



Course Curriculum

(As per V Deans' Committee's Recommendations)

B.Sc. (Agriculture) Degree Programme

**University of Agricultural Sciences
GKVK, Bengaluru-560 065**

2018

University of Agricultural Sciences, Bengaluru

B.Sc. (Agriculture)

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BASIC SCIENCES AND HUMANITIES				
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2	CSC. 111	Computer Science and Agri-informatics	1+1	1
3	ENG. 111	Comprehension and Communication Skills in English	1+1	2
4	AST. 221	Agricultural Statistics	2+1	3
5	PED. 111*	Physical Education and Yoga Practices	0+1	5
6	NSS. 111*	National Service Scheme	0+1	8
7	KAN. 111/ KAN. 112*	Kannada-I	0+1	11
8	KAN. 121/ KAN. 122*	Kannada-II	0+1	12
Total			5+4=9	

* Non-gradual courses

Note: 1. PED. 111 (0+1) Spread over for one year
2. NSS. 111 (0+1) Spread over for two years

AGRICULTURAL AND ALLIED SUBJECTS

AGRONOMY

1	AGR. 111	Fundamentals of Agronomy	2+1	12
2	AGR. 121	Water Management	1+1	13

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1	2	3	4	5
3	AGR. 122	Introductory Agrometeorology & Climate Change	1+1	14
4	AGR. 211	Crop Production Technology-I	2+1	15
5	AGR. 212	Practical Crop Production-II (Irrigated)	0+1	16
6	AGR. 221	Crop Production Technology-II	1+1	16
7	AGR. 311	Practical Crop Production-I (Rainfed)	0+1	17
8	AGR.312	Experimental Techniques in Agricultural Research	0+1	17
9	AGR. 321	Farming Systems, Organic Farming and Precision Agriculture	2+1	18
10	AGR. 322	Rainfed Agriculture and Watershed Management	1+1	19
Total			10+10=20	

AGRICULTURAL ECONOMICS

1	AEC. 111	Fundamentals of Agricultural Economics	2+0	20
2	AEC. 121	Agricultural Finance & Co-operation	1+1	21
3	AEC. 311	Agricultural Marketing, Trade and Prices	2+1	22
4	AEC. 321	Farm Management, Production and Resource Economics	1+1	24
Total			6+3=9	

AGRICULTURAL ENGINEERING

1	AEG. 111	Introductory Soil and Water Conservation Engineering	1+1	26
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1	2	3	4	5
2	AEG. 211	Farm Machinery and Power	1+1	26
3	AEG. 221	Renewable Energy and Green Technology	1+1	27
4	AEG. 321	Protected Cultivation and Secondary Agriculture	1+1	28
Total			4+4=8	

AGRICULTURAL ENTOMOLOGY

1	AET. 121	Fundamentals of Entomology	2+1	29
2	AET. 211	Insect Ecology, Principles of Pest Management and Natural Enemies	2+1	30
3	AET. 221	Insect Pests of Horticultural Crops and their Management	1+1	31
4	AET. 311	Insect Pests of Field Crops & Stored Grains and their Management	1+1	32
Total			6+4=10	

AGRICULTURAL EXTENSION

1	AEX. 111	Rural Sociology, Education Psychology and Constitution of India	0+2	33
2	AEX. 121	Fundamentals of Agricultural Extension Education and Rural Development	1+1	33
3	AEX. 211	Communication and Diffusion of Agricultural Innovations	1+1	35
4	AEX. 321	Entrepreneurship Development and Business Communication	1+1	36
Total			3+5=8	

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1	2	3	4	5
AGRICULTURAL MICROBIOLOGY				
1	AMB. 111	Fundamentals of Microbiology	1+1	36
2	AMB. 221	Soil and Applied Microbiology	1+1	37
Total			2+2=4	

ANIMAL SCIENCE

1	ASC. 311	Livestock, Poultry & Fish Production Management	2+1	38
Total			2+1=3	

APICULTURE

1	API. 311*	Introduction to Apiculture	1+1	39
Total			1+1=2	

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

CROP PHYSIOLOGY

1	CPH. 211	Fundamentals of Crop Physiology	2+1	40
2	CPH. 221	Applied Plant Physiology and Crop Modeling	1+1	42
3	CPH. 222	Nanotechnology in Agriculture	0+1	43
Total			3+3=6	

FOOD SCIENCE AND NUTRITION

1	FSN. 111	Principles of Foods Science & Nutrition	2+0	44
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1	2	3	4	5
2	FSN. 321	Food Processing, Food Safety Standards and Value Addition	1+1	44
Total			3+1=4	

FORESTRY AND ENVIRONMENTAL SCIENCE

1	FES. 111	Introduction to Forestry	1+1	45
2	FES. 221	Environmental Studies and Disaster Management	2+0	46
Total			3+1=4	

GENETICS AND PLANT BREEDING

1	GPB. 121	Fundamentals of Cytogenetics	1+1	48
2	GPB. 211	Fundamentals of Genetics	1+1	49
3	GPB. 221	Fundamentals of Plant Breeding	2+1	49
4	GPB. 311	Crop Breeding	1+1	50
5	GPB. 321	Intellectual Property Rights	1+0	51
Total			6+4=10	

HORTICULTURE

1	HRT. 121	Fundamentals of Horticulture and Fruit Crops Production	1+1	51
2	HRT. 211	Production Technology of Vegetable Crops	1+1	52
3	HRT. 221	Production Technology of Flower Crops and Landscaping	1+1	53
4	HRT. 311	Production Technology of Plantation Crops, Spices, Medicinal and Aromatic Plants	1+1	53

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1	2	3	4	5
5	HRT. 321	Post Harvest Management and Value Addition of Fruits and Vegetables	1+1	53
Total			5+5=10	

PLANT BIOTECHNOLOGY

1	PBT. 121	Fundamentals of Plant Biotechnology	2+1	54
Total			2+1=3	

PLANT PATHOLOGY

1	PAT. 211	Fundamentals of Plant Pathology	2+1	55
2	PAT. 221	Principles of Plant Disease Management	1+1	56
3	PAT. 311	Diseases of Field Crops and their Management	2+1	58
4	PAT. 321	Diseases of Horticultural Crops and their Management	1+1	58
Total			6+4=10	

SEED SCIENCE & TECHNOLOGY

1	SST. 311	Principles and Practices of Seed Production	1+1	59
2	SST. 321	Post Harvest Seed Technology and Quality Assurance	1+1	60
Total			2+2=4	

SERICULTURE

1	SER. 321	Introduction to Sericulture	1+1	62
Total			1+1=2	

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

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1	2	3	4	5
SOIL SCIENCE & AGRICULTURAL CHEMISTRY				
1	SAC. 121	Fundamentals of Soil Science	2+1	63
2	SAC. 211	Soil Chemistry	1+1	63
3	SAC. 311	Problematic Soils and their Management, Geoinformatics	1+1	64
4	SAC. 321	Manures, Fertilizers and Soil Fertility Management	2+1	65
Total			10=6+4	

ABSTRACT

Basic Sciences and Humanities			5+4	
Agricultural and Allied Subjects			71+56	
Student “ READY ” Programme				66
•	RAWE- Rural Agricultural Work Experience		0+20	68
•	EL/HoT- Experiential Learning/Hands on Training		0+20	69
Non Gradial Courses:				
•	Physical Education		0+1	
•	NSS		0+1	
•	Kannada		0+2	
•	Educational Tour		0+1	85
•	Remedial Courses		2(1+1) / (2+0)	
Grand Total		(9+127+20+20+7*)=183		

* Non--gradial Courses

BASIC SCIENCES AND HUMANITIES

BCM. 111 Plant Biochemistry 1+1

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

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

CSC. 111 Computer Science and Agri-informatics 1+1

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

Basic Computer networks, Internet and World Wide Web (WWW), Editing and Formatting a document, Database, concepts and types, creating database. Introduction to Computer C-Programming language, concepts and standard input/output operations. Introduction to ICT and uses in agriculture. Introduction to Computer-controlled devices (automated systems) for Agri-input management, Smartphone

apps in Agriculture. Introduction to Bioinformatics and Omics database NCBI, searching and accessing genome sequences and protein sequences. Introduction to GIS and its applications in Agriculture. Introduction to MIS and Decision Support System and its applications in Agriculture.

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

ENG. 111 Comprehension and Communication Skills in English 1+1

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

Practical: Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Presentation skills and Public speaking. Reading skills:

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; Group discussion.

AST. 221 Agricultural Statistics 2+1

Theory: Introduction to Statistics and its Applications in Agriculture, Classification & Frequency Distributions of data, Diagrammatic Representation of Data: Bar & Pie diagrams, Graphical Representations of Data: Histogram, Frequency Polygon, Frequency curve and Cumulative frequency curve (Ogives). Measures of Central Tendency: Concepts & Definition, Characteristics of ideal Average, Arithmetic Mean, Median, Mode, Quartiles, Deciles & Percentiles (both for Ungrouped and Grouped data), Geometric Mean and Harmonic Mean (Ungrouped data). Measures of Dispersion: Concepts & Definition, Types of Measures of Dispersion: Range, Quartile deviation, Absolute Mean Deviation from mean and median, Standard Deviation and Variance, and Co-efficient of dispersion (both for Ungrouped and Grouped data). Moments, Measures of Skewness and Kurtosis (both for Ungrouped and Grouped data). Concept of Set Theory: , Permutation & Combinations. Theory: of Probability: Concept & Definition, Addition and Multiplication rules (without proof). Theoretical Probability distributions: Binomial, Poisson and Normal Distribution, their Properties & Applications.

Simple Correlation Analysis: Definition, Measures of Correlation: Scatter diagram, Karl Pearson product moment and Spearman's rank correlation coefficients and their properties. Simple Linear Regression Analysis: Definition, Fitting of simple linear regression equations Y on X and X on Y, Properties of regression coefficient, interrelation between correlation and regression.

Introduction to Sampling Theory: , Sampling versus Complete Enumeration, Methods of Sampling, Type of Sampling- Simple Random Sampling (with and without replacement), Use of Random Number Tables for selection of Simple Random Sample, Concept of Sampling distribution and standard error, concept of systematic,

stratified and cluster sampling along with their advantage & disadvantages .

Test of Significance: Introduction, Null & Alternative hypothesis, Types of Errors, Level of significance, degrees of freedom, Critical & Acceptance regions. Large sample tests: Z-Test for Means - One and Two sample Means for Known and Unknown population variance. Small sample test: Student t-test for Means - One and Two sample means, Paired t-test and F-test for two population variances. Chi-Square test: Test for Goodness of Fit, Test for independence of attributes for $r \times c$ contingency table, 2×2 contingency table with Yates correction, and test for single population variance.

Introduction to Analysis of Variance and its Assumptions, Analysis of Variance for One & Two Way Classification. Concept of design of experiments: Basic Principle of Experimental Design: Randomization, Replication & Local control, Basic Designs: CRD, RCBD and LSD, their advantages and disadvantages.

Practical: Construction of Frequency Distribution tables. Diagrammatic presentation of data: Bar diagrams & pie diagrams. Graphical Representation of Data: Histogram, Frequency polygon, Frequency curve and Cumulative frequency curve (Ogives). Computation of Measures of Central Tendency: Arithmetic Mean, Median, Mode, Quartiles, Deciles & Percentiles (both for Ungrouped and Grouped data), Geometric Mean and Harmonic Mean (Ungrouped data). Computation of Measures of Dispersion: Range, Quartile deviation, Absolute Mean Deviation, Standard Deviation and Variance and Co-efficient of dispersion (both for Ungrouped and Grouped data). Computation of Moments, Measures of Skewness and Kurtosis (both for Ungrouped and Grouped data), Problems on permutation and combination. Problems on Simple Probability, Addition and Multiplication rules. Computation of probabilities using Binomial, Poisson and Normal Distributions. Computation of Correlation Coefficient: Karl Pearson product moment and Spearman's rank correlation coefficients. Fitting of Simple linear

Regression Equations Y on X, & X on Y. Use of Random Number Tables for selection of Simple Random Sample. Problems on Large sample tests: Z-Test for Means - One and Two sample means for known and unknown population variance. Problems on Small sample tests: Student t-test for Means - One and Two sample means, Paired t-test, and F-test two population variances. Problems on Chi-Square test: Test for Goodness of Fit, Test for independence of attributes for $r \times c$ contingency table, 2×2 contingency table with Yates correction and test for single population variance. Problems on Analysis of Variance for One & Two Way Classified data. Problems on CRD, RCBD and LSD.

PED. 111 Physical Education and Yoga Practices 0+1

PART I

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

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

PART II

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

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

17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of weight training – demonstration practice and correction.
19. Teaching of circuit training – demonstration practice and correction.
20. Teaching of calisthenics – demonstration practice and correction.

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

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

NSS. 111

National Service Scheme

0+1

PART I

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

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

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

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

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

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

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

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

PART II

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

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

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

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

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

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

PART III

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

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

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

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

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

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

PART IV

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

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

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

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

ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ

ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ

KAN. 111

0+1

ಅ. ಕಾವ್ಯ-ಕಥೆ

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

ಆ. ಕೃಷಿ ಬರಹ

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

ಇ. ಪ್ರಾಯೋಗಿಕ

ಅನುವಾದ, ಪಾರಿಭಾಷಿಕ ಪದರಚನೆಯ ವಿಧಾನಗಳು.

ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ/ For Non Kannada Speaking Students

KAN. 112

0+1

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

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

ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ

KAN. 121

0+1

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

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

ಈ. ಪ್ರಾಯೋಗಿಕ

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

ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ/ For Non Kannada Speaking Students

KAN. 122

0+1

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

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

AGRICULTURAL AND ALLIED SUBJECTS

AGRONOMY

AGR. 111

Fundamentals of Agronomy

2+1

Theory:Agronomy and its scope, Agriculture as an art, science and business of crop production, Factors affecting crop production,

History of agriculture development in India and Karnataka, Importance and scope of agriculture, classification of crops, Seeds and sowing, Soil and its components, properties, fertility and productivity and their management, Tillage and tith, Crop density and geometry, Crop nutrition - manures and fertilizers, nutrient use efficiency, Growth and development of crops, ideotypes, Cropping systems and its principles, Crop adaptation and distribution, crop management technologies in problematic areas, Harvesting and threshing of crops. Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

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

AGR. 121 Water Management 1+1

Theory: Definition of irrigation, water resources; soil water relations; Basic terms in water management and irrigation. Study of soil moisture constant and hydrodynamic relation. Measurement of soil moisture-direct and indirect methods; Expression of soil moisture and their mutual relations, Plant water relationship –critical stages. Meaning and impact of water stress, water availability and its relationship with nutrient availability and losses. Water management of crops – its definition, meaning, measurement and relevance in crop production, concept of evapotranspiration and its management, factors affecting water management, study of water requirement of

field and horticultural crops, methods of irrigation – surface, subsurface, sprinkler and drip, constraints and advantages of different methods. Efficiency of irrigation and methods to measure them, Quantitative estimation of irrigation water – direct and indirect methods, Expression of flowing water and mutual relations, Concept of water use efficiency and methods to improve water use efficiency, Assessment of irrigation requirement, Scheduling of irrigation – Approaches and methods, Suitability of water for irrigation, Concept of drainage and methods.

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

AGR. 122 Introductory Agrometeorology 1+1
& Climate Change

Theory: Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud

formation and classification; Artificial rainmaking. Monsoon-mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture and mitigation strategies

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

AGR. 211 Crop Production Technology-I 2+1

Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharifcrops. Cereals – rice, maize, wheat, sorghum, pearl millet and finger millet, Nutrimillets/small millets: kodo millet, foxtail millet, Proso millet, little millet, baranyard millet Pulses- chickpea, peas, pigeonpea, mungbean, urdbean, cowpea, horsegram and lentil; Forage crops: sorghum, cowpea, cluster bean, napier, berseem, lucerne and oat.

Practical: Study of area, production and productivity of cereals, pulses and forage crops in Karnataka, India and world, Raising of important cereals, pulses and forage crops in the crop museum, Rice nursery preparation, transplanting of Rice, effect of seed size on germination and seedling vigour crops, effect of sowing depth on germination of crops, identification of weeds in crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of crops, visit to research centres of related crops. Green leaf manuring and use of bio-fertilizers in rice, Fertilizer management in cereals, pulses and forage crops, fertilizer management of paddy, preservation of fodder and silage making,

AGR. 212 Practical Crop Production-II 0+1
(Irrigated)

Practicals: Crop planning, raising field crops in an area of 5 guntas by each student. 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.

AGR. 221 Crop Production Technology-II 1+1

Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of oilseed crops- groundnut, sunflower, rapeseed and mustard, soybean, sesamum, niger, safflower, castor, linseed, Commercial crops – sugarcane, cotton, jute, mesta.

Practicals: Study of area, production and productivity of oilseeds and commercial crops in Karnataka, India and world, Raising of important oilseed and commercial crops in the crop museum, Planting methods of sugarcane, Study on methods of shelling and rhizobium and PSB seed treatment in groundnut, study on nipping in castor and safflower, Methods of testing the maturity of sugarcane and computation of commercial cane sugar, Study of yield contributing characters of oilseed and commercial crops, Study on quality parameters of cotton, study of bast fibre like mesta, jute and their retting, visit to research stations of related crops/sugar factory.

AGR. 311 Practical Crop Production-I (Rainfed) 0+1

Practicals: Crop planning, raising field crops in an area of 5 guntas by each student. 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.

AGR. 312 Experimental Techniques in Agricultural Research 0+1

Practicals: Aims and objectives of field experiments, Essence, levels and methods of research, Identification and statement of problem, selection of treatments, selection of site, plot shape and size, Use of random sampling numbers in field experiments, Layout of field experiments and conduct of field trials by individual student, Recording of observations from field experiments, Review collection and writing of reference cards, Basic concepts and measurement of data, Analysis of variance and test of significance, Experimental designs and basic principles of experimental design, Completely Randomized Design (CRD), Randomized Complete Block design

(RCBD), Latin Square design (LSD), Factorial Concept, each student has to conduct a micro plot field experiment. Study of tabulation, analysis of experimental data and experimental results, Transformation of data and Preparation of research report & presentation of results

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

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

Indian agriculture. Global Positioning System (GPS) Geographic Information System (GIS). Site Specific Nutrient Management (SSNM) for nutrient and irrigation management practices. Comparative yield, quality and farm profits under SSM practices v/s Variable Rate Technology (VRT) practices.

Practical: Visit of organic farms and outlets to study the various components and their utilization. Visit to IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

AGR. 322 Rainfed Agriculture and Watershed 1+1
Management

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

Practical: Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental

irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

AGRICULTURAL ECONOMICS

AEC. 111 Fundamentals of Agricultural Economics 2+0

Theory: *Economics:* Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic Theory: ; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. **Technical change and types**, Agricultural planning and development in the country. **Land reforms: meaning of land tenure, land tenancy, land reform measures – abolition of intermediaries, tenancy reforms, fixation of ceiling on land holdings, consolidation of holdings, development of cooperative farming. Agricultural labour and farm mechanization.** Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility Theory: ; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Production: process, creation of utility, factors of production, laws of returns and returns to scale. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets.

Distribution Theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income*: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax*: meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning, *NITI Ayoga*.

AEC. 121 Agricultural Finance & 1+1
Co-operation

Theory: Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 3 R'S and 5 C'S of credits *Loan repayment plans*. Sources of agricultural finance: institutional and non-institutional sources, *types of banks, functions of commercial and central bank, credit creation policy, social control and nationalization of commercial banks, micro financing including KCC and SHGs. Lead bank scheme, RRBs, Scale of finance and unit cost. 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-Banking reforms and their implication on agricultural credit – Narasimham Committee and other reports.* Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports-

Time value of money, capital budgeting techniques – PBP, ARR, NPV, BCR, IRR, 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, multi-purpose cooperatives, farmers' service cooperative societies, role of ICA, NCUI, NCDC,

Practical: Determination of most profitable level of capital use. Optimum allocation of *scarce* capital among different enterprises. ***Exercise on Time value of money, capital budgeting techniques – PBP, ARR, NPV, BCR, IRR,*** Analysis of performance of cooperatives using *secondary* data. Analysis of performance of commercial banks and RRB's using *secondary* data. Visit to cooperative banks, credit societies, commercial banks, *NABARD, lead bank* to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – *Case studies*. Preparation and analysis of balance sheet – *case studies*. Preparation and analysis of income statement – *case studies*. Appraisal of a loan proposal – *case studies*. Techno-economic parameters for preparation of projects. Preparation of bankable projects for various agricultural *crops / products including their value added products.*

AEC. 311 Agricultural Marketing, Trade and Prices 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; *studying the problems of marketing-Functional, institutional, commodity and behavioural approaches, Market forces – Demand and Supply, Consumer surplus and producer surplus,* 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; **Price determination under different types of markets**, 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 **and market regulation, Market research- information and intelligence**, Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India, **NAFED** Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; need for agricultural price policy; **Administered Prices, CACP, MSP, MIS**, 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.

Quality control, HACCP, Eco-mark, Agri-export zones, Export-import bank of India.

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 behaviour over time for some selected commodities; Construction of index numbers; Visit to local markets to study various marketing functions performed by different agencies, identification of marketing channels for **commodities**, collection **and analysis** of data on marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, **e-marketing, regulated market**, cooperative marketing society, Export house, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

AEC. 321 Farm Management, Production and Resource Economics 1+1

Theory: Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: **Differences between farm management and production economics**, concept of production function and its type - **Linear, quadratic, Cobb Douglas models, meaning and interpretation**. Uses of production function in decision-making, **Laws of returns: Law of variable proportions (factor-product)**, factor-factor and product-product relationships, law of equi-marginal returns, principle of opportunity cost, law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, **fixed costs, sunken costs, valuation and depreciation of farm assets**, total and average cost curves in the short and long run and farm management cost concepts (CACP), Concept and estimation- gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. **Discounted Cash Flow Measures and their role in financial evaluation, equipping farmer as decision maker – production,**

strategic decisions etc., Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, *single entry and double entry book keeping*, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting, linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty *in farming*, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance *schemes* – weather based crop insurance, features, determinants of compensation, PMFBY.

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

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

Amortization, Illustration of costing of groundwater irrigation. Visit to IFS farms, farm section office, cooperative farms, and other representative farms.

AGRICULTURAL ENGINEERING

AEG. 111 **Introductory Soil and Water Conservation Engineering** **1+1**

Theory: Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical: General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

AEG. 211 **Farm Machinery and Power** **1+1**

Theory: Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement, Familiarization

with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

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

AEG. 221 Renewable Energy and Green Technology 1+1

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

Practical: Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production

process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

AEG. 321 Protected Cultivation and Secondary Agriculture 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.

AGRICULTURAL ENTOMOLOGY

AET. 121 Fundamentals of Entomology 2+1

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

Formicidae, Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae, Tabanidae, Syrphidae.

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

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

AET. 211 Insect Ecology, Principles of Pest Management and Natural Enemies 2+1

Theory: Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem.

Categories of insect pests, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests and pest risk analysis. Methods of detection and diagnosis of insect pest. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests

management. Survey surveillance and forecasting of Insect pest. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest). Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Study of insecticides including mode of actions, formulations. Pest resurgence and insecticide resistance.

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

Practical : Methods of diagnosis and detection of various insect pests, Methods of insect pests measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of NPV, coccinella, green lace wing and other important bioagents. Identification and nature of damage of important insect pests and their management. Insecticides formulations, plant protection equipments, Crop (agro-ecosystem) dynamics of a selected insect pest. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases, Awareness campaign at farmers' fields. Identification of major parasitoids and predators commonly being used in biological control.

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

AET. 221 Insect Pests of Horticultural Crops 1+1 and their Management

Theory: General account on nature and types of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and control practices for other important arthropod pests of various vegetable crops, fruit crops, plantation crops, ornamental crops, narcotics, flowers, spices and condiments.

Pest of crops grown under protected cultivation. Pests of tuber crops, important vectors of plant diseases of horticultural crops.

Practical: Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Vegetable Crops; (b) Fruit Crops; (c) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests. Identification of pests of protected cultivation crops. Determination of fruit and spices moisture content. Methods of sampling for pest damage assessment. Visit to nearby Horticultural research stations.

Note: Students should submit 50 insect specimens representing different Horticultural crops pests.

AET. 311 Insect Pests of Field Crops & 1+1 Stored Grains and their Management

Theory: General account on nature and type of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crops, 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. Important vectors of plant diseases of field crops.

Practical: Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; 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.

Note: Students should submit 50 insect specimens representing different crops and stored product insects.

AGRICULTURAL EXTENSION

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

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

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

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

Theory: Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and

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

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Development-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.

Practical: To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories. Presentation skills exercise; micro teaching exercise. A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level. Visit to NGO and learning from their experience in rural development. Understanding PRA techniques and their application in village development planning; exposure to mass media.

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

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

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

AEX. 321 Entrepreneurship Development 1+1
and Business Communication

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

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

AGRICULTURAL MICROBIOLOGY

AMB. 111 Fundamentals of Microbiology 1+1

Theory: Origin and evolution of Microbial life. Brief history of microbiology. Microscopes and microscopy. Overview of cell structure of prokaryotes and eukaryotes. General properties of viruses, overview of plant, animal and bacterial viruses, virioids and prions. Different groups of Microorganisms- Bacteria, Fungi, Algae and Protozoa. Microbial nutrition and culture media. Overview of microbial metabolism: glycolysis, citric acid cycle, anaerobic respiration,

photosynthesis and fermentation. Microbial growth - measurement of growth, effect of environmental factors on growth. Qualitative and quantitative methods for the study of microorganisms. Microbial genetics: genetic recombination, conjugation, transformation, transduction, mutation and mutants, plasmids, transposons and insertion sequences, cloning vectors. Control of microbial growth: heat sterilization, radiation sterilization, filter sterilization, chemical growth control, disinfectants, antiseptics and antibiotics. Microbial ecology- Microorganisms in nature and their interaction, methods in microbial ecology, Microbial interactions with higher organisms – plants and animals. Concepts of Immunology - Cells and organs of immune system, antigen- antibody reactions, types of immunity, polyclonal and monoclonal antibodies.

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

AMB. 221 Soil and Applied Microbiology 1+1

Theory: Occurrence and distribution of microorganisms in nature. Soil as a habitat for microbes. Soil microorganisms - bacteria, fungi, algae, protozoa and viruses. Soil enzymes. Role of microorganisms in biogeochemical cycles of carbon, nitrogen, potassium, phosphorus, sulphur and secondary and tertiary nutrients. Soil biotechnology - utilization of microorganisms in improving soil productivity. Microbial interactions - neutralism, commensalism, synergism, mutualism, competition, amensalism, parasitism and predation. Plant microbe interactions and their biotechnological implications, rhizosphere microflora, symbiotic and free living nitrogen fixing

microorganisms, ectomycorrhizal and endomycorrhizal associations. Microbiology of hydrosphere and atmosphere. Microorganisms associated with animals and insects. Potentials and limitations of using microorganisms as agents of biological control of insect pests and diseases. Pesticide micro-flora interactions. Biodegradation, bioconversion of industrial, domestic and agricultural wastes. Industrial use of microorganisms - biochemical processes involved and biotechnological applications. Microbiology of milk and milk products. Single cell protein. Role of microorganisms in biochemical transformation of raw and processed foods. Food spoilage, food poisoning and food borne infections. Principles and methods of Food preservation.

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

ANIMAL SCIENCE

ASC. 311 Livestock, Poultry & Fish Production 2+1
Management

Theory: Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Broiler production. Management of growers and layers. Important Indian and exotic

breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Importance of Indigenours Live stock and poultry species. Feeding principles of livestock and poultry. Feed ingredients. Feed supplements and additives for livestock and poultry ration. Study of livestock and poultry diseases. Prevention, vaccination schedule and control of important diseases of livestock and poultry. Marketing and Economics of livestock and poultry. Fisheries resources of india. Importance of Inland fisheries. important fishes and their production. New vistas in Inland fish production.

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

APICULTURE

API. 311 Introduction to Apiculture 1+1

Theory: : Importance of Bees and Beekeeping, History and Development of Beekeeping; Species of honeybees and their colony structure; Morphology of honeybees; Anatomy of honeybees – Digestive, reproductive, nervous, Circulatory and Glandular system; Colony organization; Bee biology; Caste determination in honeybees; Age related activities of workers; Nest architecture; Behaviors in honeybees- Foraging, Communication, Robbing, Swarming and Homeostatis; How, when and where to start beekeeping; Bee flora; Seasonal management of bee colonies; Management of Robbing,

Swarming and Queenless colonies; Uniting and division of honeybee colonies; Queen rearing; Bees as pollinators and pollination management; Pests and Diseases of bees and their management; Hive products – Honey, Bee pollen, Bee wax, Propolis, Bee venom, Royal jelly and their extraction, processing, properties and uses; Poisoning of bees and its prevention; Economics of beekeeping.

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

CROP PHYSIOLOGY

CPH. 211 Fundamentals of Crop Physiology 2+1

Theory:

Introduction: Importance of physiology in agriculture.

Plant-water relations: Structure, properties and functions of water; concept of diffusion, osmosis and water potential;

Water balance of plants: Water in soil; Water absorption and translocation in plant; soil-plant-atmosphere continuum; Theories explaining water translocation.

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

Mineral Nutrition: Importance of plant nutrients; Classification of plant nutrients; Nutrient uptake- Soil, root and microbes interaction, Microbial association for improved uptake of nutrients; Functions of plant nutrients- Deficiency and toxicity symptoms of plant nutrients; Hydroponics, aeroponics. Mechanism of ion absorption and translocation. Membrane transporters and carriers.

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

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

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

Photoperiodism and vernalization: Basic concepts and their relevance in crop productivity; Phytochromes and their role.

Seed dormancy and viability: Basic concepts, seed germination and seedling vigour.

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

Practical: Preparation of standard solutions; Methods of measuring water status in plant tissue; Determination of soil water status; Determination of stomatal frequency and index; Measurement of stomatal conductance and transpiration; Measurement of water use efficiency at single leaf level; Extraction, separation and quantification of photosynthetic pigments; Measurement of photosynthetic rate; Measurement of growth and yield parameters; Measurement of respiration rate; Deficiency symptoms of nutrients and their identification; growth hormone bioassay; Seed dormancy and methods to break seed dormancy; Measurement of Seed viability and seedling vigor; effect of moisture stress on seed germination and seedling vigor.

CPH. 221 Applied Plant Physiology and Crop Modeling 1+1

Theory

Application of growth regulators in agriculture/ horticulture/ forestry/industry: Effect of growth regulators on important plant growth and developmental processes. Synthetic growth regulators - classification and their effect on plant growth and development. Practical utility of application of plant growth regulators on farm.

Physiological basis of commercial micro propagation: Micro-propagation techniques and its application specific to growth modulation. Macro-propagation techniques including clonal multiplication of elite material. Haploids in crop improvement.

Mineral nutrition: Foliar/ soil application of nutrients to correct the deficiency symptoms. Bio-fortification of micronutrients and their importance in human health.

Herbicide physiology: Classification and mode of action of herbicide and their applications. Development of herbicide tolerant crops.

Post harvest physiology: Physiological and biochemical changes during fruit ripening and storage. Senescence and post harvest shelf

life of cut flowers, vegetables and fruits. Hormonal and chemical control of post harvest deterioration of fruits, vegetables and cut flowers and its significance in storage and transport.

Seed physiology: Methods to break seed/ bud dormancy of important agriculture/ horticulture plants. Seed priming/ seed encapsulation techniques to improve seed germination and seedling vigour in important agriculture crops.

Drought mitigation strategies: Mechanism of drought adaptations. Plant traits linked to drought adaptation. Antitranspirants and their applications in agriculture, water holding polymers and their relevance

Crop modeling: Physiological yield models, plant ideotypes.

Practical: Growth regulator formulations for specific crops. Demonstration of plant growth hormones on important plant growth and developmental processes. Micro-propagation of commercially important crops. Techniques to develop deficiency symptoms of nutrients. Elemental analysis in plant tissues. Bio assay of herbicides. Mechanisms to enhance the uptake of herbicides. Identification of physiological maturity indices in important crops. Demonstration of anti-ethylene agent on shelf life of flowers/ fruits. Effect of growth regulators on delaying senescence/ ripening. Seed hardening techniques in cereal crops. Application of stable isotopes techniques in agriculture. Computer applications in plant physiology, crop productivity and modeling.

CPH. 222 Nanotechnology in Agriculture 0+1

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

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

FOOD SCIENCE AND NUTRITION

FSN. 111 Principles of Foods Science 2+0
& Nutrition

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

FSN. 321 Food Processing, Food Safety 1+1
Standards and Value Addition

Theory: : Status of food processing in India. Food processing and distinctive features of food commodities. Primary, secondary and tertiary processing. Processing of -cereals, legumes, fats and oilseeds,

fruits and vegetables, milk. Role of additives in value addition, packaging and labeling.

Food Safety- Definition, Importance, Scope and Factors affecting food safety, health risks, Types of hazards: Biological, Chemical, Physical hazards. Food storage, Hygiene and Sanitation. Sources of contamination and their control. Personal Hygiene. Food Safety management tools- basic concepts, PRPs, GHPs, GMPs, SSOPs etc. HACCP, ISO series and TQM. Food laws and Standards-Indian Food Regulatory Regime, FSSAI, Global Scenario- CAC, BIS, AGMARK

Practical: Processed and value added foods (cereals, pulses, fruits, vegetables).

Planning and preparation of weaning and supplementary foods. Planning of balanced diet. Development of teaching models for community nutrition education –

- a) Protein energy malnutrition.
- b) Micronutrient deficiencies

Preparation of different types of media. Microbiological examination of different food samples. Assessment of personal hygiene and surface sanitation. Preparation of plans for implementation HACCP.

FORESTRY AND ENVIRONMENTAL SCIENCE

FES. 111 **Introduction to Forestry** **1+1**

Theory: Introduction–definitions of forest and forestry, branches of forestry, history and education of forestry in India. objectives of silviculture, forest classification, salient features of Indian Forest Policies and Acts. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations–weeding, cleaning, thinning–

mechanical, ordinary, crown and advance thinning. Forest mensuration–objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement-geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Indian wild life and management. Social forestry and its branches. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important tree species of the region (Teak & Casurina).

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

FES. 221 **Environmental Studies and** **2+0**
Disaster Management

Theory: Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, mining, and their effects on forest b) Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using

mineral resources. d) Energy resources: Growing energy needs, use of alternate energy sources. e) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Ecosystems: Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Human Population and the Environment: population growth, variation among nations, population explosion, Environment and human health: Role of Information Technology in Environment and human health.

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

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

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

GENETICS AND PLANT BREEDING

GPB. 121 Fundamentals of Cytogenetics 1+1

Theory: Ultra structure of cell, cell organelles and their functions, structure of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes, chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis and their significance. DNA: types, structure, replication, function, RNA: structure, types and function, life cycle of angiosperms: megasporogenesis and microsporogenesis and fertilization, structural and numerical variations in chromosome and their implications.

Practical: Study of microscope, study of cell structure, mitosis and meiosis cell division, preparation and use of fixatives and stains for microscopy, preparation of slides for identification of mitotic and meiotic stages, practice on mitotic and meiotic cell division, measurements of microstructures.

GPB. 211 Fundamentals of Genetics 1+1

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

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

GPB. 221 Fundamentals of Plant Breeding 2+1

Theory: Definition, history, objectives and accomplishments of plant breeding, modes of reproduction-its relevance on genetic consequences, breeding methods and cultivar options and its of plant breeding, pollination control systems-self-incompatibility and male sterility. Domestication, Acclimatization and Introduction; Centers of origin/diversity, **Plant genetic resources, their conservation and utilization, genetic** basis and breeding methods in self- pollinated crops - mass and pure line selection, components of genetic variation; heritability and genetic advance; hybridization techniques and handling of segregating populations; multiline concept, concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population

improvement methods- Ear to row method, modified Ear to Row, recurrent selection schemes; heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization;; wide hybridization and pre-breeding; polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

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. Study of male sterility system. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design, prediction of performance of double and three-way cross hybrids

GPB. 311 Crop Breeding 1+1

Theory:Centers of origin, distribution of species, wild relatives and major breeding objectives and procedures including conventional and modern innovative approaches for development of varieties and hybrids for improved yield, adaptability, stability, biotic and abiotic stress tolerance and quality (physical, chemical and nutritional) of different cereals-rice, wheat, maize, sorghum, bajra and ragi; pulses-redgram, breengram, blackgram, chickpea, soybean; oilseeds-sunflower, niger, groundnut, sesame, castor, rapeseed and mustard, fibre crops- jute and cotton; cash crops- sugarcane, potato and tobacco.

Practical : Floral biology, emasculation and hybridization techniques in cereals-rice, wheat, maize, sorghum, bajra and ragi; pulses-redgram, breengram, blackgram, chickpea, soybean; oilseeds- sunflower, groundnut, sesame, castor, rapeseed and mustard, fibre crops- jute

and cotton; cash crops- sugarcane, potato and tobacco. Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; study of quality characters, sources of genes of important characters; Visit to AICRP plots of different field crops.

GPB. 321 Intellectual Property Rights 1+0

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

HORTICULTURE

HRT. 121 Fundamentals of Horticulture and Fruit Crops Production 1+1

Theory: Horticulture - Definition and branches, Importance and scope, Classification of horticultural crops; Plant propagation - methods and propagating structures; Principles of orchard establishment; Principles and methods of training and pruning;

Unfruitfulness; Pollination, pollinizers and pollinators; Fertilization and Parthenocarpy; Importance of plant bio-regulators in horticulture; Importance of rootstocks; Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties/hybrids, planting methods, nutrition, irrigation, weed management, pruning and training, inter and mixed cropping, harvesting and yield of Mango, Banana, Citrus, Grapes, Guava, Papaya, Sapota, Pineapple, Pomegranate and Jackfruit.

Practical: Identification of garden tools; Identification of fruits; Preparation of potting mixture; Layout and planting of orchard; Bearing habits; Propagation methods and physiological disorders of above fruits; Methods of irrigation and fertilizer application in above fruits; Visits to commercial orchards.

HRT. 211 Production Technology of Vegetable Crops 1+1

Theory: Importance of vegetables in human nutrition and national economy; Kitchen gardening; Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties/hybrids, time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, physiological disorders, harvesting and yield of Potato, Tomato, Brinjal, Chilli, Capsicum, Cucumber, Watermelon, Ridge gourd, Bitter gourd, French bean, Cabbage, Cauliflower, Onion, Garlic, Carrot, Radish, Palak, Amaranthus, and Drumstick. Protected cultivation of Capsicum and European Cucumber.

Practical: Identification of vegetables and their seeds; Study of morphological characters of different vegetables; Seed extraction; Seed viability tests; Nursery raising; Direct seed sowing and transplanting; Harvesting and grading of vegetables.

HRT. 221 Production Technology of 1+1
Flower Crops and Landscaping

Theory: Importance and scope of flower crops; Classification of ornamental plants Principles of landscaping; Garden features and adornments; Garden styles and designs, Lawn and its maintenance; Protected cultivation of Rose, Gerbera, Carnation, Anthurium and Orchids; Open cultivation of Gladiolus, Tuberose, Chrysanthemum, Marigold, Jasmine, Aster and Crossandra.

Practical: Identification of Ornamental plants; Nursery bed preparation and seed sowing; Planning, designing and layout of garden; Physiological disorders of above flower crops; Post harvest handling of cut and loose flowers; Visit to commercial flower production units and nurseries

HRT. 311 Production Technology of Plantation 1+1
Crops, Spices, Medicinal and Aromatic Plants

Theory: Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties, planting methods, nutrition, irrigation, weed management, inter and mixed cropping, harvesting and yield of Coconut, Arecanut, Cashew, Tea, Coffee, Rubber, Pepper, Cardamom, Ginger, Turmeric, Coriander and Fenugreek Ashwagandha, Aloe, Periwinkle, stevia, Mints, Lemongrass, Ocimum, Patchouli and Geranium.

Practical: Identification, propagation, physiological disorders, processing and value addition of above crops. Extraction methods for essential oils. Visits to commercial Plantation.

HRT. 321 Post Harvest Management and 1+1
Value Addition of Fruits and Vegetables

Theory: Importance of post-harvest processing of fruits and vegetables; Extent and possible causes of post-harvest losses; Pre-

harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, Cold storage, CA, MA and Hypobaric); Value addition concept; Principles and methods of preservation; Minimal processing; Intermediate moisture foods- Jam, Jelly, Marmalade – Concepts and Standards; Fermented and non-fermented beverages; Drying/ Dehydration of fruits and vegetables – Concept and methods; Canning - Concepts and Standards, Packaging of products.

Practical: Containers for shelf life extension; Effect of temperature on shelf life and quality of produce; Chilling and freezing injury in vegetables and fruits; Extraction and preservation of pulps and juices; Preparation of Jam, Jelly, RTS, Nectar, Squash, Wine, Fruit bar, Candy, Tomato products; Quality evaluation of products- physico-chemical and sensory; Visit to processing unit/ industry.

PLANT BIOTECHNOLOGY

PBT. 121 Fundamentals of Plant Biotechnology 2+1

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

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

PLANT PATHOLOGY

PAT. 211 Fundamentals of Plant Pathology 2+1

Theory:Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Cause and classification of plant diseases. Important plant pathogenic organisms, fungi, bacteria, fastidious vascular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic agents.Fungi: general characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Binomial system of nomenclature, rules of nomenclature. Classification of fungi, keys to phylum, classes, order and families.Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Keys to major plant pathogenic bacterial genera. Viruses: nature, morphology, replication and transmission and classification of plant viruses. Keys to important plant virus families / genera.Nematodes: General morphology and reproduction, classification, keys to important plant

pathogenic nematode genera, symptoms and nature of damage caused by plant nematodes.Phanerogamic plant parasites: Common characteristic of important parasites, disease development, survival and spread. Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenicity: phenomenon of host infection by Fungi, Bacteria, Viruses, mollicutes and nematodes. Pathogenesis: Penetration and colonization. Role of enzymes, toxins and growth regulators in disease development and their classification.Introduction to principles of plant disease management.

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

PAT. 221 Principles of Plant Disease Management 1+1

Theory: Defence mechanism in plants: structural, biochemical (pre and post-infection) and host plant resistances. Effect of pathogens on plant physiological processes viz., photosynthesis, respiration, translocation and transcription.Epidemiology: Epidemics and factors affecting disease development, patterns of epidemics and disease progress curves. Assessment of disease severity and crop losses. Survey, surveillance, remote sensing and forecasting of plant diseases.

Principles and methods of plant disease management: *Avoidance of the pathogen*: Choice of geographical area, selection of field and planting stock *etc.*, *Exclusion of inoculum*: Plant quarantine regulations and inspections, post entry quarantine. *Eradication of the pathogen*: Cultural and physical methods of eradication and inoculum reduction; Biological methods of disease control: Crop rotation, use of trap crops, plant and plant products, use of biological control agents, mechanisms of biocontrol, cross protection. Breeding for disease resistance: Types of resistance, Development of resistant varieties, Induced resistance. Biotechnological approaches of diseases management. IPR and related issues. Chemical methods; nature, chemical combination, classification, mode of action and formulations of fungicides, bactericides, nematocides and antibiotics. Methods of application of chemicals. Insect vector management. Diagnosis of plant diseases. Seed pathology; importance of seed health to man and animals. seed borne nature of pathogens; Identification and detection of seed borne pathogens.

IDM: Introduction, history, importance & concepts. Economic importance diseases. Epidemiology and crop loss assessment methods with case studies. IDM module for important cereal (Rice), pulse (pigeon Pea), oil seeds (Sunflower and Groundnut) and vegetable (Tomato and Potato) and horticulture/plantation crops.

Practical: Methods of detection of different plant pathogens. Methods of estimation crop disease severity; Methods of estimation of crop losses; Methods of detection and identification of seed borne pathogens; Isolation of biocontrol agents; Testing the efficacy of biocontrol agents by dual culture technique. Mass multiplication of bioagents; methods of application of bioagents; Study of fungicides, bactericides, nematocides and their formulations. Preparation of Bordeaux mixture and calculation of fungicide spray concentration. Bioassay of fungicide and antibiotics. Methods of application of chemicals; Study of pesticide compatibility and their safe use; Study of plant protection equipment's. Methods of screening for disease resistances. Visit to pesticide companies.

PAT. 311 Diseases of Field Crops and their Management 2+1

Theory: Diseases of cereals, millets, pulses, oil seeds and cash crops with respect to economic importance, incidence, symptoms, etiology, disease cycle/life cycle and management practices. **Cereals and Millets:** Rice, Sorghum, Maize, Wheat, Bajra, Navane, & Ragi. **Pulses:** Pigeon pea, Chickpea, Blackgram and Greengram, Cowpea, & Soybean. **Oilseed crops:** Groundnut, Sunflower, Sesamum, Safflower, Mustard, Linseed, & Castor. **Cash crops:** Sugarcane, Cotton, Tobacco, Chilli, Ginger, Turmeric, & Mulberry. Important post-harvest diseases of field crops.

Practical: Study of symptoms, etiology and disease cycles / life cycles of selected diseases of field crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens. Note: Students should submit 50 pressed and well mounted specimens.

PAT. 321 Diseases of Horticultural Crops and their Management 1+1

Theory: Diseases of fruit crops, plantation crops, vegetables crops, flower crops, Aromatic and Medicinal plants with respect to economic importance, incidence, symptoms, etiology, disease cycle/life cycle and management practices. **Fruit crops:** Mango, Apple, Papaya, Citrus, Guava, Pomegranate, Grapes, Pineapple Sapota, Peach & Banana. **Plantation crops:** Coffee, Tea, Rubber, Coconut, Arecanut, Cardamom, Beetle vine, Pepper & Vanilla. **Vegetable crops:** Tomato, Potato, Brinjal, Crucifers, Cucurbits, Bhendi, Leafy vegetable diseases, Carrot, Onion, Garlic, Cassava, Beans, Peas & Capsicum. **Flower crops:** Rose, Jasmine, Tuberose, Crossandra, Chrysanthemum & Gladioli. **Medicinal and Aromatic crops:** Periwinkle, Dioscorea, Solanum, Coleus, Davana, Citronella, Sandle, Geranium & Patchouli. Important post-harvest diseases of horticultural crops.

Practical: Study of symptoms, etiology and disease cycle / life cycles of selected diseases of horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens. Note: Students should submit 50 pressed and well mounted specimens.

SEED SCIENCE & TECHNOLOGY

SST. 311 Principles and Practices of Seed Production 1+1

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

Seed marketing and distribution strategies– organizations, structures, sales, International trade. Export and import policies for seed trade, generation activities, sales promotional media and factors affecting seed marketing. Seed Sales, License, pricing policy, cost benefit ratio, economic feasibility and factors influencing.

Practical: Identification of seeds of agricultural/ horticulture crops. Study of seed structure in monocot and dicot seeds in agricultural and horticulture crops. Study of floral biology in self, cross and often cross pollinated crops. Identification of sex in gourds and melons. Identification of different varieties based on seed morphological characters in agriculture and horticulture crops.

Isolation types, measurement and determination in self and cross pollinated crops. Carrying out field inspection and taking field counts. Study of different contaminants and practicing rouging.

Practicing hybrid seed production techniques – hand emasculation and pollination. Practicing detassling techniques. Diagnostic identification of A, B and R lines in hybrid seed production.

Studies on planting ratio, border rows and synchronization and supplementary pollination techniques in hybrid seed production. Determination of physiological maturity in agricultural crops. Visit to KSSOCA and grow out test farms. Visit to seed production plots (OPV and hybrids) of public and private organizations. Calculation of economics of seed production (OPV and Hybrids). Visit to seed production under protected cultivation.

SST. 321 Post Harvest Seed Technology and Quality Assurance 1+1

Theory: Introduction and importance of seed quality regulations- seed legislations and regulatory measures. Seeds Act (1966), Seed Rules (1968), Seed Control Order (1983), Central Seeds Committee, Central Seed Certification Board, OECD Seed Certification Schemes,

State Seed Certification Agency – Central and State Seed Testing Laboratories and their functions, New Seed Policy (1988), The plants, fruits and seeds (regulation of import into India), Order (1989). DUS testing principles and applications, PPV and FRA (2001 and 2003), National Seed Policy (2002) and the Seed Bill (2004). Seed Drying — importance, principles and methods. Psychrometric chart and its use in seed drying process. Seed processing — objectives and principles. Air screen cleaner and its working principles, different upgrading equipments and their use. Seed treatment- importance and types, equipments used for seed treatment, Seed testing — objectives, history, sampling procedures, testing for moisture, physical purity, germination, viability, vigour and seed health. Seed quality regulation systems (Grow out test and molecular markers). GM crop testing. Seed packaging — principles, procedures and types of containers. Varietal release, notification – seed certification, history, phases and procedures, field inspection, field counts, field and seed standards, Post harvest inspections and seed quality assurance. Seed storage - general principles, stages, factors affecting seed longevity, conditions required for safer storage, measures for humidity, moisture and temperature control, mid storage corrections and seed quality enhancement techniques.

Practicals: Study of instruments used in Seed testing laboratory. Visit to seed testing laboratories. Visit to seed processing plant. Study of air screen cleaner and upgrading machines. Practicing seed sampling methods in bulk and in containers. Conducting Physical purity test. Determination of seed moisture. Conducting standard germination test and seedling evaluation in agricultural crops. Assessment of seed viability through Tz test and Seed blending. Carrying out different vigor test. Conducting seed health test in agri-horticultural crops. Visit to grow out test plots. Determination of cultivar purity tests. Practicing pre-storage seed treatment and dormancy breaking methods. Studies on packaging types and methods. Visit to seed godowns and cold storage units. Visit to public and private (National and multinational) seed companies.

SERICULTURE

SER. 321

Introduction to Sericulture

1+1

Theory: Introduction, origin & history, statistics and distribution of sericulture, Mulberry varieties. Types of silks, Species of silkworms and their host plants. Raising of mulberry saplings, mulberry cultivation practices for irrigated and rainfed conditions, separate chawki garden. Intergrated nutrient Management. Pests and diseases of mulberry and their management. Life cycle of silkworms. Morphology and anatomy of *Bombyx mori* L. Commercially exploited breeds of silkworm. Steps in silkworm egg production at grainage, egg sheets and loose egg production technology. Tier system of silkworm seed multiplication, seed area concept. Preservation and handling of eggs, egg incubation. Disinfection and hygiene in silkworm rearing. Silkworm rearing plan, Rearing house plan and equipments. Importance of chawki rearing, chawki rearing centres. Harvesting, transportation and preservation of leaves. Methods of silkworm rearing, shoot feeding, shelf rearing, rearing operations, environmental conditions and their management. Importance of feeding, bed cleaning, spacing, care during moulting. Picking and mounting ripened silkworms. Harvesting of cocoons, grading, cocoon sorting, defective cocoons, and sale of cocoon in silk cocoon markets. Mechanization in sericulture. Pests and diseases of silkworms and their management. Post cocoon technology, Steps in reeling – storage- cocoon drying/stifling, cocoon cooking, brushing, reeling and re-reeling. Different methods of silk reeling. Raw Silk Marketing- Silk Exchange– functions, Silk trade -import-export. Sericulture byproducts and their utilization for additional income. Economics of Sericulture.

Practical: Mulberry varieties, Host plants of non-mulberry silkworms. Preparation of land, preparation of planting material and planting of mulberry, pruning, harvesting and storage of mulberry leaves. Pests and diseases of mulberry. Species of silkworms – life cycle of *Bombyx mori* L. Mulberry pests and diseases. Identification of cocoons of

important breeds. External morphology of life stages – egg-larva-pupa and moth of *Bombyx mori* L. Study of silk gland and digestive system of *Bombyx mori* L. Disinfectants - rearing bed and general disinfectants. Grainage techniques. Study of rearing house plan and equipments for shoot feeding and shelf rearing. Methods Incubation of silkworm eggs and brushing. Identification of silkworms settling for moult, at moult, out of moult. Feeding, bed cleaning and spacing. Identification and picking of ripe worms, mounting, types of mountages, cocoon harvesting and grading. Pests and diseases of mulberry silkworm. Single cocoon reeling, study of reeling equipment.

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

SAC. 121 Fundamentals of Soil Science 2+1

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

Practical : Study of general properties of minerals, Study of silicate and non-silicate minerals, Study of igneous, sedimentary and metamorphic rocks, Study of soil sampling tools and collection of representative soil samples, Study of soil profile, Determination of soil moisture content, Determination of bulk density and particle density and porosity of soil, Study of soil texture by feel and bouyoucos method, Determination of soil colour, Study of capillary rise phenomenon of water in soil column and water movement in soil, Demonstration of heat transfer in soil, Study of soil map, Visit to NBSS&LUP.

SAC. 211 Soil Chemistry 1+1

Theory : Soil chemistry- Scope and importance . components of soils – inorganic and organic components. Soil colloids – types properties and significance of soil colloids. Layer silicate clays- genesis, structure and properties. Source of charges – positive and negative charges, electrical double layer – Helmholtz, Gouy – Chapman, stern theories. Ion exchange cation exchange capacity and anion exchange capacity, factors influencing ion exchange and its significance. Soil organic matter – composition, decomposition, fractionation of organic matter, uses; Humus – humic substances, nature and properties ; carbon cycle, C:N ratio; Chemistry of submerged soils.

Practical : Analytical chemistry – basic concepts, techniques and calculation; Determination of soil pH; Determination of electrical conductivity of soil; Determination of soil organic carbon; (Ca, Mg, K and Na); Determination of base saturation and exchangeable sodium percentage of soil.

SAC 311 Problematic Soils and their 1+1 Management, Geoinformatics

Theory : Soil quality and health, Distribution of Waste land and problem soils in India. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils - Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water – quality and standards, utilization of saline water in agriculture. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems. Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping;

fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs. Remote sensing and GIS in diagnosis and management of problem soils.

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

SAC. 321 Manures, Fertilizers and Soil Fertility Management 2+1

Theory : Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.

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

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops.

Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

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

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

Components of the programme :

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

I EXPERIENTIAL LEARNING

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

a) Concept

- ❖ ‘Experiential’ means that learning and development are achieved through personally determined experience and involvement.

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

b) Objectives

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

The main objectives of EL are:

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

c) Duration

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

d) Attendance

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

e) Students' Eligibility

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

II RURAL AGRICULTURAL WORK EXPERIENCE

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

Objectives

- To provide an opportunity to the students to understand the rural setting in relation to agriculture and allied activities.
- To make the students familiar with socio-economic conditions of the farmers and their problems.
- To impart diagnostic and remedial knowledge to the students relevant to real field situations through practical training.

- To develop communication skills in students using extension teaching methods in transfer of technology.
- To develop confidence and competence to solve agricultural problems.
- To acquaint students with on-going extension and rural development programmes.

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**.

Course No.	Course Title	Cr. Hrs.
ESE. 421	Commercial Sericulture	0+10
EAG. 421	Organic Production Technology	0+10
EAM. 421	Production Technology for Bio-fertilizers	0+10
EAM. 422	Mushroom Cultivation Technology	0+10
EAP. 421	Commercial Beekeeping	0+10
EAS. 421	Poultry Production Technology	0+10
EEP. 421	Production Technology for Bio-agents	0+10
EFS. 421	Food Processing	0+10
EHR. 421	Commercial Horticulture	0+10
EHR. 422	Floriculture and Landscaping	0+10
ESA. 421	Soil, Plant, Water and Fertilizer Testing	0+10
ESA. 422	Agriculture Waste Management	0+10
EST. 421	Seed Production and Technology	0+10

ESE. 421 Commercial Sericulture 0+10

Mulberry Cultivation: Raising of mulberry saplings, establishment of mulberry garden for rainfed, irrigated condition and exclusive chawki garden, manure and fertilizer schedule. Integrated Nutrient management, pruning practices, mechanization in mulberry cultivation, mulberry diseases and pests and their control measures.

Silkworm rearing: Planning and preparation for silkworm rearing, disinfection and hygiene in rearing house, different rearing appliances, egg transportation, egg incubation, harvest and leaf preservation, chawki rearing, late age silkworm rearing methods, bed spacing, feeding, care during moult. Silkworm diseases and pests and their management, mounting, harvesting, cocoon sorting, deflossing, transportation and marketing of cocoons. Mechanization in silkworm rearing.

Economics of mulberry cultivation and silkworm rearing. By-product utilization and value addition for additional income.

EAG. 421 Organic Production Technology 0+10

Production of Organic Manures: Green biomass production: Raising sunhemp, dhaincha, and other green manure crops in 500 m² area by each student. **Compost production:** VAT method of composting, structure requirement, substrates assembling, filling the VATS, watering, turning and removing the matured compost from the VATS,. **NADEP method of composting:** structure requirement, advantage over other composting methods, filling the substrates, watering. Judging the maturity of the compost. **Vermicompost production:** Structures in vermicompost production, earthworms-species, lifecycle, temperature, moisture and substrate requirements. Management aspects-size reduction of substrates, aeration, watering, protection of earthworms against natural enemies. Each student shall produce at least 0.5 tonne of vermicompost. Maturity of the

vermicompost, separation of worms from the compost and bagging. Value addition-enrichment with concentrated organic sources, microbial cultures, Quality analysis of different composts, standards of different composts. **Production of biodigested liquid manures:** Structure requirements, assembling green biomass, cattle dung and cattle urine, production and use of biodigested liquid manure. Value addition of Composts:- enrichment with concentrated organic nutrient sources, microbial consortia. Value addition of biodigested liquid manures. **Production of indigenous organic additives:** Panchagavya, Beejamruta, Jeevamruta and Vermiwash. **Organic crop production:** Commercial cultivation of crops by adopting organic farming practices. Individual students shall raise short duration crops such as field bean, french bean, baby corn, vegetable cowpea, onion and other appropriate short duration crops in 500sq m² area in the organic farming block maintained in the campus by following organic ways of nutrient and weed management and plant protection practices. **Organic certification:** Requirements for conversion from conventional farming to organic farming, **Certification:** Government and Non-Government agencies involved in certification, permitted and restricted materials in organic farming. Cares to be taken in harvesting, processing, packaging and storing of organic produce, labelling organic produce, Organic Logos used in organic produce packages. Preparation of the project report and presentation.

EAM. 421 Production Technology for 0+10
Bio-fertilizers

Different types of biofertilizers and their role in plant nutrition. Acquaintance of laboratory and mass production equipments. Preparation of different culture media and sterilization techniques. Mother culture and starter culture production and their maintenance. Isolation and examination of freeliving heterotrophic and photo autotrophic nitrogen fixing bacteria from soil. Isolation and

examination of Associative Nitrogen fixing bacteria. Isolation and examination of root nodule bacteria from leguminous and non-leguminous plants. Study of Azolla -Anabaena symbiosis. Isolation and examination of phosphate/ potassium solubilizing microorganisms. Study of mycorrhizal symbiosis and method of mass production of arbuscular mycorrhizal fungi. Study of plant growth promoting rhizobacteria. Different formulations of biofertilizers, packing and storing methods. Production technology for carrier based and liquid biofertilizers. Quality standards for biofertilizers. Role of microorganisms in bioconversion of agricultural wastes. Principles and methods involved in Compost making. Entrepreneurship development- preparation of project proposals for setting different capacity biofertilizer units.

EAM. 422 Production Technology for Mushrooms 0+10

Characteristics and morphological features of mushrooms; Types of mushrooms cultivated, Maintenance of mushroom laboratory, Equipments used in mushroom laboratory, Preparation of culture media, Pure culture techniques, Spore print preparation, Mother culture preparation of mushroom, Spawn production, Layout of mushroom houses, Cultivation of oyster mushroom and milky mushroom, Harvesting, Processing, Packing of mushrooms. Pests, diseases and abiotic stress of cultivated mushrooms, Project preparation for spawn production and mushroom cultivation, Exposure/visits to spawn and mushroom production centers.

EAP 421 Commercial Beekeeping (0+10)

Handling of bee colonies for acquainting with different castes, immature stages and different kinds of cells of honey bees. How, When and Where to start beekeeping. Ways for procuring bee colonies. Location of bee colonies in nature, hiving and transfer to

bee hive. Survey on Bee flora for profitable beekeeping. Seasonal management of honey bee colonies during different seasons of the year. Management of honey bees colonies during dearth/ lean period and honey flow season. Preparation of honey bee colonies for higher honey production. Swarming, robbing, queenlessness colonies and their management. Dividing and uniting of honey bee colonies. Pests and diseases of honey bees and their management. Mass queen rearing for multiplication of colonies. Extraction, processing, testing of honey for its purity, composition and uses of honey. Extraction, processing, properties and uses of bee wax. Extraction, processing and uses of other bee hive products such as royal jelly, propolis, bee venom and pollen. Preparation of value added bee hive products. Role of honey bees in crop pollination for increasing crop productivity. Maintenance of honey bee colony records. Working out economics of beekeeping.

EAS. 421 Poultry Production Technology 0+10

History and classification of Modern Poultry breeds –Mankind has been rearing Poultry for game, eggs meat and as a companion bird and providing food, nutrition & financial security. *Archaeopteryx* is said to be the origin for all modern class of birds Aves. It is said to have teeth ,tail like structure and used to fly. Wild jungle fowl from Southeast Asia is said to be the origin, however, the Red jungle fowl *Gallus gallus* is predominant. All the Four modern breeds belongs to Genus namely, *Gallus* and four species *gallus*, *varius*, *sonneratti* and *lafayetti* The general classification is based on the type for which they are maintained like Egg type, Meat type, Dual purpose and Game type .

The modern classification is based on the origin and has Four Classes namely *English*, *American*, *Mediterranean* and *Asiatic*. **Egg – parts of egg and formation of egg** .In Nature, Egg is a complete

unit of all the nutrients required for development of an embryo. It has all the nutrients except Calcium, water soluble and fat soluble vitamins and is termed as unadulterated Shape of an egg is termed as *prolate spheroid* Pigments Ooporphyrins and Xanthophylls are responsible for shell and yolk colour, respectively.

Broiler and layer industry – COLOURED broiler rearing

The TWO distinct commercial activities are rearing birds for Meat and Egg. Poultry meat is the cheapest animal protein and has no religious stigma for it's use and has remained a favorite among all religions and regions globally. Broilers are meat type birds reared for 5-6 weeks which are tender, juicy, succulent , low in fat (lean meat) and nutritious. Thus a farmer can raise 5-6 crops in a year completely depending and earning livelihood. Broiler chicks are bred for faster growth achieving a growth of 2000g from a 40 g chick in 40 days ie. a growth of 50 times in 40days. A Feed Conversion Ratio (FCR) of 1.7-1.8 is achieved with a mortality rate of less than 2 % . Still the per capita poultry meat consumption is about 2 kgs against an ICMR recommendation of 15 kgs. India stands 4th in Poultry Meat production.

Layer farming- In poultry females are exclusively maintained commercially for Eggs (table eggs) for providing wholesome and nutritious eggs for use in various farms both in fresh and egg white and yellow in powder farms. A per capita consumption of 45 eggs is achieved against the recommendation of 180 eggs leaving a huge gap leaving scope for growth in layers.

Housing principles- Orientation, Brooder houses, grower houses, layer houses

The Poultry sheds are to be in elevated places, rat proofed, oriented in East-West direction enabling a good cross ventilation with a width of not more than 25 ft ,overhang of 2-2.5 ft and any required length. Gable type sheds with side wall of 8 ft & center height of 12 ft with

asbestos roofing is ideal. Quality water supply to be ensured. Depending upon the type /age of birds brooder ,grower & layer sheds are built. Care must be taken to spend least on sheds but ensure technical specifications.

Management practices – scientific principles, litter management feeding & watering, lighting and bio-security

Poultry farming is not only a science but also an art and incorporates the basics of birds behavior,needs and comforts that makes poultry a successful livestock business.right from brooding -providing heat initially for chicks (2-3 weeks),providing feed *ad libitum* ,cool and quality water,light for visibility, turning (raking) the litter to maintain it with optimum moisture –neither dusty that may lead to respiratory diseases or wet that may result in diseases. Sanitary and Bio security measures such as washing, disinfection, white wash, flaming, movement of workers,entry of vehicles and outsiders are to be monitored. Need based Feeding timely with right type of feeds restraining wastage is of paramount importance. Incase of broilers light during night for visibility and 8 hrs of artificial light in layers is essential for birds maturity and consistent maintenance of egg production at 1 ft.candle at bird level.

Poultry Nutrition and feeding principles- feed ingredients ,types of feed, feed formulation

In poultry nearly 70 % of the cost of production I on feed alone hence utmost care to be exercised in selection of feed ingredients, macro & micro nutrients, feed mixing depending upon the age of the birds. The require protein ,energy & other nutrients are provided by mixing various feed ingredients like maize, soya extract, cotton ,sunflower cake,rice polish, mineral mixture etc.,Types of feed are Broiler pre-starter,starter, finisher ration , grower and layer feeds. Standard Feeds are available in the market and a large farmer will have own feed mixing plant for better economics.

Common diseases and Vaccination programme- viral, bacterial, ecto & endo parasites

Various diseases and pests have to be checked using both prophylactic and curative measures. Timely vaccination, de worming, and preventive doses of medicine in feed as well a water are administered. We are having pellet vaccines for easy administration of vaccines. Bio securi

Marketing and Economics of Poultry production

Indian Poultry marketing is very interesting and 90-95 % of the birds are sold as Live and termed as WET market. Only a small portion is marketed as dressed, frozen , ready to cook meatHowever organization like NECC, NMPPB, Egg & Meat corporations have tried to contain, guide the industry which is contributing to the tune of about 60,000 crores providing food & nutrition security, employment both direct & indirect. It is highly unpredictable leaving Economists ,producers a well a consumers guessing.

EEP 421 Production Technology for Bio Agents 0+10

Biological Control; definition, history, prospectus & principles and important mile stones in biological control. Mass multiplication of important bio agents, predators, parasitoids, rearing of laboratory hosts for parasitoids, predators and pathogens, Mass multiplication of selected parasitoids such as *Trichogramma* sp., *Goniozus nephantidis*, *Bracon brevicornis*, *Cotesia plutella* etc., ; Predators (*Cryptolaemus montrouzieri*, *Chrysoperla carnea*, *Dipha aphidivora* etc., ; Insect Pathogens (Ha NPV, SL NPV, *Beauveria bassiana*, *Metarhizium anisopliae*, *Nomurea rileyi*, *Verticillium lecanii*); Entomo pathogenic nematodes *Stinernema glaseri*, *Heterorhabditis* sp. Etc. Determination of cost of production of biocontrol agents. Visit to commercial units producing biocontrol agents.

Biological control; definition and introduction from Plant Pathology perspective, Methods of isolation of biocontrol agents viz., *Trichoderma*, *Pseudomonas*, *Bacillus*, *Paecilomyces* and *Verticillium* from rhizosphere soil, roots and foliage of different crop plants, their purification and cultural studies viz., growth phase, C, N, temperature and pH requirement. Methods of screening of biocontrol agents for their efficacy against selected fungal, nematode and bacterial plant pathogens. Interaction between different biocontrol agents. Evaluation of different solid and liquid growth media for mass multiplication. Study of methods for rapid multiplication. Formulation of mass produced biocontrol agents using different carrier and additives and packaging. Quality control: evaluation of formulated products for bioefficacy and longevity in different storage conditions. Methods of application of biocontrol agents viz., seed treatment, seedling dip, foliar application, soil application and their evaluation in vivo. Enrichment of organic manures and amendments with biocontrol agents.

EFS. 421 Food Processing 0+10

Importance of commercial processing, need for understanding market status and data analysis Different processing, methods Primary processed foods, Secondary processed foods and Tertiary processed foods. Grain quality assessment, Cereals, millets, Ragi, Wheat, Maize, Pulses, /legumes, Selection of grains: Test suitability of grains namely Rice, Wheat, Ragi, Maze, Pulses for processing as approved by (FDA/FAO, HACCP/FSSAI, WHO/GOI/GOK/BIS/any other.) Indian regulatory agency. Primary processing of grains: dehusking /dehulling milling, roasting, popping, malting, etc. for grains, namely ragi, paddy, wheat, millets, maize, pulses, nuts, value added/fortified flours & foods: Energy food mix: Ragi/wheat maize/ millets. Malt drink, supplementary foods, fortified composite flour, and instant flour mixes. Techniques evaluation of products Physical, Sensory & Objective evaluation methods computing nutritive value. Food Safety measures : Hygiene/

sanitation/ standards/regulations related to grains & products based on suitable methods approved by FDA/FAO/WHO/ GOI/GOK/BIS/ any other Indian regulatory agency. Shelf life of products: Grain storage practices. Use of additives & Preservatives, Labeling & its importance. Market study of exiting labeled foods, Label designing/ Packaging its requirements. Development of RTE Foods, Flour based shelf stable snack foods. Acceptability testing, project plan & Presentation By students: Product design, Machinery and equipment material & marketing supply chain. Processing & recording/book keeping, costing. Value chain of raw materials: study existing practice in industry trough visit & interaction Milling industry procurement/ milling/ marketing system. Storage & testing of raw materials testing of function & behavior of raw materials & products. Familiarization of equipment and their role, functioning, operation techniques cleaning condition regulation, maintenance handling. Baked produces. Processing of bread by different methods, importance of RH/ Temperature/pH, baking & finishing, processing of rolls/pizza/rusk/ etc., serving Techniques. Processing of biscuits: Regular biscuits fiber rich (Different fiber).

Development of questionnaire for data collection. Market survey on the processed and health foods, Data computation and presentation. Industry Visits/ Food processing industries, Flourmills, Baking industries, Vegetable and fruits processing units. Student group activities.

EHR. 421 Commercial Horticulture 0+10

Study of importance, problems and prospectus of nursery industry. Study of high-tech nursery management practices, use of polyhouses and shade nets in planting materials production. Practice of propagation techniques of fruits, vegetables and plantation crops and care of nursery plants. Tissue culture techniques in rapid multiplication of horticulture crops. Practice of open and protected cultivation

techniques such as bed preparation, fumigation, mulching, drip irrigation, fertigation, training, pruning, foliar application of micronutrients and other special practices, plant protection measures, harvesting, grading and packaging of important vegetable crops. Practice of pruning and training methods, fertilizers application, foliar application of micronutrients and growth regulators, identification of symptoms of insect and disease infestation, plant protection measures, intercultural operations, harvesting, grading, marketing of important fruit crops. Roof top / terrace gardening. Practice of preparing processed products such as RTS, Jams, Ketchup, Pickles, etc., from fruits and vegetables. Estimation of cost of cultivation and economic feasibility studies of important vegetables and fruits. Visit to high tech nurseries, institutions and farmers field. Final evaluation and examination.

EHR. 422 Floriculture and Landscaping 0+10

Importance and scope of Floriculture and landscaping, practice of nursery techniques and management of ornamental crops. Propagation techniques for ornamental crops, nursery bed preparation, raising seedlings in protrays and poly bag. Production technology of flower crops like –China aster, Marigold, Tuberose and Gladiolus under open condition and Rose, Gerbera, Anthurium and Carnations under protected cultivation. Preparation of main field, application of FYM, fertilizer management, mulching, drip irrigation practices for open cultivation as well as protected cultivation. Special practices to be followed in flower crop production such as pinching, disbudding, pruning, training, desuckering, staking and wire netting etc., Maintenance of shrubs climbers and trees. Establishment of hedges, edges, flower beds and rockeries. Practices of Bonsai and flower arrangement. Establishment of Garden adornments and vertical gardens. Maintenance of lawn and its management. Visit to commercial nurseries, high tech floriculture units and farmer’s field. Final evaluation and examination.

ESA. 421 Soil, Plant, Water Manure and Fertilizers 0+10
Testing

Good laboratory practices (GLP)

Principles of analytical chemistry

Analytical techniques, concepts of gravimetry, concepts of titrimetry (volumetric), preparation of standard solution of an acid

Instruments used in soil, plant, water, manure and fertilizer analysis

Potentiometer (pH meter), Conductometer (EC bridge), Spectrophotometer, Flame photometer, Atomic Absorption, Spectrophotometer (AAS)

Soil Analysis

Collection and preparation of soils samples, study of soil profile, physical properties of soil, mechanical analysis (soil texture), International pipette method, Hydrometer method, Determination of soil texture by feel method, density of soil, Bulk density of soil, Particle density of soil, pore space of soil, soil colour, physic chemical properties of soil, pH of soil, EC of soil, Chemical properties of soil, organic matter in soil, cation exchange capacity (CEC) of soil, Major nutrients in soil, available nitrogen in soil, available Phosphorus in soil, available potassium in soil, Secondary nutrients in soil, Determination of exchangeable calcium and magnesium in soil, available sulphur in soil, Micronutrients in soil, available micronutrient cations in soil, available boron in soil, Problematic soils and amendments, Soil acidity and lime requirement, Determination of exchangeable acidity in soil, reserve acidity in soil, extractable aluminum in soil, lime requirement of acid on soil, Soil alkalinity and gypsum requirement, Determination of lime content of soil, carbonate and bicarbonate in soil, chloride in soil, carbonate and bicarbonate in soil, chloride in soil, sodium in soil, gypsum requirement of alkali soil

Irrigation Water Analysis

Irrigation water sampling, Determination of pH irrigation water, electrical conductivity of irrigation water, carbonate and bicarbonate in irrigation water, chloride in irrigation water, calcium and magnesium in irrigation water, sodium in irrigation water, Computation of SAR and RSC of irrigation water, Determination of boron in irrigation water.

Waste Water Analysis

Collection and preservation of waste water samples, Analysis of different parameters of waste water, Determination of pH of waste water, EC in waste water, carbonate and bicarbonate in waste water, chloride in waste water, calcium and magnesium in waste water, potassium and sodium in waste water, Phosphorus in waste water, sulphur in waste water, acidity of waste water, total, suspended and dissolved solids in waste water, nitrate in waste water, dissolved oxygen in waste water, biological oxygen demand in waste water, chemical oxygen demand in waste water

Plant Analysis

Sampling handling and preparation of plant sample, Determination of Nitrogen in plant sample, Digestion of plant sample for estimation of nutrients (except nitrogen), Determination of phosphorus in plant sample, potassium in plant sample, calcium and magnesium in plant sample, sulfur in plant sample, micronutrients in plant sample

Organic Manure Analysis

Determination of pH of manure, EC of manure, organic carbon in manure, nitrogen in manure, Digestion for estimation of other nutrients in manure, Determination of phosphorus in manure, potassium in manure, calcium and magnesium in manure, sulfur in manure, micronutrients in manure

Fertilizer Analysis

Fertilizer sampling, Qualitative test for identification of fertilizer, Detection of adulterants in fertilizer, Estimation of ammonium nitrogen ($\text{NH}_4\text{-N}$) in ammonium fertilizer, nitrate nitrogen ($\text{NO}_3\text{-N}$) in nitrate fertilizer, amide nitrogen ($\text{NH}_2\text{-N}$) in amide fertilizer (urea), Determination of biuret content of urea, Estimation of phosphorus in phosphatic fertilizer, Determination of potassium in potassic fertilizer.

ESA. 422 Agriculture Waste Management / 0+10 Management of organic resources in Agriculture

- Collection of crop residues – bulky organic residues, concentrated organic residues. Green manuring. Agro industrial waste urban waste, sewage and sludge.
- Composting of organic residues. Conventional and mechanized techniques of composting.
- Vermicomposting of organic residues.
- Biogas preparation using organic resource
- Analysis of physical, chemical, biological and biochemical properties of different compost and spent slurry.
- Evaluation of different types of compost and spent slurry through field study and analysis of soil and crop data and presentation of soil test results and submission of report.

EST. 421 Seed Production Technology (0+10)

1. Principles of seed production in self and cross pollinated crops
2. Land preparation and management of seed production in maize, sunflower, tomato / chilli, soybean
3. Seed production techniques in cereals, pulses, oilseeds and vegetable crops

4. Seed production techniques in hybrids and varieties
5. Seed certification principles and procedures
 - Phases of seed certification
 - Field inspections
 - Rejection of seed field
 - Awarding the labels and tags
 - Indian minimum seed certification standard for important field crops
6. Harvesting of seed crop, physiological maturity index and methods of harvesting, and threshing
7. Seed processing and drying
8. Seed testing methods and procedures
 - Seed sampling, method of sampling and procedures
 - Seed germination
 - Seed moisture determination
 - Physical purity analysis
 - Seed vigour and viability
 - Seed health testing methods
 - Genetic purity testing
9. Seed treating methods and procedures
10. Seed storage and methods of storability
11. Seed marketing channels in Karnataka
12. Visit to seed production fields and seed industries

Evaluation of Experiential Learning (EL) / Hands on Training (HoT) Programme

Sl.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
Total		100

EVALUATION OF STUDENT READY PROGRAM

- Students shall be evaluated component-wise under village attachment/ agro-industrial attachment/ hands on training/skill development training/experiential learning/student projects.
- Each College of the University will designate a Student READY Program Coordinator and component wise evaluation committees. These committees will evolve a method of evaluation depending upon the component undertaken giving due weightage to the observations made by the Scientists/Agro-industrial Officer and the Program Coordinator with whom they are attached.

- Since the Credit Hours allotted to the Student READY program are gradual, the minimum condition of attendance and grading system will apply for the program as will be applicable to other courses.
- It is expected that at the end of Student READY program, the students should gain competency for entrepreneurship, which should be innovative and creative in nature. The evaluation committee must ensure percentage increase in this competency at the end & successful organization of all Student READY programs.

Educational Tour

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

EXAMINATION AND EVALUATION SYSTEM

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

1 Examination

- External theory (50%)
- Internal Theory + Practical (50%)
 - **Courses with Theory and Practical**
Mid-term Exam (30%) + Assignment (5%) in practical oriented courses + Practical (15%)
 - **Courses with only Theory**
Mid-term Exam (40%) + Assignment (10%)
 - **Courses with only Practical:**
(100%) Internal

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

2. Evaluation

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

GPA	=	Total points scored / Total credits (for 1 semester)
CGPA	=	Σ Total points scored / Course credits
OGPA	=	Σ Total points scored (after excluding failure points) / Course credits
% of Marks	=	OGPA x 100/10