 (3+1)
8	AEX 101	Constitution of India, Rural Sociology & Educational Psychology	2 (1+1)
9	FSN 101	Principles of Food Science and Nutrition	1 (1+0)
10	KNK 101 KAN 101	Kannada Language (Non Karnataka students) * OR Kannada Krushi Bhaga- I (Karnataka students) *	1 (0+1*)
11	AEX 102	Human Values & Ethics*	1 (1*+0)
12	NCC 101 / PED 101	NCC/Physical Education & Yoga Practices-I*	1 (0+1*)
<b>Total</b>			<b>19 +3*</b>
*NC: Non-gradial courses			

Sl. No.	Course No	Title of Course	Credit Hours
<b>I YEAR II SEMESTER</b>			
1	GPB 101	Fundamentals of Genetics and Cytogenetics	3 (2+1)
2	AEX 103	Fundamentals of Agricultural Extension Education	3 (2+1)
3	AEG 101	Soil and Water Conservation Engineering	2 (1+1)
4	CPH 101	Fundamentals of Crop Physiology	3 (2+1)
5	AEG 201	Farm Machinery & Power	2(1+1)
6	PAT 101	Fundamentals of Plant Pathology	3 (2+1 )
7	AET 101	Fundamentals of Entomology	3 (2+1)
8	AGR 102	Introductory Agro-meteorology & Climate Change	2 (1+1)
9	KNK 102 KAN 102	Kannada Culture (Non Karnataka students) * OR Kannada Krushi Bhaga- II (Karnataka students) *	1 (0+1*)
10	NCC 102 PED 102	NCC / Physical Education & Yoga Practices-II*	1 (0+1*)
<b>Total</b>			<b>21+2*</b>
1	REM-101	Elementary Mathematics**	2 (2*+0)
<b>Total</b>			<b>21+4*</b>
*NC: Non-gradial courses; **R: Remedial course			

Sl. No.	Course No	Title of Course	Credit Hours
<b>II YEAR I SEMESTER</b>			
1	AGR 201	Crop Production Technology – I ( <i>Kharif Crops</i> )	3 (2+1)
2	GPB 201	Fundamentals of Plant Breeding	3 (2+1)
3	SST 201	Principles of Seed Technology	3 (1+2)
4	AGR 202	Practical Crop Production - I ( <i>Kharif crops</i> )	1 (0+1)
5	AEC 201	Farm Management, Production and Resource Economics	2 (1+1)
6	AMB 201	Agricultural Microbiology	3 (2+1)
7	HRT 201	Production Technology for Vegetables and Spices	2 (1+1)
8	FOR 101	Introduction to Forestry	2 (1+1)
9	ASC 201	Livestock and Poultry Management	3 (2+1)
10	NSS 201	National Service Scheme-*	1 (0+1*)
<b>Total</b>			<b>22+1*</b>
1	REB 101	Introductory Biology*	2*(1+1)
<b>Total</b>			<b>22+3*</b>

Sl. No.	Course No	Title of Course	Credit Hours
<b>II YEAR II SEMESTER</b>			
1	AGR 203	Crop Production Technology –II ( <i>Rabi Crops</i> )	2 (1+1)
2	HRT 202	Production Technology for Ornamental Crops, Medicinal & Aromatic Plants and Landscaping	2 (1+1)
3	AEG 202	Protected Cultivation and Secondary Agriculture	2 (1+1)
4	SAC 202	Problematic Soils and their Management	2 (1+1)
5	ENS 201	Environmental Studies and Disaster Management	2 (1+1)
6	AEX 201	Communication Skills and Personality Development	2 (1+1)
7	AGR 204	Practical Crop Production -II (Rabicrops)	1 (0+1)
8	AGR 205	Geoinformatics and Nano-technology for Precision Farming	2 (1+1)
9	AST 202	Statistical Methods	3 (2+1)
10	AET 201	Principles of Integrated Pest Management	3 (2+1)
11	ELC 201	Elective Course	3(2+1)
12	NSS 202	National Service Scheme-*	1 (0+1*)
<b>Total</b>			<b>24+1*</b>

<b>Sl. No.</b>	<b>Course No</b>	<b>Title of Course</b>	<b>Credit Hours</b>
<b>III YEAR I SEMESTER</b>			
1	ASC 301	Livestock and Poultry Health Care	1 (0+1)
2	PAT 301	Principles of Integrated Disease Management	2 (1+1)
3	SAC 301	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
4	AET 301	Pests of Crops and Stored Grains and their Management	3 (2+1)
5	PAT 302	Diseases of Field and Horticultural Crops and their Management -I	3 (2+1)
6	GPB 301	Crop Improvement-I ( <i>Kharif</i> Crops)	2 (1+1)
7	HRT 301	Production Technology for Fruit and Plantation Crops	2 (1+1)
8	AGR 301	Experimental Techniques in Agricultural Research	1 (0+1)
9	AGR 302	Principles of Organic Farming	1 (0+1)
10	AEX 301	Entrepreneurship Development and Business Communication	2 (1+1)
11	AST 201	Agricultural Informatics	1 (0+1)
12	ELC 301	Elective Course	3 (2+1)
<b>Total</b>			<b>24</b>

<b>Sl. No.</b>	<b>Course No</b>	<b>Title of Course</b>	<b>Credit Hours</b>
<b>III YEAR II SEMESTER</b>			
1	AGR 303	Rainfed Agriculture & Watershed Management	2 (1+1)
2	AEG 301	Renewable Energy and Green Technology	2 (1+1)
3	PAT 303	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)
4	HRT 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
5	AET 302	Management of Productive Insects	1 (0+1)
6	GPB 302	Crop Improvement-II ( <i>Rabi</i> crops)	2 (1+1)
7	AEC 301	Agricultural Marketing, Trade and Prices	3 (2+1)
8	BTH 301	Fundamentals of Plant Biotechnology	1 (1+0)
9	AGR 304	Farming System & Sustainable Agriculture	1 (1+0)
10	AST 301	Intellectual Property Rights	1 (1+0)
11	AEC 202	Agricultural Finance & Co-operation	3 (2+1)
12	ELC 302	Elective Course	3 (2+1)
<b>Total</b>			<b>24</b>

<b>IV YEAR I SEMESTER</b>				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA)				
Sl. No.	Course Number	Activities	No. of Weeks	Credit Hours
1	SRP 401	General orientation & On campus training by different faculties	1	14
		Village attachment	8	
		Plant clinic	2	
		Agro-Industrial Attachment	3	
2	SRP 402	Unit attachment in Univ./College/KVK/Research Station Attachment	5	06
		Project Report Preparation, Presentation and Evaluation	1	
		Total Weeks for RAWE & AIA	20	
3	TOR 401	All India Study Tour	1	0+1*
<b>Total</b>				<b>20+1*</b>
Note: All India Study Tour - 1 week within Semester, 2 weeks in Semester break *Non-gradial				

<b>IV YEAR II SEMESTER</b>			
SN.	Experiential Learning Programme		
	Course No.	Title of Course	Credit Hours
1.	ELP 401	Module 1	10 (0+10)
2.	ELP 402	Module 2	10 (0+10)
		Total	20

#### Abstract of Credit Hours

Sl. No.	Courses	Credit Hours	Total
1.	Gradiual Courses (of disciplines)	125	125
2.	Electives	09	09
3.	Student READY:		
	RAWE + AIA	20	20
	ELP	20	20
4.	Non-gradial Courses	--	09
			183
5.	Remedial Courses		02

# Syllabus

## I. Core Courses

### 1. Agricultural Economics

#### 1. AEC 101: Fundamentals of Agricultural Economics

2 (2+0)

##### Theory:

*Economics*: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. *Demand*: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale. *Cost*: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income*: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax*: meaning, direct and indirect taxes, agricultural taxation, VAT. *Economic systems*: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

##### Suggested reading:

1. Agrawal, A. N., Indian Agriculture – problems, progress and prospects
2. Ahuja, H. L., Advanced Economic Theory: Micro economic Theory.
3. Basava K.D, Elements of Economics.
4. Basava K.D, Principles of Economics.
5. Chinna,S.S, Agricultural Economics and Indian Agriculture.

6. Dewet, K.K. and others, 2005, Modern Economic Theory.
7. Dewett K.K and Verma J.D, Elementary Economic Theory.
8. Jingan, M.L., Advanced Economic Theory-Micro and Macro Economics
9. Jingan, M.L., Principles of Economics.
10. Subbareddy, S and *et. al.*, Agricultural Economics.

## **2. AEC 201: Farm Management, Production and Resource Economics 2 (1+1)**

### **Theory:**

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/ livestock/ machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

### **Practical:**

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

### **Suggested reading:**

1. Chinna, S.S., Agricultural Economics and Indian Agriculture
2. Heady, E.O and Dhillon, J.L., Agricultural Production Functions.
3. Jhon, P. Doll and Frank Orezen, Production Economics: Theory with Applications.

4. Johl S.S. and Kapoor T.R., Fundamentals of Farm Business Management.
5. Memoria, C.B., Agricultural Problems of India.
6. Raju, V.T. and Vishwashankar Rao, Economics of Farm Production and Management
7. Sadhu and Singh, Fundamentals of Agricultural Economics.
8. Sankhyan, P.L, Introduction to Economics of Agricultural Production.
9. Subba Reddy *et. al*, Agricultural Economics.
10. Springer. Natural resource management and policy.

### 3. AEC 202: Agricultural Finance and Co-Operation

3 (2+1)

#### Theory:

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

#### Practicals:

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

#### Suggested reading:

1. Broadway, A.C. and Broadway, A.A., 2004, A Text Book of Agri Business Management, Kalyani Publishers, New Delhi.
2. Chinna, S.S., 1992, Agricultural Economics and Indian Agriculture, Kalyani Publishers, New Delhi.
3. Davis, J. and Goldberg, R., A Concept of Agri Business
4. Hrishikes Bhattacharya, 2005, Banking Strategy, Credit Appraisal and Lending Decisions – A Risk-return framework, Oxford University Press.
5. Johl, S.S. and Moore, C.V., Essentials of Farm Financial Management

6. Kahlon, A.S. and Karam Singh, Managing Agril. Finance: Theory and Practice
7. Lekhi, R.K. and Joginder Singh, 2006, Agricultural Economics, Kalyani Publishers, New Delhi.
8. Pandey Mukesh and Tewari, Deepali, 2004, Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi.
9. Subba Reddy and Raghuram, P., 2005, Agricultural Finance and Management, Oxford and IBH Publishing Co. Private Ltd., New Delhi.
10. Subba Reddy, Raghuram, P., Neelakanta Sastry, T.V. and Bhavani Devi, 2005, Agricultural Economics, Oxford and IBH Pub Co. Pvt. Ltd., New Delhi.

#### **4. AEC 301: Agricultural Marketing, Trade and Prices**

**3 (2+1)**

##### **Theory:**

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

##### **Practical:**

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behavior over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation

of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

**Suggested reading:**

1. Acharya, S.S. and Agarwal, N.L., 2006, Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chinna, S.S., 2005, Agricultural Economics and Indian Agriculture. Kalyani Pub, N Delhi.
3. Dominic Salvatore, Micro Economic Theory
4. Kohls Richard, L. and Uhl Joseph, N., 2002, Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.
5. Kotler and Armstrong, 2005, Principles of Marketing, Pearson Prentice-Hall.
6. Lekhi, R. K. and Jogindr Singh, 2006, Agricultural Economics. Kalyani Publishers, Delhi.
7. Memoria, C.B., Joshi, R.L. and Mulla, N.I., 2003, Principles and Practice of Marketing in India, Kitab Mahal, New Delhi.
8. Pandey Mukesh and Tewari, Deepali, 2004, Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi.
9. Sharma, R., 2005, Export Management, Laxmi Narain Agarwal, Agra.
10. Subbareddy, S and *et. al.*, 2005, Agricultural Economics. Oxford & IBH Publ. Co.(P), New Delhi.

**Agricultural Engineering**

**1. AEG 101: Soil and Water Conservation Engineering**

**2 (1+1)**

**Theory:**

Surveying - survey instruments and their uses. Calculation of area of regular and irregular fields. Leveling - terminologies, instruments and their uses; methods of calculation of reduced levels and contouring. Soil and water conservation - Introduction, causes and agents of soil erosion; water erosion : forms of water erosion. Soil loss estimation by Universal Soil Loss Equation, Erosion control measures: Bunding - contour bund, graded bund, bench terracing. Rain water harvesting and its techniques. Irrigation – terminologies and units. Measurement of irrigation water. Irrigation methods – Surface, Sprinkler and drip irrigation systems. Drainage of agricultural lands – surface and subsurface drainage systems.

**Practical:**

Use of survey instruments in the field, use of field book, Survey for contouring using leveling instrument, preparation of contour map. General status of soil conservation in India, Planning and design of soil and water conservation structures - contour bunds, graded bunds and bench terraces. Design of water harvesting structures. Measurement of irrigation water through weirs, flumes and orifices. Design of sprinkler and drip irrigation systems. Design of surface and subsurface drainage systems.

**Suggested reading:**

1. Introduction to soil and water conservation engineering-B.C. Mal Kalyani Publishers, New Dehli
2. Principles of Agricultural Engineering(Vol-II)-A.M. Michael and T.P. Ojha *Tata Mcgraw Hill Publishing Co* Ltd, New Dehli
3. Land and water management engineering-VVN Murthy Kalyani Publishers, New Dehli
4. Surveying and leveling-(Part-I)-T.P. Kanitkar and Kulkarni Pune Vidyarthi Griha Prakashan, Pune
5. Elements of Agricultural Engineering - O.P.Singhal Merath Aman publick house, Meerut

**2. AEG 201: Farm Machinery and Power****2(1+1)****Theory:**

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

**Practical:**

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

**Suggested reading:**

1. Elements of Agricultural Engineering - Jagadishwar Sahay Standard Publishers Distributors, New Dehl
2. Principles of Agricultural Engineering(Vol-I)-A.M. Michael and T.P. Ojha *Tata Mcgraw Hill Publishing Co* Ltd, New Dehli
3. Farm Machinery and Equipments- C.P. Nakra Dhanpat Rai and sons, New Dehli
4. Elements of Agricultural Engineering - O.P.Singhal Merath Aman publick house, Meerut

### **3. AEG 202: Protected Cultivation and Secondary Agriculture**

**2(1+1)**

#### **Theory:**

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis.

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

#### **Practical:**

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant

#### **Suggested reading:**

1. Unit Operations of Agricultural Processing – K. M. Sahay & K.K.Singh Vikas Publishing House Pvt Limited, New Dehli
2. Greenhouse Management for Horticultural Crops -S. Prasad and U. Kumar, Agrobios, Agro house ,Jodhpur
3. Green House Technology and Management - K. Radha Manohar & C. Igathinathane, BS Publications, Gujarathi Galli, Sultan Bazar, Koti, Hyderabad, A.P.
4. Green house technology-Aruprathan Ghosh, Kalyani Publishers, New dehli
5. Principles and Practices of Post Harvest Technology – P. H. Pandey, Kalyani Publishing, Ludhiana

### **4. AEG 301 - Renewable Energy and Green Technology**

**2(1+1)**

#### **Theory:**

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

**Practical:**

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

**Suggested reading**

1. Non Conventional Energy Sources - G.D.Rai, Standard *Publishers* Distributors, New dehli
2. Non Conventional Energy Resources- B.H. Khan, *Mcgraw Hill Publishing Co* Ltd, New Dehli
3. Renewable Energy and Energy Management - PATRA, S.C., International Book Distributing , Mumbai
4. Elements of electrical engineering \_ B.L.Theraja, S. Chand & Company Limited-Delhi

**Agricultural Entomology****1. AET 101 - Fundamentals of Entomology****3 (2+1)****Part – I:**

History of Entomology in India. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

**Part – II :**

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Miridae, Reduvidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleyrodidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae, Hemerobidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Nymphalidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae.

Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae, Encyrtidae; Bethyridae, Formicidae, Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae, Tabanidae, Syrphidae.

### **Practical:**

Methods of collection and preservation of insects including immature stages; External features of Cockroach / Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper/ Cockroach); Dissection of male and female reproductive systems in insects (Grasshopper/ Cockroach); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

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

### **Suggested Reading**

1. Richard, O.W. and Davies, R.G., 1977, Imm's general text book of Entomology 10<sup>th</sup> edition Vol-I & II
2. Mani, M.S., 1968, General Entomology.
3. Nayar, K.K., Ananth Krishnan, T.N. and David, B.V., 1976, General and Applied Entomology.
4. Triplehorn, C.A. and Johnson. N.F., 2005, Borner and Delongs introduction to the study of insects (7<sup>th</sup> Edition).
5. Champman, R.F., Insects structure and function.
6. Romoser, W.S., 1973, The Science of Entomology.
7. Olderoyd, H., 1958, collecting preserving and studying insects, Autchinson, London 312 pp.

## **2. AET 201: Principles of Integrated Pest Management**

**3(2+1)**

### **Theory:**

\*Survey surveillance and forecasting of insect pests. Categories of insect pests, IPM: Introduction, history, importance - scope and limitation of IPM, concepts, principles and tools of IPM. Economic importance of insect pests and pest risk analysis. Methods of detection and diagnosis of insect pest. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological – Parasitoids, predators and micro-organisms used in pest control and their mass multiplication techniques. Recent methods of pest control repellents, antifeedants, hormones, attractants, gamma radiation. Chemical control: Introduction to conventional pesticides for the insect pests management: classification of insecticides, toxicity of insecticides and formulations of insecticides. Hazards and limitations. Safety issues in pesticides uses. Insecticides Act 1968 – Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes. Ecological management of crop environment: Insect ecology – Environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural enemies and environmental resistance.

Important species of pollinators, weed killers and scavengers and their importance. Development of IPM module. Implementation and impact of IPM for insect pests. Social and legal implication of IPM. Case histories of important IPM modules in different crops.

**Practicals:**

Methods of diagnosis and detection of various insect pests. Sampling techniques for estimation of insect population and damage. Methods of insect pests measurement. Assessment of crop yield losses, calculations based on economics of IPM. Identification of bio-control agents: Predators, parasitoids and micro-organisms. Identification of important species of pollinators, weed killers and scavengers. Mass multiplication of *Trichogramma*, *Chrysoperla* spp., NPV etc. Identification and nature of damage of important insect pests, their management. Crop (agro-ecosystem) dynamics of selected insect pests. Plan and assessment of preventive strategies (IPM module) and decision making. Crop monitoring attacked by insect pests. Insecticides and their formulations. Compatibility of pesticides. Study of PP equipments, pesticide calculation for field application.

Note: Each student should submit 25 insects representing parasitoids, predators, weed killers, pollinators and scavengers.

**Suggested reading:**

1. Kulkarni, H. L., 1967, General Entomology for Agricultural Students.
2. Metcalf, C.L. and Flint W.P., 1962, Destructive and useful insects – their habits and control.
3. Richards O.W. and Davis, R.G., 1977, Imm's General text book of Entomology Vol.II.
4. Ramakrishna Ayyar, T.V., 1963, Handbook of Economic Entomology for South India.
5. Vasantraj David, B. and Kumarswamy, T., 1982, Elements of Economic Entomology.
6. Bahl. Y.S. and Tangri O.P., 1986, Integrated Urban Pest Management.
7. Jacobson, D., 1975, Insecticides of the futurea.
8. Seshagiri Rao, D., 1972, A Handbook of Plant Protection
9. Puttarudriah, M., 1983, A guide for cultivation and protection of important crops.

**3. AET 301: Pests of Crops and Stored Grains and their Management      3 (2+1)**

**Theory:**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management major pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

**Practical:**

Identification of different types of damage. Identification of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearest FCI godowns and ware houses.

**Note: Each student should submit 50 insect pests representing different crops and stored products.**

**Suggested reading:**

1. Vasantaraj David, B. and Kumaraswami, T., 1984, Elements of Economic Entomology.
2. Regupathy, A., Palanisamy, S., Chandramohan, N., and Gunathilagaraj, K., 1994, A Guide on Crop Pests. TNAU Coimbatore
3. Srivastava, K.P., 1993, Text Book of Applied Entomology-II
4. Ramakrishna Ayyar, T.V., 1984, Hand Book of Economic Entomology for South India
5. Shaha, L.R., 1990, A Hand Book of Plant Protection
6. Jha, L.K., 1987, Applied Agricultural Entomology
7. Nayar, K.K., Ananthakrishnan, T.N. and David, B.V., 1986, General and Applied Entomology
8. Anonymous, 2009, Package of Practices for Higher Yields (All regions) UAS, Dharwad and KSDA, Bangalore.
9. Anonymous, 2009, Cultivation Practices for Horticultural Crops, UAS, Dharwad and KSDA, Bangalore
10. Zakladnoi, G.A. and Ratanova, V.F., 1987, Stored Grain Pests and Their Control

**4. AET 302: Management of Productive Insects      1 (0+1)****Theory**

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipments used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management. Rearing appliances of mulberry silkworm and methods of disinfection.

Species of lac insect, morphology, biology, host plants, lac production – seed lac, button lac, shellac, lac- products.

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

### **Practical**

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.

Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers.

Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

### **Suggested reading:**

1. G. Rangaswami, M.N. Narasimhanna, K. Kashivishwanathan, C.R.Sastry and M.S.Jolly, 1973. Manual on Sericulture: Vol.I- Mulberry cultivation, FAO, Rome.
2. K. Krishnaswami, M.N. Narasimhanna, S.K. Suryanarayana and Kumararaj, 1973. Manual on Sericulture: Vol.II- Silkworm rearing , FAO, Rome.
3. K. Krishnaswami, N. R. Madhav Rao, S.K. Suryanarayana and T. S. Sundaramurthy, 1972. Manual on Sericulture: Vol.III- Silk reeling , FAO, Rome.
4. S. B. Dandin, Jayant Jayaswal and K. Giridhar, 2001. Hand Book on Sericulture Technologies, CSB, Bengaluru.
5. Vasantaraj David B. and Kumaraswami, T., 1984, Elements of Economic Entomology
6. Srivastava, K.P., 1993, Text Book of Applied Entomology-II

### **Agricultural Extension**

1. **AEX 101: Constitution of India, Rural Sociology & Educational Psychology 2 (1+1)**

#### **Theory:**

Constitution of India- meaning, preamble and characteristics.Fundamental rights, duties, directives and principles of state policy; provisions for welfare of SCs and STs, minorities, women and children; powers and functions of Union executive, president, vice-President, Prime Minister, Council of Ministers, Parliament and Supreme court of India. Powers and functions of state executive, Governor, Chief minister, Council of ministers, Legislature and Judiciary; electoral process and human rights commission.

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

#### **Practical:**

Test of attitude towards agriculture; types of personality; effect of meaning on learning; achievement motivation; levels of needs and motives; verbal test of intelligence; non-verbal test of intelligence; emotional intelligence; study habits; abstract reasoning; verbal reasoning; and test of anxiety

**Suggested reading:**

1. Basu Durga Das, 2007. *Introduction to the constitution of India*. Wadhwa & Company law Publishers Agra
2. Bakshi,P.M.,2008. *Constitution of India, Ed.8*. University Law, Publishing co.pvt. Limited New Delhi
3. Bhatnagar Sukhbir, 2008. *Constitutional Law and the Governance*. Mittal Publication New Delhi
4. Braj kumar Mishra, 2008, *Psychology- the study of Human Behaviour*, PHI Learning Private
5. limited, New Delhi,pp-53.
6. Guy Rocher, 2004, *A General Introduction to Sociology*, Academic publisher, Kolkata-700073
7. Loomis, C.P. and Beegle J.A., 1957, *Rural Sociology*. Prentice Hall, Inc. Englewood Cliffs, New Jersey.
8. Mangal.S.K., 2009, *An Introduction to Psychology*, Sterling Publishers Pvt.Ltd, pp-86.
9. Mohan Rao, B., 1991. *Study of Indian Society*. Karnatak Printing Press, Bank Road, Gadag- 582101
10. Seacord and Backman, 1974, *Social Psychology*, McGraw-Hil Publishers, pp-124.
11. Shankar Rao C.N., 1993. *Sociology*. S. Chand & Company Limited, Ram Nagar, New Delhi-110053

**2.AEX 103 - Fundamentals of Agricultural Extension Education****3 (2+1)****Theory:**

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

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D; Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel communication: meaning and definition; models and barriers to communication. extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies; Agriculture journalism; diffusion and adoption of innovation: concept and meaning,

process and stages of adoption, adopter categories.

**Practical:**

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; Study of organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

**Suggested reading:**

1. Addison.H. M.,1973, *Agricultural Extension: A Reference Manual*. Food and Agricultural Organization of the United Nations. Rome,
2. Adivi Reddy A. 2001, *Extension Education*, Sree Laxmi Press, Bapatla, A.P.
3. Dahama, O.P. and Bhatnagar O.P. 2005, *Education and Communication for Development*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Jalihal K.A ., and Veerabhadraiah V., 2007, *Fundamentals of Extension Education and Management in Extension*. Concept Publ. Co.
5. Ray G.L., 1999, *Extension Communication and Management*, Noya prakash, Calcutta, West Bengal.

**3.AEX 201 - Communication Skills and Personality Development 2(1+1)**

**Theory:**

Communication Skills: Structural and functional grammar; meaning and process of communication, encoding and decoding skills, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences; personality development, personality theories, attitudes, motivation, and perception.

**Practical:**

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

**Suggested reading:**

1. Adair, John. 2003, *Effective Communication*. London: Pan Macmillan Ltd.,

2. Anjali Ghanekar, *Communication Skills for Effective Management*, Everest Publishing House, New Delhi
3. Raman, Meenakshi and Sangeeta Sharma. 2011, *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press,
4. Sharma, R. C. and Krishna Mohan, 2007, *Business Correspondence and Report Writing: Third Edition*. New Delhi: Tata McGraw-Hill Publishing company Limited,
5. Chandan, J.S., 1994, *Organizational Behaviour*. Vikas Publishing House PVT LTD
6. Cattell, R. B., 1966, *The scientific analysis of personality*. Aldine Pub. Co., Chicago

#### **4. AEX 301: Entrepreneurship Development and Business Communication**

**2 (1+1)**

##### **Theory:**

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Assessment of entrepreneurship skills, SWOT Analysis & achievement motivation, Entrepreneurial behavior, Government policy and programs and institutions for entrepreneurship development, Entrepreneurial Development Process; Business Leadership Skills; Communication skills for entrepreneurship development, Developing organizational skills, Developing Managerial skills, Problem solving skills, Achievement motivation; time management; Supply chain management and Total quality management, Project Planning Formulation and report preparation; Opportunities for entrepreneurship and rural entrepreneurship.

##### **Practical:**

Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

##### **Suggested reading:**

1. Hisrich, 2001. *Entrepreneurship*, Tata McGraw Hill, New Delhi,
2. Kaleel F M H and Krisnamurthy J. 2007. *Market Led Extension Dimensions and Tools*. Agro Tech Publ. Academy.
3. Guffey, M., 2007, *Essentials of business communication (7th ed.)*. Mason, OH: Thomson/Wadsworth.
4. Kaliyamoorthy, S. and Chandrasekhar. K., 2007, *Entrepreneurship Training Theory and Practice*,
5. Kanishka publishers Distribution
6. Khanka S S. 1999. *Entrepreneurial Development*. S. Chand & Co.
7. Mohanty, S.K., 2009, *Fundamentals of Entrepreneurship*. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Prasad, R., 2003, *Entrepreneurship - Concepts and Cases*. ICFAI Publications, Hyderabad.
9. Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, 2008, *Entrepreneurship*, Tata
10. McGraw-hill Publishing co. Ltd. New Delhi.

#### **STATISTICS, COMPUTER APPLICATION AND IPR:**

## 1. AST 201: Agri- Informatics

1 (0+1)

### Practical:

\* Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types, Applications of MS-Office for creating, Editing and Formatting a Document, Data presentation, tabulation and graph creation statistical analysis, mathematical expression, Database, concepts and types, creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts, components and creation of web HTML, XML coding.

\* e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies in agriculture. ICT for Data collection, formation of development programmes, monitoring and evaluation of programmes. Computer Models in Agriculture; Statistical weather analysis and crop simulation models, concepts, structure, inputs-outputs files, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. IT application for computation of water and nutrient requirement of crops, computer-controlled devices for Agri-input management, Smartphone mobile apps in agriculture for farm advises, market price, post-harvest management etc., Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.

### Suggested reading:

1. Agricultural and Environmental Informatics, Governance and Management
2. Zacharoula Andreopoulou Aristotle University of Thessaloniki, Greece
3. Computer Fundamentals, Anita Goel
4. *Introduction to Scientific Computing: A Matrix Approach Using MATLAB*. Prentice Hall, Englewood Cliffs, NJ, 1997.
5. Computer Fundamentals, Dr. Sushila Madan
6. Computer Fundamentals and Information Technology, Ramesh Bangia
7. Computer Fundamentals and Internet Basics, Rohit Khurana
8. Digital Computer Fundamentals, Thomas C. Bartee
9. Computer Fundamentals, Architecture & Organisation, B. Ram
10. Fundamentals of Computers, E. Balagurusamy
11. Database System, Thomas M. Connolly

## 2. AST 202 Statistical Methods

3 (2+1)

### Theory:

Introduction to Statistics and its Application in Agriculture, Frequency distribution and cumulative frequency distribution, frequency curve, Graphical Representation of Data, Measures of Central Tendency: Arithmetic Mean, Median, Mode, GM & HM-

merits, demerits and properties of each, Dispersion: Range, QD, MD, Standard deviation: merits, demerits and properties of each and Relative measures of Dispersion- CV, Moments, Skewness and Kurtosis, Definition of Probability, Addition and Multiplication Theorem. Simple Problems Based on Probability Theory, Binomial, Poisson and Normal Distribution and their Properties, Definition of Correlation, Scatter Diagram, Karl Pearson's Coefficient of Correlation. Linear Regression Equations, Introduction to Test of Significance, One Sample, Two Sample Test for Means(Large Sample , Small sample), test for proportions, Chi Square Test of Goodness of Fit, Chi-Square Test of Independence of Attributes in  $2 \times 2$  Contingency Table, Introduction to Analysis of Variance, Analysis of One Way and Two Way Classification, Introduction to Sampling Methods, Sampling Versus Complete Enumeration., Simple Random Sampling with and without Replacement, Use of Random Number for Selection of Simple Random Sample.

**Practical:**

Examples on Frequency distribution and cumulative frequency distribution, Graphical Representation of Data, Histogram, Frequency Polygon, Frequency curve, Ogives, Measures of Central Tendency Problems on Arithmetic Mean, Median, Mode, GM & HM (Ungrouped Data and Grouped data) with Calculation of Quartiles, Deciles and Percentiles, Measures of Dispersion-Range, QD, MD, Standard deviation and Relative measures of Dispersion- CV (Ungrouped Data), Measures of Dispersion: Range, QD, MD, Standard deviation and Relative measures of Dispersion- CV (Grouped Data), Moments, Measures of Skewness and Kurtosis (Ungrouped Data), Moments, Measures of Skewness and Kurtosis (Grouped Data), Simple Problems Based on Probability Theory, Problems on Binomial, Poisson and Normal Distribution. Correlation and Regression Analysis. Application of One Sample t-Test, Application of Two Sample Fisher's t--Test, One sample Z-Test, Two sample Z-test, test for proportions, Chi-Square Test of Goodness of Fit, Chi-Square Test of Independence of Attributes. For  $2 \times 2$  Contingency Table, Analysis of Variance One Way Classification, Analysis of Variance Two Way Classification, Selection of Random Sample Using Simple Random Sampling.

**Suggested reading:**

1. Statistics for Agricultural Sciences. – G. NageshwarRao
2. Statistical Methods - S.P. Gupta
3. Fundamentals of Statistics - D.N. Elhance
4. Applied Statistics -C. Kailasam& R. GangaiSelvi
5. Fundamentals of Mathematical Statistics. S.C. Gupta & V.K. Kapoor
6. Advanced Practical Statistics, S.P. Gupta
7. A Textbook of Agril. Statistics - R. Rangaswamy
8. Basic Statistics - Vol.( 1 ) - Rajmohan
9. Introduction to Statistics: An application approach – Anderson D R, SweeneyD J & Williams T. A
10. Elements of Practical Statistics - S. K. Kapur

**3. AST 301: Intellectual Property Rights**

**1 (1+0)**

**Theory:**

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

### **Suggested reading:**

1. Intellectual Property Rights- Unleashing the knowledge economy 2001 Ganguly P., Tata McGraw Hill
2. Intellectual Property Rights in Animal Breeding and Genetics 2003, Rothschild, M. and Scott, N.(Ed.).. CABI.
3. WIPO Intellectual Property Handbook: Policy, Law and Use. Fields of Intellectual Property Protection WIPO 2008
4. Intellectual Property Rights in Agricultural Biotechnology, 1998 Erbisch, F.H. and Maredia, K., . CABI.
5. The Indian Acts – Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.
6. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol V. Technology Generation and IPR Issues. Academic Foundation.
7. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies, 2006, , Saha, R. (Ed.). Daya Publ. House.

## **Agronomy**

### **1. AGR 101: Fundamentals of Agronomy**

**4 (3+1)**

#### **Theory:**

History of Agriculture development in India and world. Agronomy and its scope, seeds and sowing, tillage and tilling, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, Kinds of soil water, soil plant water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging, drainage.

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting

and threshing of crops.

**Practical:**

Identification of crops, seeds, fertilizers, herbicides and tillage implements, Effect of sowing depth on germination and seedling vigour, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and other soil moisture constants infiltration rate, Measurement of irrigation water, Methods of irrigation, Water control structure.

**Suggested reading:**

1. Balasubramaniyan P & Palaniappan SP. 2001. Principles and Practices of Agronomy. Agrobios.
2. Sankaran S & Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ.
3. Singh SS. 2006. Principles and Practices of Agronomy. Kalyani.
4. Michael AM. 1978. Irrigation: Theory and Practice. Vikas Publ.
5. Prihar SS & Sandhu BS. 1987. Irrigation of Food Crops - Principles and Practices. ICAR.
6. Gupta OP. 2007. Weed Management – Principles and Practices. Agrobios.
7. Rao VS. 2000. Principles of Weed Science. Oxford & IBH.

**2.AGR 102: Introductory Agrometeorology & Climate Change 2(1+1)**

**Theory:**

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

**Practical:**

Visit and study of Agrometeorological Observatory, site selection of observatory,

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

**Suggested reading:**

1. S. R. Ghadekar, 4th Edn. 2002, Practical Meteorology Data Acquisition Techniques Methods and Instruments.
2. Lal DS.1998. Climatology. Sharda Pustak Bhawan. Lenka D.1998. Climate, Weather and Crops in India. Kalyani Publ.
3. Prasad Rao, GSLHV, 2003, Agricultural Meteorology, Keral Agric. Univ.

**3. AGR 201: Crop Production Technology-I (Kharif Crops)**

**3(2+1)**

**Theory:**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals – rice, maize, sorghum, pearl millet, finger millet and other minor millets pulses-pigeonpea, mungbean, cowpea, moth bean, horsegram and urdbean; oilseeds- groundnut, soybean, sesamum, niger and castor; forage crops-maize, sorghum, and cowpea.

**Practical:**

Rice nursery preparation, transplanting of Rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

**Suggested reading:**

1. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
2. Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.
3. Reddy, S. R. 2009, Agronomy of Field Crops. Kalyani Publisher.
4. Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
5. Singh, SS. 1998. Crop Management. Kalyani Publishers.
6. Hand book of Agriculture 6<sup>th</sup> Revised edition ICAR Publication, New Delhi.

**4. AGR 202: Practical Crop Production-I (Kharif Crops)**

**1(0+1)**

**Practical :**

Crop planning, raising field crops, Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

**Suggested reading:**

1. Chidda Singh, Modern techniques of field crop production. Oxford and IBH publishers, Delhi
2. Rathore, P.S. Techniques and Management of field crop production. Ag (India) Publisher.
3. Das, N. R, 2011, Tillage and Crop production. Scientific publisher

**5.AGR 203: Crop Production Technology-II (Rabi crops)****2(1+1)****Theory:**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals – sorghum, wheat and barley, pulses-chickpea, lentil, oilseeds- safflower, linseed, rapeseed, mustard and sunflower; commercial crops-sugarcane, sugarbeet;cotton, tobacco, chilli, Forage crops-berseem, lucerne oat, napier hybrid, guinea, and para grass.

**Practical:**

Sowing methods of different crops, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, visit to research stations and industries of related crops.

**Suggested reading:**

1. Das N R. 2007. Introduction to Crops of India. Scientific Publ.
2. Panda, S. C. 2006 Crop Management and Integrated Farming.
3. Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.
4. Reddy, S. R. 2009, Agronomy of Field Crops. Kalyani Publisher.
5. Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
6. Singh, SS. 1998. Crop Management. Kalyani Publishers.
7. Hand book of Agriculture 6<sup>th</sup> Revised edition ICAR Publication, New Delhi.

**6.AGR 204 : Practical Crop Production-II (*Rabi Crops*)****1(0+1)****Practical:**

Crop planning, raising field crops. Field preparation, seed, treatment, nursery

raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students

**Suggested reading:**

1. Chidda Singh, Modern techniques of field crop production. Oxford and IBH publishers, Delhi
2. Rathore, P.S. Techniques and Management of field crop production. Ag (India) Publisher.
3. Das, N. R., 2011, Tillage and Crop production. Scientific publisher

**7.AGR 205: Geoinformatics and Nano-technology for Precision Farming 2(1+1)**

**Theory:**

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop identification and yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; System Simulation- Concepts and principles, Introduction to Crop Simulation Models and their uses for optimization of agricultural inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in, seed, water, fertilizer, plant protection for scaling-up farm productivity and environmental protection.

**Practical:**

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming, Visit to Nanotechnology centre.

**Suggested reading:**

1. G. S., Srivastavva, Introduction to Geoinformatics publication.
2. Mc Graw Hill Education (India) Private Limited.
3. P.L.N. Raju, Fundamentals of Geographic Information systems.
4. Aronoff, Stan, 1991, Geographic Information Systems. A management perspective. 2<sup>nd</sup> Education WDL publications.

5. Star, Jeffrey, and John Estes, 1990. Geographic Information Systems. An introduction. Prentice Hall publication.

### **8. AGR 301: Experimental Techniques in Agricultural Research** **1(0+1)**

#### **Practical:**

Definition of research-aims, goals, phases and kinds, Classification of research and categories of research, Methods and levels of research, History and development of agricultural research in India and world. Principles and practices of field experiments. Different types of field experiments layout and conduct of field experiment by the students. Selection of site, aims and types of field experiments, uniformity trials, soil heterogeneity, optimum plot size and shape, errors and ways to eliminate them. Research and the research pattern of NARS.

Basic concepts in statistics, Measures of central tendency and measures of dispersion, Test of significance, Probability and characteristics of normal curve, Basic principles of experimental designs and analysis of variance, Methods of sampling, Experimental designs, Completely randomized design, Randomized block design, Latin square design, Factorial experiments, Split plot design and split-split plot design, Split block or strip plot design, Correlation and regression, Transformation of data, Execution of the experiment and collection of observations, Guidelines for preparation of a research report.

#### **Suggested reading:**

1. Gomez, K. A. and Gomez, A. A., 1984, *Statistical Procedure for Agriculture Research*, 2<sup>nd</sup> Ed., John Willey and Sons, New York.
2. Panse, V. G. and Sukhatme, P. V., 1967, *Statistical Methods of Agricultural Workers*. Indian Council of Agricultural Research, New Delhi.

### **9. AGR 302: Principles of Organic Farming** **1(0+1)**

#### **Practical:**

Organic farming, principles and practices, its scope in India and World; Initiatives taken by Government (central/state), Organic farming guidelines and alternative philosophies, NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Soil Organic matter and its forms Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming;; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, labeling, economic considerations and viability, marketing and export potential of organic products. Visit of organic farms to study the various components and their utilization; Preparation of enriched compost, vermicompost, liquid organic manures, green manuring, crop residue management, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling, establishment of ICS (Internal control system for organic certification).

#### **Suggested reading:**

1. Joshi M & Prabhakarasetty TK. 2005. Sustainability through Organic Farming. Kalyani.
2. Lampin N. 1990. Organic Farming. Farming Press Books.
3. Palaniappan SP & Anandurai K. 1999. Organic Farming - Theory and Practice. Scientific Publ.
4. Veeresh GK, Shivashankar K & Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
5. WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO.
6. Woolmer PL & Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley.

## **10. AGR 303: Rainfed Agriculture and Watershed Management                    2(1+1)**

### **Theory:**

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

### **Practical:**

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

### **Suggested reading:**

1. Gupta US. (Ed.). 1995. Production and Improvements of Crops for Drylands. Oxford & IBH.
2. Katyal JC & Farrington J. 1995. Research for Rainfed Farming. CRIDA.
3. Somani, LL, Vittal, KPR and Venkateswarlu.1992. Dryland Agriculture. State of Art of Research in India. Scientific Publ.
4. Suresh, R. 2006. Soil and Water Conservation Engineering Standard Publ. & Distributors.
5. Venkateswarlu J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.

## **11. AGR 304: Farming System and Sustainable Agriculture**

**1(1+0)**

### **Theory:**

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system definition, Principles and concepts, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, indices for evaluation of cropping system, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA Concepts, Principles and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Resource cycling and flow of energy Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

### **Suggested reading:**

1. Balasubramanian P & Palaniappan SP 2006. Principles and Practices of Agronomy. Agrobios.
2. Panda S C. 2004. Cropping systems and Farming Systems. Agribios.
3. Panda S C, 2014, Cropping and Farming System. Agrobios (India) Publisher.
4. Somani, LL, Vittal, KPR and Venkateshwarlu.1992. Dryland Agriculture State of Art of Research in India Scientific Publi
5. Venkata Rao BV. 1995. Small Farmer Focused Integrated Rural Development: Socioeconomic Environment and Legal Perspective. Publ. 3. Parisaraprajna Parishtana, Bangalore.

## **BIOCHEMISTRY/ PHYSIOLOGY/ MICROBIOLOGY/ ENVIRONMENTAL SCIENCES**

### **1.BCH 101: Fundamentals of Plant Biochemistry**

**2 (1+1)**

#### **Theory:**

Importance of Biochemistry, Properties of water, pH and buffer. Carbohydrate: Importance and classification. Structures of Monosacchrides; Reducing and oxidizing properties of Monosacchrides, Mutarotation ; Structure of Diasaccharides and polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Amino acids: Structures and classification, Zwitterions nature of amino acids. Proteins: Importance of proteins and classification. Structural organization of proteins. Enzymes: General properties, Classification; Mechanism of action: Factors affecting the rate of enzyme catalyzed reaction; Introduction to Allosteric enzymes. Nucleic acids: Importance and Classification; Structures of nucleotides, A, B, and Z DNA; RNA: Types and Secondary and Tertiary structure. Metabolism of Carbohydrates; Glycolysis, TCA cycle, glyoxylate cycle, Electron Transport Chain. Metabolism of Lipids; Knoop's experiment, Beta oxidation,

**Practical:**

Preparation of solutions, pH & buffers, Qualitative tests of Carbohydrates and amino acids. Quantitative estimation of glucose/ Proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, Temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharide.

**Suggested reading:**

1. David.L.Nelson and Michael M.Cox. Lehninger, Principles of Biochemistry
2. Hans-Walter Heldt , Plant Biochemistry (Third Edition)
3. Stryer, S.L., Biochemistry
4. Thimmaiah, S.R., Textbook of Biochemistry
5. Hames & N. M. Hooper, Instant Notes Biochemistry (Second Edition)
6. Donald Voet, Biochemistry

**2. BTH 302: Fundamentals of Plant Biotechnology****1(1+0)****Introduction: Concepts and applications of plant biotechnology****Unit I :Plant Tissue Culture for crop Improvement**

Organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; Somatic hybridization and Cybrids; Somaclonal variation and its use in crop improvement' Cryopreservation

**Unit II : Introduction to recombinant DNA Technology for crop Improvement**

Gene cloning steps, common enzymes used as molecular tools, vectors, transformation and selection of recombinants, construction of genomic libraries, isolation and cloning of coding parts of eukaryotic genes-cDNA cloning.

Gene transfer methods; Transgenics and its importance

**Unit III : Introduction to Marker Assisted Breeding in Crop Improvement****PCR Techniques and its applications, Molecular markers, RAPD,RFLP, SSR, SNP****Suggested reading:**

1. Brown, T. A., 2006, Gene cloning and DNA analysis: An ntroduction. Blackwell Publishing, Oxford, UK.
2. Gardener, E. J., Simmons, M. J. and Snustad, D. P., 1991, Principles of Genetics. John Wiley & Sons, Inc, New York, USA.
3. Singh, B. D., 2013, Biotechnology, Kalyani Publishers.
4. Chawla, H.S, 2002, Introduction to Plant Biotechnology, Science Publishers

**3. CPH 101 – Fundamentals of Crop Physiology****3 (2+1)****Theory:**

Introduction to crop physiology and its importance in Agriculture.

Plant cell: an Overview; Cell organelles and their functions; Cell membranes, Chloroplast, mitochondria. Physical and chemical properties of water and their role

plant sustenance. Water potential: Definition, free energy, significance of water potential, water potential components – solute and pressure potential, Vant Hoff's equation. Study of basic terms in relation to movement of solvent / solute - imbibitions, diffusion, osmosis, plasmolysis, incipient plasmolysis. Hypotonic and hypertonic solutions.

Absorption of water: Study of root and shoot system in relation to path of water movement- Apoplastic and symplastic movement, Mechanism of water absorption – passive and active absorption of water. Ascent of sap – definition, theories involved. Transpiration pull. Transpiration: Definition, Structure of stomata, stomatal and cuticular transpiration, Transpiration ratio, water use efficiency. Mechanism of stomatal movement. Factors affecting transpiration. Difference between transpiration and guttation. Nutrient uptake / Solute transport – Passive and Active transport, Channel, Carrier and Facilitated diffusion transport,  $H^+$  and  $K^+$  pumps, Symport and Antiport transport. Translocation of assimilates, phloem loading, apoplastic and symplastic transport of assimilates, source sink concept. Photosynthesis: Definition, principles of photobiology, chlorophyll and accessory pigments, Structure of chlorophyll, fluorescence (Singlet state) and phosphorescence (Triplet State). Mechanisms involved in photosynthesis: Light reaction – Study of photo systems- I and II. Electron transport chain (Z-Scheme), Photolysis of water, Photophosphorylation (cyclic and non-cyclic) Dark reaction: Pathways involved in  $CO_2$  fixation. Melvin-Calvin cycle ( $C_3$ -pathway), Hatch-Slack pathway ( $C_4$ -path way), CAM and Photorespiration. Difference between  $C_3$ ,  $C_4$  and CAM. Factors affecting photosynthesis and productivity, Methods of measuring Photosynthesis and photosynthetic efficiency. Respiration and its significance, Definition, RQ, Steps involved in biological oxidation – Glycolysis, Krebs's cycle, Fermentation, lactic acid fermentation. Electron transport chain in respiration. Total ATP / energy balance. Pentose Phosphate Pathway, Maintenance, Alternate, Salt, Wound respiration. Growth and development- Definition, Phases of growth, growth regions, growth curve. Basic principles of growth analysis . Growth parameters – LAI, AGR, RGR, NAR, CGR and LAD. Nutrio-physiology – definition, Mengel's classification of nutrients, Functions and deficiency / toxic symptoms of nutrients, foliar nutrition, hydroponics. Plant hormones/ plant growth regulators, precursors, mode of action, and physiological role of different growth regulators – Auxins, Gibberillins, Cytokinin, ABA, and Ethylene. Commercial uses in Agriculture.

### **Practical:**

Study of plant cells and structure, Preparation of standard solutions, Diffusion, Osmosis and Imbibition, Methods of measuring water status in plants (RWC), Measurement of water potential, Chardakov's dye method, Gravimetric method, Measurement of root pressure, Measurement of transpiration by photometers, Measurement of absorption spectrum of chloroplast pigments and fluorescence, Photosynthetic pigments, Separating funnel method, Spectrophotometric method, SPAD. Measurement of stomatal frequency and stomatal index. Measurement of photosynthetic  $CO_2$  assimilation by Infra Red Gas Analyser (IRGA). Measurement of leaf area in crop plants by different methods. Growth analysis and measurements of growth parameters. Yield analysis, Chlorophyll retention test by cytokinin, Demonstration of fruit ripening by ethylene.

### **Suggested reading:**

1. Noggle and Fritz :Introductory Plant Physiology
2. Mohr and Scopfer : Plant Physiology

3. Kumar and Purohit : Plant Physiology (Fundamentals and Application)
4. Taiz and Zeiger : Plant Physiology
5. Salisbury and Ross : A Text Book of Plant Physiology
6. Pande and Sinha : Plant Physiology

#### **4. AMB 201: Agricultural Microbiology**

**3 (2+1)**

##### **Theory:**

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon.

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

##### **Practical:**

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Isolation of BGA. Staining and microscopic examination of microbes.

##### **Suggested reading:**

1. Michael Madigan ; John Martinko; David Stahl And David Clark, Brock- Biology Of Microorganisms, Pearson (Thirteen Edition)
2. Mark S. Coyne, Soil Microbiology-An Exploratory Approach, Delmar Publishers-2004
3. Atlas Bartha, Microbial Ecology –Fundamentals And Application, Pearson (Fourth)
4. J Nicklin, K Graeme-Cook, T.Paget And R. Killington, Instant Notes In Microbiology, Viva

#### **5. ENS 201: Environmental Studies and Disaster Management**

**2 (1+1)**

1. Multidisciplinary nature of environmental studies Definition, scope and importance
2. Natural Resources: Renewable and non-renewable resources. Natural resources and associated problems. Discussion on Use and over-exploitation of forest, water, mineral, food, energy and land resources. World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems,

**3&4.**Ecosystems: concept, structure and function of an ecosystem. • Producers,

consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of different ecosystems

**5&6** Biodiversity and its conservation:- Introduction, definition, genetic, species & ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**7-11.** Environmental Pollution: definition, cause, effects and control measures of :-

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards.

**12.** Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Pollution prevention- case studies.

**13 & 14** Social Issues and the Environment: From Unsustainable to Sustainable development Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, Consumerism and waste products.

**15.** Environment Protection Acts. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

Public awareness.

**16 & 17** Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves.

**18 & 19** Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework

### **Practical:**

1. Visit to food and beverage industries/ effluent treatment plants: collection of samples for pollution study
2. Visit to Municipal sewage flow sites and collection of samples for pollution study
3. Visit to disaster affected sites
4. Determination of pH & EC, of sewage/effluent waters.
5. Estimation of DO and BOD of sewage.
6. Estimation of COD of industrial effluent water samples.
7. Estimation of phosphates in polluted water samples
8. Determination of Total Solids (TS) and Total Dissolved Solids (TDS) in Effluent samples

9. Estimation of heavy metal contents in sewage irrigated soil
10. Estimation of drinking water parameters
11. Visit to Regional office of pollution control board (KSPCB) and their air pollution monitoring stations.
12. Estimation of Nitrate contamination in Groundwater.
13. Analysis of Temporary and Total Hardness of Water samples.
14. Estimation of phosphates in polluted water samples
15. TSS, TDS, Acidity/ alkalinity of sewage/effluent waters
16. Determination of Chlorides in polluted water
17. Estimation of Particulate Matter/ Dust in Air.
18. Microbial population of polluted air and water.
19. Microbiological analysis of sewage and industrial effluents.

**Suggested reading:**

1. D.D. Sahu, R. K. Mathukia and P. K. Chovatia, Sustainable Environmental Science, Nipa
2. Y. Anjaneyalu and Valli Manickam, Environmental Impact Assessment Methodologies, 2/e PB (English) 2nd Edition, BS Publications, ISBN-10: 0415665566
3. Bala Krishnamoorthy, Environmental management: Text and cases PHI Learning Pvt. Ltd
4. F. Stuart Chapin III, Gary P. Kofinas, Carl Folke (Editors), Principles of ecosystem stewardship – Resilience based natural resource management in a changing world, Springer, ISBN: 978-0-387-73032-5
5. Arvind Kumar, A text book of environmental Science, APH Publishing Corporation
6. Dibyendu Sarkar, Rupali Dutta, Avinandan Mukherjee, Robbyn Hannigan. An integrated approach to environmental management, Wiley, ISBN: 978-1-118-74435-2
7. P. E. Hansen and Sven Erik Jørgensen, Introduction to environmental management. Elsevier, ISBN: 0444884696, 9780444884695
8. John Houghton, Global warming: a complete briefing (4<sup>th</sup> edition), Cambridge University Press

**6. FOR 101: Introduction to Forestry**

**2 (1+1)**

**Theory:**

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing

trees, age determination of trees. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

**Practical:**

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

**Suggested reading:**

- |                                              |                                     |
|----------------------------------------------|-------------------------------------|
| 1. Principles and practices of Agroforestry  | - A. P. Dwedi                       |
| 2. Hand book of Forestry                     | - S. S. Negi                        |
| 3. Agroforestry Potentials and Opportunities | - P. S. Patnaik and Ramnewaj        |
| 4. Agroforestry                              | - P. K. Nair                        |
| 5. General Silviculture for India            | - Champion and Seti                 |
| 6. Principles and Practices of Silviculture  | - L. S. Khanna                      |
| 7. Forest Mensuration                        | - A. N. Chaturvedi and L. K. Khanna |
| 8. Elements of General Silviculture          | - S. S. Negi(IBD Publishers)        |

**Genetics and Plant Breeding:**

**1.GPB 101:Fundamentals of Genetics and Cytogenetics**

**3 (2+1)**

**Theory:**

Nucleus, chromosome, types, chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Structural and numerical variations of chromosomes. Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Probability and chi-square. Dominance relationships, gene interaction. pleiotropism and multiple alleles, linkage and its estimation, crossing over mechanisms, chromosome mapping. Sex determination and sex linkage, sex limited and sex influenced traits, qualitative quantitative traits, polygenes and continuous variations, multiple factor hypothesis. epistatic interactions with examples, cytoplasmic inheritance, genetic disorders, natural structure & replication of genetic material, protein synthesis, transcription and translational mechanism of genetic material. Gene concept: Fine structure of a gene, function and regulation, Lac and Trp operons. Mutation: classification, methods inducing mutation & CIB technique, mutagenic agents and induction of mutation.

**Practical:**

Study of microscope; Study of cell structure. Mitosis and meiosis cell division karyotype. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross

Experiments on epistatic interactions including test cross and back cross; Experiments on probability and chi-square test; Determination of linkage and cross over analysis (through two point test cross and three point test cross data); Study on sex linked inheritance in *Drosophila*; Study of models on DNA and RNA structure; Induction of polyploidy.

**Suggested reading:**

1. Gardner, E. J. and Snustad, D. P. 1991, Principles of Genetics, John Willey & Sons
2. Klug, W.S. and Cummings, M.R., 2003, Concepts of Genetics, Peterson Edu.
3. Robert H. Tamarin, 1996, Principles of Genetics, Tata McGraw-Hill Edition
4. Lewin B Jones & Barttlet, 2008, Genes IX.
5. Strickberger, M.W., 2005, Genetics ( III Ed), Prentice Hall, New Delhi India
6. Snustad, D.P. and Simmons M.J. 2006, Genetics (IV Ed) John Wiley & Sons

**2. GPB 201- Fundamentals of Plant Breeding**

**3(2+1)**

**Theory:**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixies, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, acclimatization, introduction; Centre of origin/diversity, component of genetic variation; Heritability and genetic advance;

Genetic consequences of selfing, sibling, Genetic basis and breeding methods in self-pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population: pedigree, bulk, single seed descent and back crossing. Multiline concept.

Concepts of population genetics and genetic consequences of random mating, Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, implications, modes of selection; Population improvement schemes- Ear to row method, modified ear to row method, recurrent selection schemes, synthetics and composites, Heterosis and inbreeding depression, development of inbred lines and hybrids, types of hybrids; Breeding methods in asexually propagated crops, clonal selection and hybridization; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Participatory plant breeding

**Practical:**

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregating populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiment, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out crossing. Prediction of performance of double cross hybrids.

**Suggested reading:**

1. Briggs W. A. Introduction to plant breeding, Reihold Publishing corporation, New

York

2. Briggs FN and Knowles Introduction to plant breeding, Reihold Publishing corporation, New York
3. Allard R. W. Principles of plant breeding, John Wiley & Sons, New York
4. Chopra V. L. Plant breeding: Theory and Practice, Oxford & IBH Publishing CO. Pvt. Ltd., New Delhi
5. Sharma J. R. Principles and practices of plant breeding, Tata McGraw Publishing Compay Ltd., New Delhi
6. Singh B. D. Plant breeding : principles and methods, Kalyani Publishers, Ludhiana
7. Hays, Immer and Smith, Methods of plant breeding, McGraw Hill Publications, New York
8. Falconer D. S. Introduction to quantitative genetics, Longman Scientific & Technical, Longman Group, UK, Ltd., England
9. Singh R. K. and Chaudhary B. D., Biometrical methods in quantitative genetic analysis, Kalyani Publishers, Ludhiana
10. Mather K and Jinks J. L. Introduction to Biometrical genetics, Chapman and Hall, London

### **3.GPB 301: Crop Improvement I (Kharif crops)**

**2(1+1)**

#### **Theory:**

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; Plant genetic resources, its utilization and conservation. Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated and cross pollinated crops; Major breeding objectives and methods in self pollinated and cross pollinated crops. Breeding approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in kharif crops (modified). Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

#### **Practical:**

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame , Caster, Cotton, Cowpea, Pearl millet and Tobacco. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots (public and private); Visit to AICRP plots of different field crops.

#### **Suggested reading:**

1. Hays and Garber, Breeding crop plants, McGraw Hill Publications, New York

2. Poelman J. M. and Sleper D. A. Breeding field crops, Panima Publishing Corporation, New Delhi
3. Fehr W. R. Principles of cultivar development: theory and technique (Vol. 1), Macmillan Publishing Company, New York
4. Mandal A. K., Ganguli R. K. and Banerjee S. P. Advances in plant breeding (Vol. 2) CBS Publishers & Distributors, Delhi
5. Kaul MLH, Male sterility in higher plants Springer Verlag ,Berlin, Germany

#### **4. GPB 302 Crop Improvement II ( Rabi crops)**

**2 (1+1)**

##### **Theory:**

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; Plant genetic resources, its utilization and conservation; Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated and cross pollinated crops; Major breeding objectives and methods in self pollinated and cross pollinated crops. Breeding approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) in rabi crops (modified); Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

##### **Practical:**

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

##### **Suggested reading:**

1. Singh BD Plant breeding : principles and methods, Kalyani Publishers, Ludhiana
2. Hays, Immer and Smith, Methods of plant breeding, McGraw Hill Publications, New York
3. Hays and Garber, Breeding crop plants, McGraw Hill Publications, New York
4. Poelman J. M. and Sleper D. A. Breeding field crops, Panima Publishing Corporation, New Delhi
5. Fehr W. R. Principles of cultivar development: theory and technique (Vol. 1), Macmillan Publishing Company, New York
6. Mandal A. K., Ganguli R. K. and Banerjee S. P. Advances in plant breeding (Vol. 2) CBS Publishers & Distributors, Delhi
7. Kaul, MLH, Male sterility in higher plants, Springer Verlag, Berlin, Germany

#### **Horticulture:**

##### **1.HRT 101: Fundamentals of Horticulture**

**2(1+1)**

**Theory:**

Horticulture-Its definition and branches, importance and scope; horticultural classification; Orchard layout systems. Principles of establishment of orchards. Climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination and pollinators; fertilization and parthenocarpy; Systems of orcharding. use of plant regulators in horticulture. Irrigation & fertilizers application-method and quantity.

**Practical:**

Identification of garden tools. Identification of horticultural crops. Layout systems in orchards. Practice of sexual and asexual methods of propagation. Layout and planting of orchard plants. Training and pruning of fruit trees. Transplanting and care of vegetable seedlings. Preparation of potting mixture, potting and repotting. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

**Suggested reading:**

1. Chadha KL. (Ed.). 2002. *Hand Book of Horticulture*. ICAR
2. Peter KV. 2008. (Ed.) *Basics of Horticulture*. New India Publ. Agency.
3. Rajan S & Baby LM. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency.
4. Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. New India Publ. Agency

**2. HRT 201: Production Technology for Vegetable and Spices****2(1+1)****Theory:**

Definition, importance of vegetables & spices in human nutrition, anti-nutritional factors and national economy, classification of vegetables, Vegetable production systems, brief about origin, soil, climate, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, physiological disorders, of important vegetable and spices. Important vegetables- potato, tomato, brinjal, chilli, cabbage, cauliflower, peas, beans, onion, carrot, radish, watermelon, cucumber, drumstick, amaranthus. Important spices:- Pepper, cardamom, ginger, turmeric

**Practical:**

Identification of vegetables & spices crops and their seeds. Layout of kitchen garden. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters, genotypes of different vegetables & spices. Important vegetables- potato, tomato, brinjal, chilli, cabbage, cauliflower, peas, beans, onion, carrot, radish, watermelon, cucumber, drumstick, amaranthus. Important spices:- Pepper, cardamom, ginger, turmeric. Fertilizers applications. Harvesting & preparation for market. Visit to hitech horticulture units and farmers field.

**Suggested reading:**

1. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. *Vegetable Crops*. Vols. I-III. Naya Udyog.

2. Bose TK, Som MG & Kabir J. (Eds.). 2002. *Vegetable Crops*. Naya Prokash.
3. Chadha KL. (Ed.). 2002. *Hand Book of Horticulture*. ICAR.
4. Gopalakrishanan TR. 2007. *Vegetable Crops*. New India Publ. Agency.
5. Kalloo G & Singh K (Ed.). 2000. *Emerging Scenario in Vegetable Research and Development*. Research Periodicals & Book Publ. House.
6. Palaniswamy & Peter KV. 2007. *Tuber Crops*. New India Publ. Agency.
7. Rana MK. 2008. *Olericulture in India*. Kalyani.
8. Rana MK. 2008. *Scientific Cultivation of Vegetables*. Kalyani.
9. Singh DK. 2007. *Modern Vegetable Varieties and Production Technology*. International Book Distributing Co.
10. Singh NP, Bharadwaj AK, Kumar A & Singh KM. 2004. *Modern Technology on Vegetable Production*. International Book Distributing Co.
11. Thamburaj S & Singh N. 2004. *Vegetables, Tuber Crops and Spices*. ICAR.

### **3. HRT 202: Production Technology for Ornamental Crops, Medicinal and Aromatic Plants and Landscaping** **2(1+1)**

#### **Theory:**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Uses of trees, shrubs and climbers in landscape. Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Intorudction to production technology of important medicinal plants like aloe, ashwagandha, opium, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

#### **Practical:**

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Elements of landscape design. Planning and layout of garden. Propagation of ornamental plants. Propagation of medicinal crops. Propagation of aromatic crops. Training and pruning of Ornamental plants. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

#### **Suggested readings:**

1. Arora JS. 2006. *Introductory Ornamental Horticulture*. Kalyani.
2. Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
3. Lauria A & Ries VH. 2001. *Floriculture – Fundamentals and Practices*. Agrobios.
4. Prasad S & Kumar U. 2003. *Commercial Floriculture*. Agrobios.
5. Randhawa GS & Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publ.
6. Sheela VL. 2007. *Flowers in Trade*. New India Publ. Agency.

7. Valsalakumari PK, Rajeevan PK, Sudhadevi PK & Geetha CK. 2008. *Flowering Trees*. New India Publ. Agency.

#### **4. HRT 301: Production Technology for Fruits and Plantation Crops      2(1+1)**

##### **Theory:**

Importance and scope of fruit and plantation crop industry in India; Dry land horticulture – principles and practices; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, sapota, papaya, pineapple and pomegranate. Plantation crops-coconut, areca nut, cashewnut, coffee and tea.

##### **Practical:**

Rootstock production, Establishment and maintenance of mother plants, Propagation methods for fruit and plantation crops including Micro-propagation. Botanical description and identification of fruit and plantation crops. Preparation of plant bio regulators and their uses, Pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchard.

##### **Suggested reading:**

1. Peter KV. 2008. (Ed.). *Basics of Horticulture*. New India Publ. Agency.
2. Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. Parts I, II. New India Publ. Agency.
3. Radha T & Mathew L. 2007. *Fruit Crops*. New India Publ. Agency.
4. Kurian A & Peter KV. 2007. *Commercial Crops Technology*. New India Publ. Agency.
5. Nybe EV, Miniraj N & Peter KV. 2007. *Spices*. New India Publ. Agency.
6. Parthasarthy VA, Kandiannan V & Srinivasan V. 2008. *Organic Spices*. New India Publ. Agency.
7. Peter KV. 2002. *Plantation Crops*. National Book Trust.
8. Pradeep Kumar T, Suma B, Jyothibhaskar & Satheesan KN. 2008. *Management of Horticultural Crops*. Part I, II. New India Publ. Agency.
9. Pruthi JS. 2001. *Minor Spices and Condiments- Crop Management and Post Harvest Technology*. ICAR.
10. Thamburaj S & Singh N. (Eds.). 2004. *Vegetables, Tuber Crops and Spices*. ICAR.
11. Tiwari RS & Agarwal A. 2004. *Production Technology of Spices*. International Book Distr. Co.

#### **5. HRT 302 - Post-harvest Management and Value Addition of Fruits and Vegetables    2 (1+1)**

##### **Theory:**

Fresh form of fruits and Vegetables: - Post- harvest technology – definition and importance, causes of perishability, possible causes of post harvest losses; Pre-harvest

factors affecting postharvest quality. Maturity, ripening and changes occurring during ripening; Ways and means of reducing losses during post harvest handling: 1) Start with good quality fruits and vegetables; 2) Avoid physical damage; 3) Control environmental factors; 4) Use proper procedures- harvesting, trimming, grading, treatments, pre-cooling, packaging, transportation, ripening: Extending shelf life of fruits and vegetables in fresh form; Processed form of fruits and vegetables :Value addition concept-history, importance, and scope of processing industries; Principles of preservation- by physical methods, moisture limitation, application of heat, chemical preservatives and fermentation

**Practical:**

Pre-harvest treatments of fruits and vegetables. Applications of different types of packaging containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Cold storage and ZECC. Demonstration of chilling and freezing injury in vegetables and fruits. Instruments / equipments commonly used in food preservation. Containers used in preservation. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, squash, and candy and tomato products, canned products. Visit to processing unit/ industry. Visit to cold storage units and local market yards.

**Suggested readings:**

1. Bhutani RC. 2003. *Fruit and Vegetable Preservation*. Biotech Books.
2. Mitra SK. 1997. *Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits*. CABI.
3. Ranganna S. 1997. *Hand Book of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw-Hill.
4. Sudheer KP & Indira V. 2007. *Post Harvest Technology of Horticultural Crops*. New India Publ. Agency.
5. Willis R, Mc Glassen WB, Graham D & Joyce D. 1998. *Post Harvest. An Introduction to the Physiology and Handling of Fruits, Vegetables and Ornamentals*. CABI.

## **Plant Pathology**

### **1. PAT 101: Fundamentals of Plant Pathology**

**3(2+1)**

**Theory:**

Introduction: Importance of plant diseases, scope and objectives of plant pathology. History of plant pathology with special reference to Indian work. Terms and concepts in plant pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

Fungi: general characters, definition of fungus, somatic structures, types of fungal

thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.

Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites.

Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Radopholus* etc.)

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defence mechanisms in plants. Epidemiology: Factors affecting disease development.

### **Practical:**

Acquaintance with various laboratory equipment's and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

### **Suggested readings:**

1. Agrios, G. N., 2005, Plant Pathology. 5<sup>th</sup> Ed. Academic Press, New York.
2. Alexopoulos, C. J., Mims, C. W. and Blackwell, M., 2000, Introductory Mycology 4<sup>th</sup> Ed. John Wiley & Sons, New York.
3. Chaube, H. S., and Ramji Singh., 2001, Introductory Plant Pathology, IBDCO, Lucknow.
4. Dropkin, V. H., 1980, An Introduction to Plant Nematology. John Wiley & Sons, New York.
5. Jayaraman, J. and Verma, J. P., 2002, Fundamentals of Plant Bacteriology. Kalyani Publ., Ludhiana.
6. Maggenti, A. R., 1981, General Nematology. Springer-Verlag, New York.
7. Mehrotra R.S. and Agarwal, A. 2003, Plant Pathology II Edition Tata Mc Graw Hill Publication New Delhi.
8. Mehrotra, R. S. and Aneja, K. R., 1990, An Introductory Mycology. Wiley Eastern, New Delhi.
9. Singh, R. S., 1982, Plant Pathogens – The fungi. Oxford & IBH, New Delhi.

## **2. PAT 301: Principles of Integrated Disease Management**

**2 (1+1)**

### **Theory:**

Categories of diseases, IDM: Introduction, history, importance, concepts, principles and tools of IDM. Economic importance of diseases. Methods of detection and diagnosis of diseases. Principles and methods of plant disease management: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Introduction to conventional & new molecules of fungicides, nematicides and bactericides in disease management, their classification, mode of action and formulations. Ecological management of crop environment. Survey, surveillance and forecasting of diseases. Development and validation of IDM module. Implementation and impact of IDM module. Safety issues in pesticide uses. Political, social and legal implication of IDM. Case histories of important IDM programmes.

### **Practical:**

Methods of diagnosis and detection of various plant diseases, Methods of plant disease measurement, assessment of crop yield losses, calculations based on economics of IDM, identification of biocontrol agents, mass multiplication of *Trichoderma*, *Pseudomonas*, etc. Crop (agro-ecosystem) dynamics of a selected diseases. Plan & assess preventive strategies (IDM module) and decision making. Crop monitoring for disease prevalence & severity. Introduction to appliances used in disease management (seed drum, sprayers, duster etc.). Awareness campaign in farmer's fields.

### **Suggested readings:**

1. Agarwal, V. K., 2006, Seed Health, IBDCO Publication, New Delhi.
2. Agrios, G. N., 2005, Plant Pathology. 5<sup>th</sup> Ed. Academic Press, New York.
3. Gnanamanickam, S. S (Eds). 2002, Biological Control of Crop Diseases. CRC Press, Florida.
4. Mehrotra R.S. and Agarwal, A. 2003, Plant Pathology II Edition Tata Mc Graw Hill Publication New Delhi.
5. Paul Neergaard. 1988, Seed Pathology, MacMillan, London.
6. Rangaswami, G. and Mahadevan, A. 2012, Diseases of Crop Plants in India, Prentice Hall India Private Limited, New Delhi.

### **3. PAT 302: Diseases of Field and Horticultural Crops & their Management-I 3 (2+1)**

Theory: Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural crops: Guava: wilt and anthracnose; Banana: panama wilt, bacterial wilt, sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial

blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

**Practical:**

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Note: Students should submit 50 pressed and well-mounted specimens.

**Suggested readings:**

1. Agrios, G. N., 2005, Plant Pathology. 5<sup>th</sup> Ed. Academic Press, New York.
2. Chaube, H. S. and Pundhir, V. S., 2005, Crop diseases and their management. Prentice Hall of India.
3. Gupta, V. K., and Sharma, S. K., 2000, Diseases of Fruits Crops. Kalyani Publ., New Delhi.
4. Kolte, S. J., Diseases of Oil Seeds, CRC Press.
5. Mehrotra R.S. and Agarwal, A. 2003, Plant Pathology II Edition Tata Mc Graw Hill Publication New Delhi.
6. Ou, S.H. 1984, Rice diseases II Edition, CMI Publications, England.
7. Rangaswami, G. and Mahadevan, A. 2012, Diseases of Crop Plants in India, Prentice Hall India Private Limited, New Delhi.
8. Shahid Ahamad 2012, Recent Trends in Plant Diseases Management in India. Kalyani Publishers. New Delhi.
9. Singh R. S., 2005, Plant diseases 8<sup>th</sup> Edition Oxford & IBH publishing co. Pvt. Ltd. New Delhi.
10. Singh, R. S., 2005, Plant Diseases, IX<sup>th</sup> edition. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

**4. PAT 303: Diseases of Field and Horticultural Crops & their Management-II  
3 (2+1)**

**Theory:**

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops:

Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle

Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white

rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta

blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea:

downy mildew, powdery mildew and rust.

Horticultural Crops:

Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus:

canker and gummosis; Grape vine: downy mildew, powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall; Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

**Practical:**

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. Note: Students should submit 50 pressed and well-mounted specimens.

**Suggested readings:**

1. Agrios, G. N., 2005, Plant Pathology. 5<sup>th</sup> Ed. Academic Press, New York.
2. Chaube, H. S. and Pundhir, V. S., 2005, Crop diseases and their management. Prentice Hall of India.
3. Gupta, V. K., and Sharma, S. K., 2000, Diseases of Fruits Crops. Kalyani Publ., New Delhi.
4. Kolte, S. J., Diseases of Oil Seeds, CRC Press.
5. Mehrotra R.S. and Agarwal, A. 2003, Plant Pathology II Edition Tata Mc Graw Hill Publication New Delhi.
6. Nene, Y.L. and Thapliyal, P. N., 1993, Fungicides in Plant Disease Control. 3<sup>rd</sup> Ed. Oxford & IBH, New Delhi.
7. Rangaswami, G. and Mahadevan, A. 2012, Diseases of Crop Plants in India, Prentice Hall India Private Limited, New Delhi.
8. Singh, R. S., 2005, Plant Diseases, IX<sup>th</sup> edition. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
9. Srinivasan K. V., 1994. Cotton Diseases. Indian Society for Cotton Improvement, Bombay.
10. Thind, T. S., 2005, Diseases of fruits and Vegetables and their management, Kalyani publishers

## **Seed Science and Technology**

### **SST 201-Principles of Seed Technology**

**3 (1+2)**

**Theory:**

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal

Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

### **Practical:**

Varietal and hybrid seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra Ragi and other minor millets; major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea; major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut, Safflower, Castor and Mustard and important vegetable crops.

Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

### **Suggested readings:**

1. Agrawal R. L., 1996, Seed Technology, Oxford and IBH Publicity Company, New Delhi.
2. Joshi, A. K. and Singh, B. D. 2003. Seed Science and Technology. Kalyani Publishers. Ludhiana.
3. Kulkarni, G. N. 2002. Principles of Seed Technology. Kalyani Publishers. Ludhiana.
4. Nema, N. P. 1986, Principles of Seed Certification and Seed Testing. Pub. Allied Publishers Private limited, New Delhi.
5. Singhal, N. C. 2002. Hybrid Seed Production. Kalyani Publishers, Ludhiana.
6. Tunwar, N. S. and Singh, S. V. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, New Delhi.
7. Bhale, M. S, 2013, A hand book of seed certification. Vardhman Books and Periodicals.
8. Sen Subip and Ghosh Nabinanda. 2002. Seed Science and Technology. Kalyani Publishers. Ludhiana.
9. Agarwal, P. K. and M. Dadlani, 1987, Techniques in Seed Science and Technology. South Asian Publishers, New Delhi.
10. Khare, D. P. 1994. Stored Grain Pests and their Management. Kalyani Publishers. Ludhiana.
11. Agarwal, V. K., 2003, Seed health. International Book Distributing Co.
12. Paul Neergaard, 1977, Seed Pathology, Vol. — I and II McMillan Press, London.

# Soil Science and Agricultural Chemistry

## 1.SAC 101: Fundamentals of Soil Science

3 (2+1)

### Theory:

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; Soils of Karnataka, Soil water-classification, soil water characteristic curves , Soil moisture constants, energy concepts, Measurements and soil water flow.

Soil temperature; Amount and flow of heat in soils, Thermal conductivity and diffusivity in soils, effect on plant growth.

Anion exchange capacity, organic matter fractions Soil survey, land capability classification and soil suitability GIS and Remote Sensing; its applications in agriculture

### Practical:

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Determination of soil pH and electrical conductivity. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil. Determination of aggregate stability, Determination of infiltration rate, Determination of soil moisture constants (Field Capacity, Wilting point and MWC). Determination of soil colour, and COLE value.

### Suggested readings:

1. The Nature and Properties of Soils, Harry O. Buckman & Nyle C. Brady
2. Fundamental of Soil Science – ISSS, New Delhi
3. Text Book of Soil Science ICAR, New Delhi, Mehra, R.K.,
4. Soils-An Introduction to Soils and Plant Growth, Printice – Hall of India, Donhe, R.L., Miller, R.W. and Shickluna, J.C.
5. Pedology, Kalyani Publishers, Ludhiyana , J.Sehgal
6. A Text Book of Soil Science, J.A.Daji, J.R.Kadam & Dr. N.D.Patil
7. The ABC of Soils 1965, Jacob S. Joffe
8. Basic Concepts of Soil Science 2 edition, 2000, A.K.Kolay
9. Introductory Soil Science 1997, Dilipkumar Das
10. Fundamentals of Soil 2000, V.N.Sahai

## 2. SAC 202: Problematic Soils and their Management

2 (1+1)

### Theory:

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Bio remediation through MPTs of soils, Extent and distribution of degraded lands. Major problematic soils, Calcareous soils, Physically constraint soils, Highly and slowly permeable soils, Crusted soils, Marginal lands.

Reclamation and their management, bio remediation of soils through Multi purpose trees.

Alternate land use strategies for management of problematic soils.

### Practicals:

Eighteen practical's

Determination of soil crust strength

2-3 Determination of soil permeability and hydraulic conductivity

4 Determination of reserve acidity of acid soils

5 Determination of lime requirement of acid soils

6 Determination of salt content (EC) of salt affected soils

7-8 Determination of water soluble cations of salt affected soils (Na, K, Ca & Mg)

9- 10 Determination of water soluble anions of salt affected soils ( $\text{CO}_3$ ,  $\text{HCO}_3$ , Cl &  $\text{SO}_4$ )

11- 12 Determination of exchangeable Na, Ca Mg and K in soils and computation of ESP

13- 14 Determination of gypsum requirement of alkali soils

15- 18 Determination of quality parameters of irrigation waters (pH, EC, SAR, RSC etc)

### Suggested readings:

1. Soil acidity, Ulrich & Summer
2. Crop production in acid soils, L Somani
3. Handbook of soil acidity, Z.Rengel
4. Soil salinity and water quality, Ranbir Chhabra
5. Salinization of land and water resources, Ghassemi, Jakeman & Nix
6. Management of saline soils & waters, SK Gupta & IC Gupta
7. Use of saline water in agriculture, IC Gupta & SK Gupta
8. Saline and sodic soils, Bressler, McNeal & Carter
9. Crop production in salt-affected soils, Dargan, Singh & Gupta
10. Reclamation of alkali soils in India, KK Mehta

## 3. SAC 301:Manures, Fertilizers and Soil Fertility Management

3 (2+1)

### Theory:

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation

approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. Soil fertility and productivity – definitions. Mixed fertilizers advantages, disadvantages, methods of preparation Law of minimum, growth equations. Different approaches for fertilizer recommendation.

NOTE : Topics on organic manures has to be after chemical fertilizers. History of soil fertility and elements in plant nutrition and criteria of essentiality has to be at the beginning of the course

#### **Practical:**

Estimation of available P in soils. Estimation of available K. Estimation of available S in soils. Estimation of available Ca and Mg in soils. Estimation of available Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants. Determination of organic matter, Estimation of available micronutrient cations and boron. Plant sampling and preparation of samples for analysis. Estimation of micronutrients in plants. Rapid tissue testing  
Estimation of NPK in fertilizers and manures

#### **Suggested readings:**

1. A Hand book of Soil , Fertilizer & Manure – 2<sup>nd</sup> edition, 2003, P.K.Gupta
2. Chemistry of fertilizers and manures 1975, A, Mariakulandai & T.S.Manickam
3. Fundamentals of Soil 1999 – 2<sup>nd</sup> edition , V.N.Sahai
4. Introductory Soil Science 1997, D.K.Das
5. Fundamentals of Soil Science, 2002, Published by The Indian Society of Soil Science
6. Textbook of Soil Science 1987, T.D.Biswas & S.K.Mukherjee
7. Soil Fertility & Fertilizers 6<sup>th</sup> Edition, 2003, J.L.Havlin, J.D.Beaton, S.O.Tisdale & W.L.Nelson
8. Soil Fertility, Miller
9. The Nature & Properties of Soils 9<sup>th</sup> edition, Nyle C. Brady
10. Fertilizers, Ranjan K. Basak
11. Manures & Fertilizers, P.C.Das
12. Manures & Fertilizers Agri-Horticulture, Publishing House, Nagpur Yawlkar, K.S, Agarwal, J.P and Bokde, S.
13. Soil Chemistry, Fertility & Fertilizers 2016, Rajakumar, G.R. and S.V.Patil
14. Soil Fertility 2016, R.K.Kaleeswari , R.Rajeswari & J.Prabhakaran
15. Soils and Crops 2015, H.B.Kitchen

16. Soils and Fertilizers 2015, A.J.Macself
17. The Fertiliser (Control) Order, 1985 and The Essential Commodities Act, 1995

## **Animal Production**

### **1. ASC 201: Livestock & Poultry Management**

**3 (2+1)**

#### **Theory:**

Role of livestock and poultry in the national economy. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Housing principles, space requirements for different species of livestock and poultry. Various terms related to animal nutrition. Classification of feeding stuff. Anatomy and physiology of digestive systems of livestock and poultry. Formulation of concentrate mixture for various classes of livestock and poultry. Feed supplements and feed additives. Conservation of green and dry fodder and dry fodder enrichment. Female reproductive system of livestock and reproduction behaviour. Artificial insemination and its importance. Improvement of farm animals and poultry- Selective breeding, Cross breeding and Grading up. Feeding and management of calves, heifers, pregnant and milking animals. Management of bulls and bullocks. Anatomy of mammary system, milk synthesis and secretion. Physico-chemical properties of milk. Factors affecting milk production. Summer management of cows and buffaloes. Management during natural calamities.

Incubation, hatching and brooding in poultry. Management of broilers, growers, layers and backyard birds. Egg structure and composition. Factors affecting quality and production of egg. Management of sheep and Goats.

#### **Practical:**

1. Orientation of livestock and poultry farm and breeds
2. Study of external body parts of animals. Handling and restraining of animals.
3. Housing systems of livestock and poultry
4. Determination of age of livestock.
5. Methods of identification of animals.
6. Judging and culling of animals
7. Anatomy of mammary system, milk synthesis and secretion. Clean milk production and milking methods.
8. Physical and chemical properties of milk and platform testing.
9. Estimation of specific gravity and fat in milk.
10. Estimation of total solids and SNF in milk.
11. Study of feeds and fodder. Conservation of fodder.
12. Study of reproductive system of hen, formation of egg, egg structure and chemical composition.
13. Hatchery management, preparation of brooder house and vaccination of chicks.
14. Management of growers and layers. Collection, grading and marketing of eggs.
15. Economics of livestock units
16. Economics of poultry units.
17. Important records of livestock and poultry units.
18. Visit to livestock and poultry units.

19. Visit to processing units.

**Suggested readings:**

1. Hand book of Animal Husbandry-ICAR.
2. Jagadish Prasad, Animal Husbandry and Dairy Science. Kalyani
3. N.S.R. Sastry & C.K. Thomas, Livestock production management. Kalyani
4. Jagadish Prasad, Principles and Practices of Dairy farm management. Kalyani
5. N.V. Jadhav & M.F. Siddiqui., Hand book of poultry production and management. Kalyani
6. D.C. Banarjee, Text book of Animal Husbandry. Kalyani
7. Sukumar De, Outline of Dairy Technology. Kalyani
8. P.V. Shreenivashaiah, Scientific poultry production. IBH
9. Jagadish Prasad, Sheep, goat and swine production. Kalyani
10. Jagadish Prasad, Poultry and rabbit production, Kalyani

**2. ASC 301 - Livestock and Poultry Health Care**

**1 (0+1)**

Study of basic anatomy and physiology of livestock and poultry. Signs of health and disease in livestock and poultry and clinical examination of patients.

Study of important Bacterial, Viral, Parasitic, protozoan and Metabolic diseases of livestock and poultry - prevention and control; Toxins and poisonings and first aid; Zoonosis and public health, post mortem examination. Safe disposal of biomedical waste. Common conditions affecting gastrointestinal, Respiratory, Urinary, Reproductive, Musculo skeletal systems and first aid. General conditions affecting mammary gland, sensory organs, horn, hoof, tail and first aid. Wounds, burns and scalds, Abscess, cyst and tumors and first aid. Heat stress and shock. Emergency critical care and patient reviving.

**Suggested readings:**

1. Veterinary Medicine: A Textbook Of The Diseases Of Cattle, Sheep, Pigs And Horses By - D.C. Blood, With Contributions By J.H. Arundel And C.C. Gay O.M. Radostits, J.A. Henderson
2. Ruminant Surgery: A Textbook Of Surgical Diseases Of Cattle Buffaloes, Camels, Sheep And Goats; Edited By- Rps Tyagi And Jit Singh;
3. Text Book Of Poultry Science: Pv Sreenivasaiah
4. Veterinary Obstetrics And Genital Diseases ((Theriogenology) By- Stephen J. Roberts

**3. FSH 101: Fisheries Science**

**1 (0+1)**

**Practical:**

1. Importance of Fish and Fisheries
2. External Morphology and Anatomy of Fish
3. Classification of commercially important fishes, Crustaceans and Molluscs.
4. Fisheries resources of India with particular reference to Karnataka.
5. Structural features of Fish Farm.

6. Biology of cultivable freshwater fish and prawns.
7. Study of predatory and weed fishes
8. Physico-chemical properties of water for aquaculture.
9. Food and feeding of Fin Fish and Shell Fish.
10. Reproduction techniques in Fish- Hyphophysation
11. Integrated Aquaculture System.
12. Post-harvest technology of fish.
13. Marketing channels in fisheries
14. Fish Disease and Fish Health Management.
15. Ornamental Fish Rearing and Keeping.
16. Field visit to freshwater fish farm and carp hatchery
17. Field visit to brackish water farm, fish market, processing plant and cold storage.
18. Practical exam

### **Suggested readings:**

1. Fish and Fisheries of India, V.G. Jhingran, Hindustan Publishing Corporation (India).
1. Text book of Fish Fisheries and Technology, Biswas K P
2. Fishery of India, Francis Day, William Dawson & Sons Ltd. London
3. Fresh water Aquaculture, R.K.Rath, Scientific Publishing
4. The Fisheries of India, Bal D.V & Rao K V, Mc Graw Hill Publishing co. New Delhi
5. A Textbook of Fish Biology & Fisheries, S.S. Khanna, Narendra Publishing House
6. Aquaculture: Principles and Practices, T.V.R.Pillay & M.N.Kutty Blackwell Publishing
7. Hand Book of Fisheries and Aquaculture, ICAR
8. Ornamental Aquaculture Technology and Trade in India, S. Felix, T.V. Anna Mercy & S.K.Sawain, Daya Publishing House, New Delhi
9. Aquaculture Technology: Fish farming & Equipment, Martin Hochleithner, Createspace
10. Textbook of Fish Processing Technology, K. Gopakumar, ICAR
11. Advances in Fish Processing Technology, Sen D.P, Daya Publishing House, New Delhi
12. Post Harvest Technology of fish and fish Products, Balachandran K K Daya Publishing House, New Delhi
13. Marine fish marketing in India, R. Satiyadas, R.Narayankumar & N.Asathy, ICAR
14. Inland fish marketing in India, U.K.Srivastava, IIM, Ahmedabad

## **Food Science and Nutrition**

### **1. FSN 103: Principles of Food Science and Nutrition**

**1 (1+0)**

#### **Theory:**

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry

(water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Functions and sources of water, carbohydrates, proteins, fats, vitamins, minerals; Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Relationship between food, nutrition and agriculture, Malnutrition (over and under nutrition), nutritional deficiencies (PEM, IDA, IDD VAD and fluorosis) and nutritional disorders (diabetes mellitus and CVD), Energy metabolism, (carbohydrate, fat, proteins); RDA; Balanced/ modified diets, Menu planning, New trends in food science and nutrition (nutraceuticals, antioxidants, nanotechnology, functional foods)

**Suggested readings:**

1. Swaminathan. M, (1997) An advanced text book on Food and Nutrition, Volume I, The Bangalore printing and Publishing Co. Ltd., Bangalore.
2. Swaminathan. M, (1997) An advanced text book on Food and Nutrition, Volume II, The Bangalore printing and Publishing Co. Ltd., Bangalore.
3. Srilakshmi. B, (2006) Food Science, New Age International(ltd) Pulishers, New Delhi.
4. Srilakshmi. B, (2007) Nutrition Science, New Age International(ltd) Pulishers, New Delhi.
5. Mahtab. S, (1996) Text book of Human Nutrition, Oxford and IBH Publishing Co. pvt. Ltd., New Delhi

**English:**

**ENG 101 Comprehension & Spoken English**

**2 (1+1)**

**Theory:**

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

**Practical:**

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

**Suggested readings:**

1. English Grammar and Composition by Wren and Martin
2. Practical English Grammar (PEG) by Thomas & Martinet
3. Business Communication by Sathya Swaroop Debasish & Bhagban Das

**Non-Gradiual Courses****National Cadet Corps / Physical Education and Yoga Practices****1. NCC 101: National Cadet Corps - I****1 (0+1)**

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
11. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, fire fighting, protection,
14. Maintenance of essential services, disaster management, aid during development projects.
15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
18. Adventure activities
19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

## **2. NCC 102: National Cadet Corps -II 1 (0+1)**

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.
7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technical terms.
11. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
12. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
13. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
14. Field defenses obstacles, mines and mine lying. Bridging, watermanship
15. Field water supplies, tracks and their construction.
16. Nuclear, Chemical and Biological Warfare (NCBW)
17. Judging distance. Description of ground and indication of landmarks.
18. Recognition and description of target. Observation and concealment. Field signals. Section formations.
19. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
20. Types of communication, media, latest trends and developments.

## **PED 101: Physical Education and Yoga Practices - I 1 (0+1)**

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)

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

**PED 102: Physical Education and Yoga Practices - II 1 (0+1)**

1. Teaching of skills of Volley ball – demonstration practice of the skills and correction.
2. Teaching of skills of Volley ball – demonstration practice of the skills and correction. And involvement of skills in games situation

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

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.

## **NSS 201: National Service Scheme**

**1(0+1)**

### **Introduction and basic components of NSS:**

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

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary, Understanding youth. Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change  
 Community mobilisation, Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership, Social harmony and national integration, Indian history and culture, role of youth in nation building, conflict resolution and peace-building  
 Volunteerism and shramdan, Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism, Citizenship, constitution and human rights. Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights to information. Family and society, Concept of family, community (PRIs and other community based organisations) and society

### **AEX 102: Human Values & Ethics**

**1 (1+0)**

#### **Theory:**

**UNIT I:** Universal human aspirations: Happiness and prosperity; Human values and ethics: Concept, definition, significance and sources; Fundamental values: Right conduct, peace, truth, love and non-violence; Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged and gender.

**UNIT II:** Spirituality, positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony; Modern challenges and value conflict: Sensitization against drug abuse and other social evils; Developing personal code of conduct (SWOT Analysis); Management of anger and stress.

#### **Suggested readings:**

1. Gaur RR, Sangal R & Bagaria GP. 2011. *A Foundation Course in Human Values and Professional Ethics*. Excel Books.
2. Mathur SS. 2010. *Education for Values, Environment and Human Rights*. RSA International.
3. Naagarazan. R.S., 2016, *Professional Ethics and Human Values*, New age International publishers New Delhi, pp-1-21.
5. Sharma RA. 2011. *Human Values and Education -Axiology, Inculcation and Research*. R. Lall Book Depot.
6. Sharma RP & Sharma M. 2011. *Value Education and Professional Ethics*. Kanishka Publishers.
7. Srivastava S. 2011. *Human Values and Professional Ethics*. S K Kataria & Sons.
8. Srivastava S. 2011. *Environmental Science*. S K Kataria & Sons.
9. Tripathi A.N. 2009. *Human Values*. New Age International (P) Ltd Publishers.
10. Yogendra Singh and Ankur Garg, 2001, *Human Values and Professional Ethics*, AJTES



KNK 101: PĒIQA' 'ĀpĒ

Īj Aīaqī	«μATA	¥Īā' ā, AU
1-2	¥Īā, Īā ¥Ī ZĪATA	Introducing each other
3-4	¥Īā» vĪā EĪā'ā'E ¥Ī' āpĒĒ	Conversation between friends
5-6	PAĪ AASZĪ SUDĒ «ZAGĪĒ	Enquiring about family
7	'ĒPĪAPE °ĒEAOĪA 'ZME	Plan to go for a movie
8	«ZĪāyōĪĪ ZĒĒACEĒ ZĪ A'ĪPĒUMĪ	Routine activities of a student
9	¥Īā, PĒZĪAUFĪĪ° ē	In a book shop
10-11	PĪĪ PĪj vĪ	About agriculture
12-13	PA'Ada / «±k ZĪā°ĪĪ ¥Ī ZĪATA	Introducing College / University
14-15	gĒvĪ' ā'vĪU «eĀPĪUMĪ EĪā'ā'E ¥Ī' āpĒĒ	Conversation between a farmer and a Scientist
16-17	°MĪĪĪ° ē' āĪA» w ¥ĪAUBĒĒ	Data Collection in a village
18	¥Īā, ā °ĒEgĪā'ā'ZĪ	Going on a tour

KNK 102: PĒIQA' ,Ī, Īw

Īj Aīaqī	«μATA	¥Īā' ā, AU
1-3	āĒēō'āĪĪ'Ē ¥Ī ZĪATA	Introducing alphabets
4-5	¥ZĪZĒĒ	Conversation between friends
5-6	āAPĪZĒĒ	Enquiring about family
7-8	SGPĪ PE±PĪ - ¥ĪMĪ' āAPĪUMĪ CEĪ' āĀZĪ	Plan to go for a movie
9-10	SGPĪ PE±PĪ - °SĀZĪ	Routine activities of a student
11-12	D±Ī' āpĒĒ	
13	EĀQVĀVĒ	
14	PĒĀōĪ PĒZĪ ZĪ vĪ¥Ī ZĪATA	In a book shop
15	PĒĀōĪ PĒZĪ ¥ĪĒĒĪĪĪ, MĪUMĪ	About agriculture
16	PĒĀōĪ PĒZĪ °SĪUMĪ	Introducing College / University
17	PĒIQA' Pk, PA' A«ZĪĪ	Conversation between a farmer and a Scientist
18	PĒĀōĪ PĒZĪ «eĀPĪUMĪ °AUKĒ vĪAvĪĪĪ	Data Collection in a village

**Remedial Courses**

**1.Introductory Biology**

**2 (1+1)**

**Theory:**

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

**Practical:**

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

**Suggested Readings**

1. Dutta A.C., 1998 Botany for Degree Students Pub : Oxford; 6 edition

**Elementary Mathematics 2 (2+0)**

**Theory:**

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

**Suggested readings:**

Shanti Narayan, 2010, Differential Calculus, Pub.by S.Chand & Co., New Delhi, 408pp