



# COURSE CURRICULUM

(As per V - Deans' Committee's Recommendations)

## B.Sc. (Hons.) Agriculture

Under Graduate Degree Programme  
(with effect from academic year 2016-17)



ಕೆಲದಿ ಶಿವಪ್ಪ ನಾಯಕ ಕೃಷಿ ಮತ್ತು ತೋಟಗಾರಿಕೆ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಶಿವಮೊಗ್ಗ  
Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

**2023**







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**(As per V - Deans' Committee's Recommendations)**

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**Keladi Shivappa Nayaka University of Agricultural  
and Horticultural Sciences, Shivamogga**  
Main Campus : Iruvakk, Sagara Taluk, Shivamogga District,  
Karnataka-577412

2023



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Karnataka-577 412

## B.Sc. (Hons.) Agriculture

### Content

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3	KAN 102 / KNK 102	ಕನ್ನಡ ಕೃಷಿ / ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಭಾಗ-2	(0+1)	2
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5	ENG 101	Comprehension and Communication Skills in English	2(1+1)	3
6	AST 202	Agricultural Statistics	3(2+1)	4
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Sl. No.	Course No.	Course Title	Credit Hrs.	Page No
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3	AET 301	Insect pests of Field Crops & Stored Grains and their Management	2(1+1)	26
4	AET 302	Insect pests of Horticultural crops and their management	2(1+1)	27
5	API 201	Introduction to Apiculture	2(1+1)	27
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Sl. No.	Course No.	Course Title	Credit Hrs.	Page No
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3	AEX 201	Communication and Diffusion of Agricultural Innovations	2 (1+1)	30
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3	CPH 301	Nanotechnology in Agriculture	1(1+0)	37
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2	FSN 201	Food processing, Food safety standards and value addition	2(1+1)	38
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Sl. No.	Course No.	Course Title	Credit Hrs.	Page No
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5	HRT 302	Post Harvest Management and Value Addition of Fruits and Vegetables	2(1+1)	45
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1	PAT 101	Fundamentals of Plant Pathology	3(2+1)	46
2	PAT 201	Principles of Plant Diseases and nematode Management	2(1+1)	47
3	PAT 301	Diseases of Field Crops and their Management	3(2+1)	49
4	PAT 302	Diseases of Horticultural crops and their Management	2(1+1)	49
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Sl. No.	Course No.	Course Title	Credit Hrs.	Page No
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### **SOIL SCIENCE & AGRICULTURAL CHEMISTRY**

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2	SAC 202	Soil Chemistry	2 (1+1)	53
3	SAC 301	Problematic Soils and their Management & Geoinformatics	2 (1+1)	53
4	SAC 302	Manures, Fertilizers and Soil Fertility Management	3 (2+1)	54

### **REMEDIAL COURSES**

1	BIO. 101	Introductory Biology (New)	2 (1+1)	55
2	MAT. 101	Elementary Mathematics (New)	2 (2+0)	55
3	TOR 301	Educational Tour (State)	1(0+1)	56
4	TOR 401	Educational Tour (All India)	1(0+1)	56

### **EXPERIENTIAL LEARNING/HANDS ON TRAINING**

1	EPA 421	Production Technology for Bio Fertilizers	(0+10)	58
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3	EAM 421	Mushroom Cultivation	(0+10)	58
4	ESA 421	Soil, Plant, Water, Manure and Fertilizers Testing Services	(0+10)	59
5	EEN 421	Commercial Beekeeping	(0+10)	61
6	EEN422	Commercial Sericulture	(0+10)	62
7	EHR 421	Nursery Management	(0+10)	64
8	EHR 422	Floriculture and Landscape Gardening	(0+10)	65
9	EHR 423	Practicing Protected Horticulture	(0+10)	66
10	EHR 424	Commercial Vegetable Production	(0+10)	67
11	EHR 425	Post harvest processing and Product development of Horticulture Crops	(0+10)	69
12	EFS 421	Food Processing and Food safety standards	(0+10)	69



Course No.	Course Title	Credit Hrs.	Page No
13 EBT 421	Plant Tissue Culture Technologies	(0+10)	70
14 EAG 421	Organic Production Technology	(0+10)	71
15 EAG 422	Agriculture Waste Management/ Management of Organic Resources in Agriculture	(0+10)	72
16 EEX 421	Agro Advisory Services	(0+10)	73
17 EEC 421	Agribusiness Management	(0+10)	73
18 EEG 421	Applied Hi-Tech Horticulture	(0+10)	74
19 EEG 422	Post Harvest handling of Agricultural and Horticultural Produce	(0+10)	75
20 EST 421	Seed Production and Technology	(0+10)	76
21 EST 422	Hybrid Seed Production Technology	(0+10)	77
22 EAS 421	Poultry Production	(0+10)	79
23 ELP 421	International training for UG for Agriculture	(0+10)	80
24 ELP 422	Internet of Things(IOT) - Smart Agriculture	(0+10)	80
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### **SRA -STUDENTS RURAL AND ENTREPRENEURSHIP AWARENESS DEVELOPMENT (READY)**

1	SRA 411	Crop Production and Crop Improvements Interventions	(0+4)	82
2	SRA 412	Crop Protection Interventions	(0+3)	83
3	SRA 413	Social and Allied Sciences Interventions	(0+3)	84
4	SRA 414	Agricultural Extension and Transfer of Technologies	(0+4)	85
5	SRA 415	Plant Clinic/Information Center/ Crop Museum	(0+2)	85
6	SRA 416	Placement in KVKs/ Research Stations and other Units	(0+2)	86
7	SRA 417	Agro Industrial Placements	(0+2)	86

## Semester-wise distribution of courses for B.Sc. (Hons.) Agri.

### I Semester

Sl. No.	Course No.	Course Title	Credit Hourse
1.	AEX 101	Rural Sociology, Educational Psychology and Constitution of India	2(0+2)
2.	AGR 101	Fundamentals of Agronomy	3(2+1)
3.	AMB 101	Fundamentals of Microbiology	2(1+1)
4.	BCM 101	Plant Biochemistry	2(1+1)
5.	CPH 101	Fundamentals of Crop Physiology	3(2+1)
6.	ENG 101	Comprehension and Communication Skills in English	3(2+1)
7.	FOR 101	Introduction to Forestry	2(1+1)
8	FSN 101	Principles of Food Science and Technology	2(2+0)
9.	GPB 101	Fundamentals of Cytogenetics	2(1+1)
10.	KAN 101 KNK 101	Kannada Sahitya Kannada Bhashe Part-1	1*(0+1)
11.	NSS 101	National Service Scheme	1*(0+1)
12.	PED 101	Physical Education & Yoga Practices-I	1*(0+1)
		<b>Remedial Courses 2(1+1/2+0)</b>	
13	BIO 101	Introductory Biology **	2(1+1)
14	MAT 101	Elementary Mathematics **	2(2+0)
<b>Total</b>			20(11+9)+3* =23 (for regular students) 20(11+9)+3*+4** = 27 For Lateral Entry students

\*NC: Non-gradial courses; \*\*R: Remedial course

## II Semester

Sl. No.	Course No.	Course Title	Credit Hourse
1.	AEC 101	Fundamentals of Agricultural Economics	2(2+0)
2.	AEG 101	Introductory Soil and Water	2(1+1)
		Conservation Engineering	
3.	AET 101	Fundamentals of Entomology	3(2+1)
4.	AEX 103	Fundamentals of Agricultural Extension Education and Rural Development	2(1+1)
5.	AGR 103	Water Management	2(1+1)
6.	AMB 201	Soil and Applied Microbiology	2(1+1)
7.	AST 201	Computer Science and Agricultural Informatics	2(1+1)
8	HRT 101	Fundamentals of Horticulture and Fruit Crops Production	2(1+1)
9.	KAN 102 KNK 102	* Kannada Krushi * Kannada Sanskrithi Part-2	1*(0+1)
10.	NSS 101	* National Service Scheme	-
11.	PAT 101	Fundamentals of Plant Pathology	3(2+1)
12.	PED 102	* Physical Education & Yoga Practices-II	1(0+1)
13	SAC 102	Fundamentals of Soil Science	3(2+1)
<b>Total</b>			<b>23(14+9)+2*=25</b>

**\*NC: Non-gradial courses**

### III Semester

Sl. No.	Course No.	Course Title	Credit Hour
1.	AEC 201	Farm Management, Production and Resource Economics	2(1+1)
2.	AEG 201	Farm Machinery and Power	2(1+1)
3.	AEX 201	Communication and Diffusion of Agricultural Innovations	2(1+1)
4.	AGR 102	Introductory Agro-meteorology and Climate Change	2(1+1)
5.	AGR 201	Crop Production Technology-I	3(2+1)
6.	AGR 204	Practical Crop Production-II (Irrigated)	1(0+1)
7.	AST 202	Agricultural Statistics	3(2+1)
8.	GPB 201	Fundamentals of Genetics	2(1+1)
9.	HRT 201	Production Technology of Vegetable Crops	2(1+1)
10.	NSS 201	* National Service Scheme	1*(0+1)
11.	PAT 201	Principles of Plant Diseases and Nematode Management	2(1+1)
12.	SER 201	Introduction to Sericulture	2(1+1)
<b>Total</b>			<b>23(12+11)+1*=24</b>

\*Non gradial Course

### IV Semester

Sl. No.	Course No.	Course Title	Credit Hourse
1.	AEC 202	Agricultural Finance and Co-operation	2(1+1)
2.	AET 201	Insect Ecology, Principle of Pest Management and Natural Enemies	3(2+1)
3.	AGR 203	Crop Production Technology-II	2(1+1)
4.	AGR 303	Rainfed Agriculture and Watershed Management	2(1+1)
5.	API 201	Introduction to Apiculture	2(1+1)
6.	CPH 201	Applied Plant Physiology and Crop Modelling	2(1+1)
7.	GPB 202	Fundamentals of Plant Breeding	3(2+1)
8	HRT 202	Production Technology of Plantation Crops, Spices, Medicinals and Aromatic plants	2(1+1)
9.	NSS 201	* National Service Scheme	-
10.	SAC 202	Soil Chemistry	2(1+1)
11.	SST 101	Principles and Practices of Seed Production	2(1+1)
		<b>Total</b>	<b>22(12+10) = 22</b>

\*Non gradial Course

## V Semester

Sl. No.	Course No.	Course Title	Credit Hour
1.	AEC 301	Agricultural Marketing, Trade and Prices	3(2+1)
2.	AEG 202	Protected Cultivation and Secondary Agriculture	2(1+1)
3.	AET 301	Insect Pests of Field Crops, Stored Grains and their Management	2(1+1)
4.	AGR 202	Practical Crop Production-I (Rainfed)	1(0+1)
5.	AGR 301	Experimental Techniques in Agricultural Research	1(0+1)
6.	CPH 301	Nanotechnology in Agriculture	1(1+0)
7.	ENS 201	Environmental Studies and Disaster Management	2(2+0)
8	GPB 301	Crop Breeding	2(1+1)
9.	GPB 302	Intellectual Property Rights	1(1+0)
10.	HRT 301	Production Technology of Flower Crops and Landscaping	2(1+1)
11.	PAT 301	Diseases of Field Crops and their Managements	3(2+1)
12.	SAC 301	Problematic Soils and their Managements and Geoinformatics	2(1+1)
13.	SST 202	Post Harvest Seed Technology and Quality Assurance	2(1+1)
14.	TOR 301	Educational Tour (State)	1*(0+1)
<b>Total</b>			<b>24(14+10) +1*=25</b>

\*Non gradial Course



## VI Semester

Sl. No.	Course No.	Course Title	Credit Hourse
1.	AEG 301	Renewable Energy and Green Technology	2(1+1)
2.	AET 302	Insect Pests of Horticultural Crops and their Management	2(1+1)
3.	AEX 301	Entrepreneurship Development and Business Communication	2(1+1)
4.	AGR 304	Farming Systems, Organic Farming and Precision Agriculture	3(2+1)
5.	ASC 201	Livestock, Poultry and Fisheries Management	3(2+1)
6.	FSN 201	Food Processing, Food Safety Standards and Value Addition	2(1+1)
7.	HRT 302	Post Harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
8	PAT 302	Diseases of Horticultural Crops and their Management	2(1+1)
9.	PBT 301	Fundamentals of Plant Biotechnology	3(2+1)
10.	SAC 302	Manures, Fertilizers and Soil Fertility Management	3(2+1)
		<b>Total</b>	<b>24(14+10)</b>

## VII Semester

Sl. No.	Course No.	Course Title	Credit Hour
1.	SRA 411	Crop Production and Crop Improvements Interventions	0+4
2.	SRA 412	Crop Protection Interventions	0+3
3.	SRA 413	Social and Allied Sciences Interventions	0+3
4.	SRA 414	Agricultural Extension and Transfer of Technologies	0+4
5.	SRA 415	Plant Clinic/Information Center/ Crop Museum	0+2
6.	SRA 416	Placement in KVKs/Research Stations and other Units	0+2
7.	SRA 417	Agro Industrial Placements	0+2
8	TOR 401	Educational Tour (All India)	1*(0+1)
		<b>Total</b>	<b>0+20</b>

\*Non gradial Course

### VIII Semester

Sl.	Course	Course Title	Credit Hourse
1.	EPA 421	Production Technology for Bio Fertilizers	(0+10)
2.	EPA 422	Production Technology for Bio inoculants	(0+10)
3.	EAM 421	Mushroom Cultivation	(0+10)
4.	ESA 421	Soil, Plant, Water, Manure and Fertilizers Testing Services	(0+10)
5.	EEN 421	Commercial Beekeeping	(0+10)
6.	EEN422	Commercial Sericulture	(0+10)
7.	EHR 421	Nursery Management	(0+10)
8.	EHR 422	Floriculture and Landscape Gardening	(0+10)
9.	EHR 423	Practicing Protected Horticulture	(0+10)
10.	EHR 424	Commercial Vegetable Production	(0+10)
11.	EHR 425	Post harvest processing and Product development of Horticulture Crops	(0+10)
12.	EFS 421	Food Processing and Food safety standards	(0+10)
13.	EFS 421	Food Processing and Food safety standards	(0+10)
14.	EBT 421	Plant Tissue Culture Technologies	(0+10)
15.	EAG 421	Organic Production Technology	(0+10)
16.	EAG 422	Agriculture Waste Management/Management of Organic Resources in Agriculture	(0+10)
17.	EEX 421	Agro Advisory Services	(0+10)
18.	EEC 421	Agribusiness Management	(0+10)
19.	EEG 421	Applied Hi-Tech Horticulture	(0+10)
20.	EEG 422	Post Harvest handling of Agricultural and Horticultural Produce	(0+10)
21	EST 421	Seed Production and Technology	(0+10)
22.	EST 422	Hybrid Seed Production Technology	(0+10)
22	EAS 421	Poultry Production	(0+10)
23	ELP 421	International training for UG for Agriculture	(0+10)
24	ELP 422	Internet of Things (IOT)-SMART AGRICULTURE	(0+10)
25	ELP 423	Programming for Agriculture Sciences	(0+10)

**Note :** Student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits)

### **Abstract of Courses for B.Sc.(Hons.) Agriculture**

<b>Sl.NO.</b>	<b>Group</b>	<b>Credit Hours</b>
1	Agronomy	20(10+10)
2	Genetics and Plant Breeding	10(6+4)
3	Seed Science and Technology	4(2+2)
4	Soil Science and Agricultural Chemistry	10(6+4)
5	Agricultural Entomology	10(6+4)
6	Apiculture	2(1+1)
7	Sericulture	2(1+1)
8	Agricultural Economics	9(6+3)
9	Agricultural Engineering	8(4+4)
10	Plant Pathology	10(6+4)
11	Horticulture	10(5+5)
12	Food Science and Nutrition	4(3+1)
13	Agricultural Extension	8(3+5)
14	Plant Biotechnology	3(2+1)
14a.	Plant biochemistry	2(1+1)
15	Crop Physiology	6(4+2)
16	Forestry and Environmental Science	4(3+1)
17	Agricultural Microbiology	4(2+2)

Sl.No.	Group	Credit Hours
18	Agricultural Statistics and Computer Science	5(3+2)
19	Animal Science	3(2+1)
20	English	2(1+1)
21	Experimental Learning/ Hands on Training	20(0+20)
22	Physical Education and Yoga Practices*	2(0+2)*
23	Rural Agricultural Work Experience	20(0+20)
24	Kannada*	1(0+1)*
25	NSS*	2(0+4)*
26	Remedial courses	4(3+1)**
27	Educational Tour	2(0+2)*
<b>Total (Agriculture and allied: 136 + EL- 20+ RAWE -20+NG-10 + Remedial 04)</b>		176+10*=186 for regular students  176+10*+4** = 190 for lateral entry students

\*Non-gradual course

\*\* Remedial courses

Note : 1) NSS to be spread over for two years

2) Physical Education and Yoga Practices to be spread over for one year

## B.Sc.(Hons.) Agriculture

### BASIC SCIENCES AND HUMANITIES

**BCM 101: Plant Biochemistry 2 (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,  $\beta$ -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.

**KAN 101 ಕನ್ನಡ ಸಾಹಿತ್ಯ (ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ) 1 (0+1)**  
ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್

ಪಠ್ಯಕ್ರಮ: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಭಾಗ-I

ಕನ್ನಡ ನಾಡು ನುಡಿ ಭಾಷೆ, ಆಧುನಿಕಪೂರ್ವ ಕನ್ನಡ ಕಾವ್ಯ (ವಚನ ಸಾಹಿತ್ಯದಿಂದ ಈಚೆಗೆ), ಆಧುನಿಕ ಕಾವ್ಯ, ಕಥೆಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ- ಹಂಪ ನಾಗರಾಜಯ್ಯ; 2. ಕರ್ನಾಟಕ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ-ಜಿ. ವೆಂಕಟಪ್ಪ ಸುಬ್ಬಯ್ಯ; 3. ಕನ್ನಡ ಭಾಷೆಯ ಸಂಕ್ಷಿಪ್ತಚರಿತ್ರೆ- ಅಶೋಕ ಕುಮಾರರಂಜೇರೆ; 4. ವಚನ ಸಾಹಿತ್ಯ: ಬಸವಣ್ಣ, ದೇಶೀಕೇಂದ್ರ ಸಂಗನ ಬಸವಯ್ಯ, ಒಕ್ಕಲಿಗ ಮುದ್ದಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ನುಲಿಯಚಂದಯ್ಯ; 5. ದಾಸ ಸಾಹಿತ್ಯ: ಉದರ ವೈರಾಗ್ಯವಿದು- ಪುರಂದರದಾಸರು; ಕುಲಕುಲವೆಂದು ಹೊಡೆದಾಡಿದಿರಿ- ಕನಕದಾಸರು. 6. ತತ್ವಪದ: ಸುಗ್ಗಿ ಮಾಡೋಣು ಬಾರವ್ವಾ- ಶಿಶುನಾಳ ಪರೀಫ; 7. ಜಾನಪದಗೀತೆ; 8. ಆಧುನಿಕ ಕಾವ್ಯ: ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ-ಡಿವಿಜಿ, ಪುಟ್ಟ ವಿಧವೆ- ದ.ರಾ. ಬೇಂದ್ರೆ, ರೈತನದೃಷ್ಟಿ- ಕುವೆಂಪು, ಅನ್ನದ ಋಣ- ಚನ್ನವೀರಕಣವಿ, ಕನ್ನಡವೆಂದರೆ ಬರಿ ನುಡಿಯಲ್ಲ- ಕೆ.ಎಸ್. ನಿಸಾರ್ ಅಹಮದ್; ಬಿಸಿಲುಗುದುರೆಯನ್ನೇರಿ ಹೋದಾ- ಚಂದ್ರಶೇಖರಕಂಬಾರ; ನನ್ನ ಕವನ-ಸಿದ್ಧಲಿಂಗಯ್ಯ; 9. ಕಥೆಗಳು: ಹಬ್ಬ ಮತ್ತು ಬಲಿ- ಬಿ.ಟಿ. ಲಲಿತಾ ನಾಯಕ್; ಚಿನ್ನ ಮತ್ತು ಮರ- ಹಿ.ಜಿ. ಬೋರಲಿಂಗಯ್ಯ.

**KAN 101 ಕನ್ನಡ ಭಾಷೆ ಭಾಗ-1 (ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ) 1 (0+1)**  
**ಮೊದಲನೇ ಸೆಮಿಸ್ಟರ್**

ಪಠ್ಯಕ್ರಮ:

ಪರಸ್ಪರ ಪರಿಚಯ(Introducing each other), ಸ್ನೇಹಿತರ ನಡುವೆ ಸಂಭಾಷಣೆ (Conversation between friends), ಕುಟುಂಬದ ಬಗೆಗೆ ವಿಚಾರಣೆ (Enquiring about family) ಸಿನಿಮಾಕ್ಕೆ ಹೋಗಲು ಸಿದ್ಧತೆ (Plan to go for a movie), ವಿದ್ಯಾರ್ಥಿಯ ದೈನಂದಿನ ಚಟುವಟಿಕೆಗಳು (Routine activities of a student), ಪುಸ್ತಕದಂಗಡಿಯಲ್ಲಿ (In a book shop), ಕೃಷಿ ಕುರಿತು (About agriculture), ಕಾಲೇಜು/ವಿಶ್ವವಿದ್ಯಾಲಯ ಪರಿಚಯ (Introducing College/University), ರೈತ ಮತ್ತು ವಿಜ್ಞಾನಿಯ ನಡುವೆ ಸಂಭಾಷಣೆ (Conversation between a farmer and a Scientist), ಹಳ್ಳಿಯಲ್ಲಿ ಮಾಹಿತಿ ಸಂಗ್ರಹಣೆ (Data Collection in a village), ಪ್ರವಾಸ ಹೊರಡುವುದು (Going on a tour).

**KAN 102 ಕನ್ನಡ ಕೃಷಿ (ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ) 1 (0+1)**  
**ಎರಡನೇ ಸೆಮಿಸ್ಟರ್**

ಪಠ್ಯಕ್ರಮ: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಭಾಗ-2 (0+1)

1. ಆಧುನಿಕ ಪೂರ್ವ ಕನ್ನಡ ಕೃಷಿ ಜ್ಞಾನ ಸಾಹಿತ್ಯದ ಸ್ಥೂಲ ನೋಟ-ಜಿ.ವೀರಭದ್ರಗೌಡ; 2. ಕನ್ನಡದಲ್ಲಿ ಕೃಷಿ ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ-ಜೆ. ಬಾಲಕೃಷ್ಣ; 3. ಕೃಷಿಕಪರ ಕೃಷಿ ಪತ್ರಿಕೋದ್ಯಮ-ಶಿವರಾಂ ವೈಲೂರು; 4 ಕೃಷಿ ಮತ್ತು ಸಂವಹನ-ಕೆ.ಸಿ. ಶಶಿಧರ; 5. ನಮ್ಮ ಹೊಟ್ಟೆಯಲ್ಲಿದ್ದ ದಕ್ಷಿಣ ಅಮೇರಿಕ-ಬಿ.ಜಿ.ಎಲ್ ಸ್ವಾಮಿ; 6. ಪರಿಸರ, ನಿರಂತರ ಹೊಂದಾಣಿಕೆಯೇ?-ಕೆ.ಪಿ. ಪೂರ್ಣಚಂದ್ರತೇಜಸ್ವಿ, ಪ್ರದೀಪಕೆಂಜಿಗೆ; 7. ಉಾಗಿ ಋಷಿಗೆ ಜನಮನ್ನಣೆ-ಎಂ. ನಾರಾಯಣ ಸ್ವಾಮಿ, ತ್ಯಾವನಹಳ್ಳಿ; 8. ಹೈಬ್ರಿಡ್ ಹತ್ತಿಯ ಸಸ್ಯ ಬ್ರಹ್ಮ- ಡಾ. ಬಿ.ಹೆಚ್. ಕಾತರಕಿ; ಸುರೇಖಾ ಸಂಕನಗೌಡರ; 9. ಗೋಟಗಾರಿಕೆರತ್ನ- ಡಾ. ಎಂ.ಎಚ್. ಮರಿಗೌಡರು; ಉಮಾ ಅಕ್ಕ; 10. ಡಾ. ಲೆಸ್ಲಿ ಕೋಲಮನ್-ಪ್ರಮೋದಕಟ್ಟೆ; 11. ಕನ್ನಡದ ಭಾಷೆಯ ಪ್ರಭೇದಗಳು ಮತ್ತು ಅವುಗಳ ವೈಶಿಷ್ಟ್ಯ-ಅಶೋಕಕುಮಾರರಂಜೇರೆ; 12. ಬಿಬಿಎಂಪಿ-ವಿಶಿಷ್ಟ ಸಮಸ್ಯೆಗಳು: ಜಿ.ಟಿ. ನಾರಾಯಣರಾವ್.

**KAN 102 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ-ಭಾಗ 2 (ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ) 1(0+1)**  
**ಎರಡನೇ ಸೆಮಿಸ್ಟರ್**

ಪಠ್ಯಕ್ರಮ:

ವರ್ಣಮಾಲೆ ಪರಿಚಯ (Introducing alphabets), ಪದರಚನೆ (word structure), ವಾಕ್ಯರಚನೆ (Sentence Structure) ಬರಹಕೌಶಲ್ಯ-ಸರಳ ವಾಕ್ಯಗಳ ಅನುವಾದ (Writing Skill-Translation of Simple sentences), ಬರಹ ಕೌಶಲ್ಯ-ನಿಬಂಧ (Writing Skill- Essay ), ಆಶುಭಾಷಣ, ನಾಡಗೀತೆ, ಕರ್ನಾಟಕದ ಚರಿತ್ರೆ ಪರಿಚಯ (Pick and Speech, Nadageethe, Introduction of Karnataka History), ಕರ್ನಾಟಕದ ಪ್ರೇಕ್ಷಣೀಯ ಸ್ಥಳಗಳು (Karnataka touring places), ಕರ್ನಾಟಕದ ಹಬ್ಬಗಳು (Festivals of Karnataka), ಕನ್ನಡದ ಕವಿ, ಕಲಾವಿದರು (Poet of kannada, Artists), ಕರ್ನಾಟಕದ ವಿಜ್ಞಾನಿಗಳು ಹಾಗೂ ತಂತ್ರಜ್ಞರು (Scientist of Karnataka and Technicians)

**AST 201 :                      Computer Science and Agri-informatics                      2 (1+1)**

**Theory:** Introduction to Computers, organization and architecture of Computers, Memory Concepts, Units of Memory. Operating System: definition, UNIX and 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 and output operations. Introduction to ICT and uses in agriculture. Introduction to Computer-controlled devices (automated systems) for Agri-input management, Smart phone apps in Agriculture. Introduction to Bio-informatics 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 101                      Comprehension and Communication                      2 (1+1)**  
**Skills in English**

**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 202**

**Agricultural Statistics**

**3 (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 Frequency distribution: 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,  $2 \times 2$  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, RCB and LSD, their advantages and disadvantages.

**Practical:** Construction of Frequency Distribution tables. Diagrammatic presentation of data: Bar diagrams & pie diagrams. Graphical Representation of Frequency distribution: 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,  $2 \times 2$  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, RCB and LSD.

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 ( Volleyball).

## Semester II

1 (0+1)

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 (Girls will have Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.

**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, analyzing guiding financial patterns of scheme, youth programme/schemes of GOI, coordination with different agencies and maintenance of diary.

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

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

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

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

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

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

### Semester 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.

### Semester III

1 (0+1)

**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.

### Semester 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 defense; needs and training of self defense.

**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.

# AGRICULTURAL AND ALLIED SUBJECTS

## AGRONOMY

**AGR 101**

**Fundamentals of Agronomy**

**3 (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 tilth, 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 soils, 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, inter-cultural 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 102**

**Introductory Agro meteorology& Climate Change**

**2 (1+1)**

**Theory:** Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave 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 Agro meteorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and long wave 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 103**

## **Water Management**

**2 (1+1)**

**Theory:** Definition of irrigation, water resources; soil water relations; Basic terms in water management and irrigation. Study of soil moisture constantans 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 201**

**Crop Production Technology-I**

**3 (2+1)**

**Theory:** Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals – rice, maize, wheat, sorghum, pearl millet and finger millet, Nutrimilletts/small millets: kodo millet, foxtail millet, Proso millet, little millet, barnyard millet Pulses- chickpea, peas, pigeonpea, mungbean, urdbean, cowpea, horse gram 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 vigor 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 centers 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 202**

**Practical Crop Production-I (Rain fed)**

**1 (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 203                      Crop Production Technology-II                      2 (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, sesame, niger, safflower, castor, linseed, Commercial crops – sugarcane, cotton, Tobacco, 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 204                      Practical Crop Production-II (Irrigated)                      1 (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 301                      Experimental Techniques in Agricultural Research                      1 (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 303      Rain fed Agriculture and Watershed Management      2 (1+1)**

**Theory:** Rainfed agriculture: Introduction, types, History of rain fed 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 rain fed 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 rain fed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rain fed areas in the country and demarcation of rain fed 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 rain fed research station/watershed.

<b>AGR 304</b>	<b>Farming Systems, Organic Farming and Precision Agriculture</b>	<b>3 (2+1)</b>
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**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.

# AGRICULTURAL ECONOMICS

**AEC 101**

**Fundamentals of Agricultural Economics**

**2 (2+0)**

**Theory:** Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic Theory: rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. 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 201**

**Farm Management, Production and  
Resource Economics**

**2 (1+1)**

**Theory:** Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: 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 & 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.

**AEC 202**

**Agricultural Finance and Co-Operation**

**2 (1+1)**

Theory: Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 3 Rs, and 3Cs 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 RRBs 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 301                      Agricultural Marketing, Trade and Prices                      3 (2+1)**

Theory: Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; problems of marketing- Functional, institutional, commodity and behavioral 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, markets 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 behavior 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; 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.

## **AGRICULTURAL ENGINEERING**

**AEG 101**

**Introductory Soil and Water  
Conservation Engineering**

**2 (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 201**

**Farm Machinery and Power**

**2 (1+1)**

**Theory:** Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for 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 202      Protected Cultivation and Secondary Agriculture      2 (1+1)**

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

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

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

## **AEG 301      Renewable Energy and Green Technology      2 (1+1)**

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

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

## **AGRICULTURAL ENTOMOLOGY**

**AET 101:**

**Fundamentals of Entomology**

**3 (2+1)**

**Theory :** Entomology-Definition/meaning and scope, Position of insects in the animal kingdom, Relationship of class insecta with phylum arthropoda, origin and evolution of insects, Dominance of insects in the Animal Kingdom, Factors responsible for dominance, History of Entomology in India, General morphology of insects: Body division and segmentation, Insect integument – structure, function and properties, moulting process, morphology of insect head and its appendages: mouth parts and antennae and their types, Insect thorax – structure: leg structure and modifications with examples, structure of a typical wing, wing venation (major veins), wing coupling; modifications, Insect Abdomen–Structure and appendages, Male genitalia and female genitalia, Metamorphosis–Definition & meaning, Types of metamorphosis, study of immature stages, Types of larvae and pupae, Insect communication: sound production, light production, honey bee dances, insect pheromones, Internal anatomy of insects: Digestive system; Circulatory system; Respiratory system; Nervous system, Reproductive system – Male and female reproductive systems; Reproduction, Sexual and asexual reproduction in insects; parthenogenesis, polyembryoni, paedogenesis, Hermaphroditism, Excretory system, glandular system, Sensory organs in insects; diapause in insects; Systematics: Taxonomy–importance, history and development and binomial nomenclature and type concepts as indicated by ICZN. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Type concept – Holotype, Homonym, Synonym, Classification of class Insecta up to Orders (Imm's and Kristenson's classification), basic groups of extant 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, Membracidae, Aphididae, Coccidae, Alydidae, Lophophidae, Aleurodidae, Pseudococcidae, Diaspididae, Orthezidae, Dactylopidae, Lacciferidae; Neuroptera: Chrysopidae, Hemerobiidae; Lepidoptera: Nymphalidae, Pieridae, Lycaenidae, Papilionidae, Hesperidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Erebiidae, Plutellidae, Pterophoridae, Cossidae, Saturnidae, Bombycidae; Coleoptera: Carabidae, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Buprestidae, Meloidae, Elateridae, Tenebrionidae;; Hymenoptera: Tenthredinidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae, Encyrtidae, Bethyidae, Scolidae, Formicidae, Apidae; Diptera: Culicidae, Cecidomyiidae, Tabanidae, Asilidae, Tachinidae, Agromyziidae, Muscidae, Tephritidae, Syrphidae.

**Practicals :** Study of Phylum Arthropoda and its classification, Methods of collection and preservation of insects including immature stages; External features of Cockroach/Grasshopper/a lepidopteran larvae; study of close relatives of insects, phylum Arthropoda. Immature stages of insects and metamorphosis in insects; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect eggs, larvae and pupae; Dissection of digestive system in insects (Grasshopper/Cockroach); Dissection of male and female reproductive systems in insects (Grasshopper/Cockroach); General taxonomic classification of insects, 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 201:** **Insect Ecology, Principles of pest management and natural enemies** **3 (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. Economic classification of insects, 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 (including entomopathogenic formulations) and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pest management. Survey, surveillance and forecasting of Insect pest. Development and validation of IPM modules. 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 classification of insecticides including mode of action, mode of entry and chemical nature. Toxicity of insecticides, formulations of insecticides. Insecticide application techniques, Pest resurgence and insecticide resistance, management of resistance and merits and demerits of insecticides. Insecticide Act 1968-important provisions, safe handling of insecticides, symptoms of poisoning, first aid and antidotes. Recent methods of pest control-repellants, Attractants, semiochemicals, Antifeedants, hormones, IGR's, Chemosterilants, Insect resistant transgenic crops and Biotechnology in pest management.

Some useful 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. Study of insect pests of house hold, medical and veterinary importance and their management. Insects as food, Scientific and aesthetic value. Species of lac insect, morphology, biology, host plant, lac production—seed lac, button lac, shellac, lac products and uses.

**Practical** : Methods of diagnosis and detection of various insect pests, Methods of insect pests measurement, Assessment of crop yield losses due to insect pests, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Species of lac insect, host plant identification. Mass multiplication of NPV, coccinellids, green lace wing, Trichogramma and other important bioagents. Identification and nature of damage of important insect pests and their management. Insecticide formulations and preparation of spray fluids of required strength and working out of dosage/concentration, 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. Awareness campaign at farmers' fields. Identification of major parasitoids and predators commonly being used in biological control.

**Note:** Students should submit 50 insect specimens representing parasitoids, predator, weed killer and scavengers.

**AET 301:                      Insect pests of Field Crops & Stored                      2 (1+1)**  
**Grains and their Management**

**Theory :** General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests of various field crops viz., cereal crops, pulse crops, oil seeds and commercial crops. Types of insect transmission of plant pathogens and important vectors of plant diseases of field crops and their management. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

**Practical :** Identification of different types of damage of crop pests. Identification and study of life cycle and seasonal history of various insect pests attacking field crops viz., cereal crops, pulse crops, oil seeds, commercial crops and their produce. Field visits to record and observe insect infestation. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods and assessment of losses due to insects. Determination of moisture content of grain and methods of grain sampling under storage condition. Identification of rodents and rodent control operations in godowns. Identification of birds and bird preventive operations in godowns. Fumigation of grain store/godown. Visit to nearest warehouse/FCI godowns.

**Note:** Students should submit 50 insect specimens representing different crops and stored products.

<b>AET 302 :</b>	<b>Insect pests of Horticultural crops and their management</b>	<b>2 (1+1)</b>
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**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 , flower crops, spices and condiments. Pests of crops grown under protected cultivation. Pests of tuber crops. Important vectors of plant diseases of horticultural crops and their management.

**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: vegetable Crops, Fruit Crops, Plantation crops, ornamental crops, flower crops, Narcotics , spices & condiments. Identification of pests of crops under protected cultivation. Visit to nearby Horticultural Research Stations/Institutes to record/observe insect infestation and management techniques followed.

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

<b>API 201</b>	<b>Introduction to Apiculture</b>	<b>2 (1+1)</b>
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**Theory :** Importance of Bees and Beekeeping, History and Development of Beekeeping; Species of honeybees and their colony structure; Morphology of honeybees; Anatomy of honeybees – Digestive, reproductive, nervous, Circulatory and Glandular system; Colony organization; Bee biology; Caste determination in honeybees; Age related activities of workers; Nest architecture; Behaviors in honeybees- Foraging, Communication, Robbing, Swarming and Homeostasis; How, when and where to start beekeeping; Bee flora; Seasonal management of bee colonies; Management of Robbing, Swarming and Queen less 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.

**SER 201**

**Introduction to Sericulture**

**2(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 rain fed conditions, separate chawki garden. Integrated 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 molting. 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 molt, at molt, out of molt. 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.

## **AGRICULTURAL EXTENSION**

**AEX 101**

**Rural Sociology, Educational Psychology  
& Constitution of India**

**2 (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 103      Fundamentals of Agricultural Extension Education      2 (1+1)**  
**and Rural Development**

**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, LCD projector, preparation and use of A,V, aids. Presentation of extension literatures-leaflets, booklets, folders, 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 development departments at district level. Visit to NGO, SHGs and farmers clubs and learning from their experience in rural development. Understanding PRA techniques and their application in village development planning; exposure to mass media.

**AEX 201                      Communication and Diffusion of                      2 (1+1)**  
**Agricultural Innovations**

**Theory:** Communication: meaning and definition; Principles and Functions of Communication. Models and barriers of communication. Agriculture journalism; adoption of innovation: concept and meaning, models, process

and stages diffusion and 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 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 301**

**Entrepreneurship Development and  
Business Communication**

**2 (1+1)**

**Theory:** Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development. Impact of economic reforms on Agribusiness/ Agri enterprises, 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 101**

**Fundamentals of Microbiology**

**2 (1+1)**

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

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

microorganisms. Biochemical activities of bacteria. Microscopic observation of bacteria, fungi, algae and protozoa.

**AMB 201**

**Soil and Applied Microbiology**

**2 (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 201                      Livestock, poultry & fisheries management                      3 (2+1)**

**Theory:** Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Broiler production. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Importance of Indigenous 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. Commercial cultivation important fishes and their production, Aquarium 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.

## CROP PHYSIOLOGY

**CPH 101                      Fundamentals of Crop Physiology                      3 (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 C<sub>3</sub>, C<sub>4</sub> and CAM pathway and their significance; Plant responses to elevated CO<sub>2</sub>,/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.



**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 301**

**Nanotechnology in Agriculture**

**1 (1+0)**

**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: Physcial, 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 enahnced nano-nutrient content in edible parts. In vitro and field efficacy of nanoparticles (pesticides) against plant pathogens. Bioassay of nano-formulations of insecticide. Bio-safety of nano-formulations on natural enemies. Study the fate and behavior of nano fertilizers in soils. Application of nano technology in recycling of Agriculture waste. Safety, toxicity and adoption of nano particles in the soil and aquatic life. Nano sensors in agriculture- nutrient, water, soil.

## **FOOD SCIENCE AND NUTRITION**

**FSN 101**

**Principles of Food Science & Technology**

**2 (2+0)**

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

**FSN 201**

**Food processing, Food safety standards  
and value addition**

**2 (1+1)**

**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**

**FOR 101**

**Introduction to Forestry**

**2 (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.

## **ENS 201      Environmental Studies and Disaster Management      2 (2+0)**

**Theory:** Multidisciplinary nature of environmental studies Definition, scope and importance.

**Natural Resources:** Renewable and non-renewable resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, mining, and their effects on forest b) Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. d) Energy resources: Growing energy needs, use of alternate energy sources. e) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

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

**Biodiversity and its conservation:-** Introduction, definition, genetic, species & ecosystem. Value of biodiversity: consumptive use, productive

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

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

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

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

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

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

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

## **GENETICS AND PLANT BREEDING**

**GPB 101**

**Fundamentals of Cytogenetics**

**2 (1+1)**

**Theory:** Cytogenetics definitions, History and objectives structure of cell, cell organelles and their functions cell theory, 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 201**

**Fundamentals of Genetics**

**2 (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 using two point test crops and three point test crops. 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 Tryptophanoperon.

**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. Solving problems of sex linkage.

**Theory:** Definition, history, objectives and accomplishments of plant breeding, modes of reproduction-its relevance on genetic consequences, pollination control systems-self-incompatibility and male sterility. Domestication, Acclimatization and Introduction of crops. Centers of origin/ diversity, Plant genetic resources, their conservation and utilization in plant breeding. Components of genetic variation; heritability and genetic advance; hybridization techniques and handling of segregating populations. Modes of selection. Genetic basis and breeding methods in self pollinated crops: mass and pure line selection, bulk method, pedigree method, single seed descent method and backcross breeding method. Multiline concept. Genetic basis and methods of breeding cross pollinated crops: Population improvement methods- Ear to row method, modified Ear to Row, recurrent selection methods; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Concepts of population genetics and Hardy-Weinberg Law.; 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.

**Practical:** Plant Breeder's kit. 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. Calculation of mean, range, variance, standard deviation, heritability and heterosis. Designs used in plant breeding experiments, Analysis of Randomized Block Design, Prediction of performance of double and three-way cross hybrids. Problems on Hardy-Weinberg Law.

**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- red gram, green gram, black gram, chickpea, soybean; oilseeds- sunflower, niger, groundnut, sesame, castor, rapeseed and mustard, fiber 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-red gram, green gram, black gram, chickpea, soybean; oilseeds- sunflower, groundnut, sesame, castor, rapeseed and mustard, fibre crops- jute and cotton; cash crops- sugarcane, potato and tobacco. Layout of field experiments; Study of quality characters, Sources of genes of important characters; Visit to AICRP plots of different field crops; Visit to seed production and certification plots; Visit to Research Stations.

**GPB 302. Intellectual Property Rights 1 (1+0)**

**Theory:** Introduction and meaning of intellectual property. Brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Paris Convention for the Protection of industrial property, Madrid protocol, Berne convention and Budapest treaty. Types of Intellectual Property and legislations covering IPR in India: Patents, Copyrights, Geographical indications, Trademarks and 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. Brief introduction to UPOV for protection of plant varieties 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.

## **HORTICULTURE**

**HRT 101 Fundamentals of Horticulture and Fruit Crops Production 2 (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 201                      Production Technology of Vegetable Crops                      2 (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 202                      Production Technology of Plantation                      2 (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, Areca nut, Cashew, Tea, Coffee, Rubber, Pepper, Cardamom, Ginger, Turmeric, Coriander, Fenugreek Ashwagandha, Aloe, Periwinkle, Stevia, Mints, Lemongrass, Ocimum, Patchouli and Geranium.

**7Practical:** Identification, propagation, physiological disorders, processing and value addition of above crops. Extraction methods for essential oil. Visits to commercial plantations.

**HRT 301                      Production Technology of Flower Crops                      2 (1+1)**  
**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 gardens; Physiological disorders of above flower crops; Post harvest handling of cut and loose flowers; Visit to commercial flower production units and nurseries.

**HRT 302                      Post Harvest Management and Value Addition                      2 (1+1)**  
**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. 301**

**Fundamental of Plant Biotechnology**

**3 (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 101**

**Fundamentals of Plant Pathology**

**3 (2+1)**

**Theory:** Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. 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. Phenomenon of pathogenicity: 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 parasites. 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 201**

**Principles of Plant Diseases and  
nematode Management**

**2 (1+1)**

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

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, Diagnosis of nematode damage, 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 301                      Diseases of Field Crops and their Management                      3 (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, Black gram and Green gram, 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 302                      Diseases of Horticultural crops and                      2 (1+1)**  
**their Management**

**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, Areca nut, 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, Sandal, 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 101

Principles and Practices of Seed Production

2(1+1)

Introduction to the 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 in different classes of seed, generation system of seed multiplication, seed replacement rates, seed multiplication ratio, 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 /parents/Hybrids-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 labeled and certified class of seed production. Seed production- foundation and certified seed production in crops like maize, rice, sorghum and bajra ((varieties, hybrids, synthetics and composites); green gram, black gram, 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 and marketing.

**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 agri-horticultural 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 202**

**Post Harvest Seed Technology  
and Quality Assurance**

**2 (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 Policy on seed development (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 stations. 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.

## **SOIL SCIENCE & AGRICULTURAL CHEMISTRY**

**SAC 102**

**Fundamentals of Soil Science**

**3 (2+1)**

**Theory:** Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: Soil-texture, structure, density and porosity, soil colour, consistence and plasticity; 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. Soil water retention, movement and availability. Elementary knowledge of soil taxonomy, classification and soils of India; soil survey, types, methods of soil survey.

**Practical:** Study of soil profile in field. Study of soil sampling tools, collection of representative soil samples, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil colour, Determination of soil texture by feel and Bouyoucos methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Estimation of organic matter content of soil. Study of soil map.

**Theory:** Soil chemistry- Scope and importance. Components of soils – inorganic and organic components. Soil colloids – types and 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. Problematic soils – acid, acid sulphate, salt affected and calcareous soils – characteristics, nutrient availabilities, reclamation – mechanical, chemical and biological methods; 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. Determination of exchangeable Ca, Mg, available S, K and Na and base saturation and exchangeable sodium percentage (ESP) of soil.

**Theory:** Soil quality and health, Distribution of Waste land and problem soils in India. Problematic soils under different Agro-ecosystems. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; Formation, reclamation and management of saline and sodic soils, acid soils, acid Sulphate soils, eroded and compacted soils and 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. 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. Remote sensing and GIS in diagnosis and management of problem soils. Global positioning system(GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs.

**Practical:** Determination of Soil pH, EC, ESP, CEC, Lime Requirement (LR) and Gypsum Requirement (GR) of soil. Quality of irrigation water – Determination of anions (Cl, NO<sub>3</sub>, SO<sub>4</sub>), cations (Ca, Mg, Na and K), SAR in irrigation water. Visit to pesticides residue lab, Field visit to problematic soil site.

### **SAC 302      Manures, Fertilizers and Soil Fertility Management      3 (2+1)**

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

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers; Fertilizer Storage, Fertilizer Control Order. Soil amendments. 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 and forms of nutrients in soil. Soil fertility evaluation and methods: Soil testing, critical levels of different 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 rain fed and irrigated conditions. Integrated nutrient management.

**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, P, K and S in plants. Analysis of Manures and fertilizers for NPK. Visit to STL/FTL.

### REMEDIAL COURSES :

**BIO. 101**

## Introductory Biology

$$2(1+1)$$

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

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

**MAT. 101**

### Elementary Mathematics (New)

 $2(2+0)$ 

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

problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form  $y=f(x)$  (Simple problems based on it).

Integral Calculus : Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

<b>TOR 301</b>	<b>Educational Tour(State)</b>	<b>(0+1)</b>
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Visits to national/state research institutes or centers, visit to state extension centers, visit to state Agri. Universities, visit to Govt./Private seed/processing industries, visit to progressive farmers fields.

<b>TOR 402</b>	<b>Educational Tour(All India)</b>	<b>(0+1)</b>
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Visits to national/state research institutes or centers, visit to state extension centers, visit to state Agri. Universities, visit to Govt./Private seed/processing industries, visit to progressive farmers fields.

### ELP/Hot Courses outline

Sl. No.	Title of the ELP module/course	Course No.	Credit Hours	Offering Department
01	Production Technology for Bio-fertilizers	EPA 421	0+10	PAT+AMB
02	Production Technology for Bio-inoculants	EPA 422	0+10	PAT
03	Mushroom Cultivation	EAM 421	0+10	AMB
04	Soil, Plant, Water, Manure and Fertilizers Testing Services	ESA 421	0+10	SAC
05	Commercial Beekeeping	EEN 421	0+10	AET
06	Commercial Sericulture	EEN 422	0+10	AET
07	Nursery Management	EHR 421	0+10	HRT
08	Floriculture and Landscape Gardening	EHR 422	0+10	HRT
09	Practicing Protected Horticulture	EHR 423	0+10	HRT
10	Commercial Vegetable Production	EHR 424	0+10	HRT
11	Post-harvest Processing and Product Development of Horticulture Crops	EHR 425	0+10	FSN+HRT
12	Food Processing and Food Safety Standards	EFS 421	0+10	FSN
13	Plant Tissue Culture Technologies	EBT 421	0+10	PBT
14	Organic Production Technology	EAG 421	0+10	AGR
15	Agriculture Waste Management / Management of Organic Resources in Agriculture	EAG 422	0+10	AGR
16	Agro-Advisory Services	EEX 421	0+10	EEX
17	Agribusiness Management	EEC 421	0+10	AEC
18	Applied Hi-Tech Horticulture	EEG 421	0+10	AEG
19	Post-harvest handling of Agricultural and Horticultural Produce	EEG 422	0+10	AEG
20	Seed Production and Technology	EST 421	0+10	SST
21	Hybrid Seed Production Technology	EST 422	0+10	SST
22	Poultry Production	EAS 421	0+10	ASC

## EXPERIENTIAL LEARNING /HANDS ON TRAINING

### PLANT PATHOLOGY AND AGRICULTURAL MICROBIOLOGY

#### **EPA 421                      Production Technology for Bio-fertilizers                      (0+10)**

Introduction to Bio-fertilizers viz., *Azospirillum*, *Azotobacter*, VAM and *Bacillus megatarium*. Acquaintance with laboratory equipments. Collection and preservation of samples. Preparation of media and glassware's. Storage and preservation of various microbial cultures-sub culturing, lyophilization etc. Mass multiplication and mass production of biofertilizers through solid and liquid medium. Preparation of medium and carrier material for large scale production. Usage of carrier materials. Bioformulation using talc based carriers including packaging. Methods of quality control tests. Viable count and quality assay of formulation. Shelf life and storage Visit to bio fertilizer inoculated fields in the university, farmer's holding and interaction.

### PLANT PATHOLOGY

#### **EPA 422                      Production Technology for Bio-inoculants                      (0+10)**

Introduction to Bio inoculants viz., *Trichoderma*, *Pseudoinonas* and *Bacillus* sp. Acquaintance with laboratory equipments. Collection and preservation of samples. Preparation of media and glassware's. Storage and preservation of various microbial cultures-sub culturing, lyophilization etc. Mass multiplication and production through solid and liquid medium. Preparation of medium and carrier material for large scale production. Usage of carrier materials. Bioformulation using talc based carriers including packaging. Methods of quality control tests: Viable count and quality assay of formulation. Shelf life and storage Visit to bio inoculants inoculated fields in university, farmer's holding and interaction Marketing of bio-inoculants. Exposure visits to bio inoculants production units with advanced techniques.

### AGRICULTURAL MICROBIOLOGY

#### **EAM 421                      Mushroom Cultivation                      (0+10)**

1. Study of important laboratory equipments and their uses in mushroom experiments
2. History of mushrooms
3. Morphological features of mushrooms
4. Scenario of mushrooms and type of mushrooms

5. Importance of mushrooms
6. Preparation of culture medium for mushroom mother culture production
7. Preparation of mushroom mother culture of and Mushroom spawn production
8. Mushroom cultivation
9. Cultivation of Milky mushroom (*Calocybe indica*)
10. Cultivation of Oyster mushroom (*Pleurotus* sp.)
11. Cultivation of button mushroom (*Agaricus bisporus*)
12. Cultivation of other mushrooms
13. Breeding techniques in mushrooms
14. Mushroom preservation and processing
15. Mushroom recipes preparations
16. Diseases in mushroom production
17. Preparation of project proposals for establishing mushroom production units.
18. Visit to mushroom production units.

### **SOIL SCIENCE AND AGRICULTURAL CHEMISTRY**

#### **ESA 421 Soil, Plant, Water, Manure and Fertilizers Testing Service (0+10)**

- I. **Good Laboratory Practices and requirements** Laboratory safety rules (Do's and Don'ts), general requirements of chemistry lab and their acquaintance.
- II. **Principles of Analytical Chemistry-** Analytical techniques- Quantitative and Qualitative methods. Preparation of reagents, standard solution of acids and alkalis. Ways of expression of concentration of solutions and their calculations.
- III. **Instruments and their working principles-** Analytical working principles of instruments like pH meter, Electrical Conductivity Meter, Kjeldahl Nitrogen Digestion and Distillation, Spectrophotometer, Flame photometer and Atomic Absorption Spectrophotometer (AAS).
- IV. **Soil Analysis-** Collection, processing and preparation of soil samples. Determination of soil physical properties-, soil texture composition by international pipette method and feel method, bulk density, particle density, pore space, soil colour and soil moisture. Determination of electro chemical properties of soil- pH, Electrical Conductivity and Cation exchange capacity (CEC). Determination of soil organic carbon. Determination of available nutrients- Nitrogen, Phosphorus, Potassium, Sulphur, and exchangeable calcium and magnesium.



Determination of DTPA - extractable micronutrients - Iron, Zinc, Copper and Manganese. Determination of soil available Boron. Calculation and recommendation of fertilizers based on soil test results. Characterization of problematic soils (Saline and alkaline) for soluble salts, pH, EC, carbonate, bicarbonate, chlorides, calcium, magnesium, sodium and CEC. Determination of soil amendments requirements - Lime requirement of acid soil, Gypsum requirement of alkaline soil. Computation of ESP and SAR of soil.

- V. Plant analysis-**Collection of different plants samples, processing and preparation for chemical analysis. Digestion of plant samples for estimation of nutrients. Determination of total nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, zinc, copper, manganese and boron content in plant samples.

**VI. Water Analysis-**

- A. Irrigation water analysis-**Collection of irrigation water samples from different sources, processing and preservation. Determination of pH, Electrical Conductivity, carbonates, bicarbonates, chloride, sodium, calcium, magnesium and potassium content in irrigation water. Computation of SAR and RSC of irrigation water. Determination of boron in irrigation water.

- B. Waste water analysis-**Collection of waste water samples from different sources, processing and preservations. Determination of pH, Electrical Conductivity, carbonates, bicarbonates, chloride, sodium, calcium, magnesium potassium, phosphorus, sulphur and nitrate content in waste water. Determination of total suspended solids (TSS), total dissolved solids (TDS), biological oxygen demand (BOD) chemical oxygen demand (COD).

- VII. Manure Analysis-** Collection of different organic manures - compost and FYM and processing for chemical analysis. Digestion of manure samples for estimation of total nutrients. Determination of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, zinc, copper, manganese and boron content in manure samples.

- VIII. Fertilizer Analysis-** Collection and preparation of different fertilizers (NPK) samples. Qualitative test for identification of fertilizers. Detection of adulterants in fertilizers. Estimation of Ammonium nitrogen ( $\text{NH}_4\text{-N}$ ) in ammonium fertilizers, Nitrate nitrogen ( $\text{NO}_3\text{-N}$ ) in Nitrate fertilizers, Amide nitrogen ( $\text{NH}_2\text{-N}$ ) in Amide fertilizers (Urea). Determination of Biuret content of urea. Estimation of phosphorus in phosphatic fertilizers. Determination of potassium in K-fertilizers.

- IX. Study/field visits**-Visits to important soil, plant, water and manure testing laboratories. Visits to large scale manure and compost production units like Karnataka Compost Development Corporation limited (KCDC), Fertilizer quality testing laboratories *etc.*,

## **AGRICULTURAL ENTOMOLOGY**

**EEN 421**

**Commercial Beekeeping**

**(0+10)**

The module aims at enhancing entrepreneurship skill in the students of the department and makes them aware of about honey bees, their importance and additional income generating subsidiary business.

Handling of bee colonies for acquainting with different castes. Biology of honey bees and different kinds of cells of honey bees. Conditions required to start beekeeping. Different methods to procure honey bee colonies. Spotting of bee colonies in nature, hiving and transfer to bee hive. Identification of plants for bee flora for profitable beekeeping. Management of honey bee colonies during different seasons of the year. Management of honey bee colonies during dearth 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 of 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 pollen, propolis, royal jelly and bee venom. Preparation of value added bee hive products. Importance of honey bees in crop pollination for increasing crop productivity maintenance of honey bee colony records in different crops. Honey bees and pesticides. Working out economics of beekeeping. Visit to progressive beekeepers unit. Visit to Apiary Unit. Migratory bee keeping. Training programme on bee keeping to self help groups.

### **Lecture outline**

1. Biology of honey bees and different kinds of cells of honey bees.
2. Handling of bee colonies for acquainting with different casts
3. Conditions required to start beekeeping.
4. Different methods to procure honey bee colonies.
5. Spotting of bee colonies in nature, hiving and transfer to bee hive.
6. Identification of plants for bee flora for profitable beekeeping.

7. Management of honey bee colonies during different seasons of the year.
8. Management of honey bee colonies during dearth period and honey flow season.
9. Preparation of honey bee colonies for higher honey production.
10. Swarming, robbing, queenlessness colonies and their management.
11. Dividing and uniting of honey bee colonies and selling of divided colonies.
12. Pests and diseases of honey bees and their management.
13. Mass queen rearing of multiplication of colonies and selling of queens.
14. Extraction, processing, testing of honey for its purity, composition and uses of honey.
15. Extraction, processing, properties and uses of bee wax.
16. Extraction, processing, and uses of other bee hive products such as pollen, propolis, royal jelly and bee venom.
17. Preparation of value added bee hive products.
18. Importance of honey bees in crop pollination for increasing crop productivity maintenance of honey bee colony records in different crops
19. Honey bees and pesticides
20. Working out economics of beekeeping
21. Visit to progressive beekeepers unit
22. Visit to Apiary Unit
23. Migratory bee keeping
24. Training programme on bee keeping to self help groups

**EEN 422**

**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 disease and pests and their control measures.

**Silkworm rearing:** Planning and preparation for silkworm rearing, disinfection and hygiene in rearing house, different rearing appliance, 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.

### **Class No. and Schedule of class wise syllabus**

1. Study on Raising of mulberry saplings
2. Study on establishment of mulberry garden for rainfed and irrigated condition
3. Study on establishment of exclusive chawki garden
4. Study on manure and fertilizer schedule, Integrated Nutrient management
5. Study on pruning practices, mechanization in mulberry cultivation,
6. Study on mulberry disease and pests and their control measures
7. Study on Planning and preparation for silkworm, rearing disinfection and hygiene in rearing house,
8. Study on different rearing appliances
9. Study on egg transportation, egg incubation
10. Study on harvest and leaf preservation
11. Study on chawki rearing
12. Study on late age silkworm rearing methods
13. Study on bed spacing, feeding, care during moult
14. Study on Silkworm diseases and their management
15. Study on Silkworm pests and their management
16. Study on mounting, harvesting, cocoon sorting, deflossing
17. Study on transportation and marketing of cocoons
18. Study on Mechanization in silkworm rearing,
19. Study on Economics of mulberry cultivation and silkworm rearing. By-product utilization and value addition for additional income.
20. Visit to mulberry garden and silkworm rearing houses in villages
21. Visit to silk reeling, weaving, twisting industries
22. Visit to silk cocoon auction markets

## HORTICULTURE

**EHR 421**

**Nursery Management**

**(0+10)**

Practical No.	Title of the experiments
1.	Study of importance, problems and prospectus of nursery industry.
2.	Horticultural tools, implements and containers used for various operations
3.	Nursery management, preparation of nursery beds and sterilization of nursery beds
4.	Studies on potting, depoting and repotting
5.	Potting mixture, media and liquid fertilizers for propagation
6.	Study of high-tech nursery management practices, use of polyhouses and shade nets in planting materials production
7.	Preparation of growth regulators and method of application
8.	Production of rootstocks
9.	Selection of mother plant, establishment and maintenance of scion bank for vegetative propagation
10.	Seed viability test, studies on dormancy and treatment to break dormancy
11.	Specialized vegetative structures / organs/ plant parts used in propagation
12.	Propagation by seeds
13.	Propagation by different methods of cuttings
14.	Propagation by different methods of layering
15.	Propagation by different methods of grafting, curing of scion, collection of scion
16.	Propagation by different methods of budding
17.	Nursery production of fruit, vegetable, flower, plantation and spice crops
18.	Practice of different cultural methods
19.	Nutrient management in nursery
20.	Identification of pest, diseases and physiological disorders and their control measures
21.	Estimation of cost of cultivation and economic feasibility studies of important vegetable, fruits, flower, plantation and spice crop nurseries
22.	Micro-propagation and handling of plants in nurseries
23.	Hardening of plants
24.	Preparation of bankable project
25.	Practical work on production of quality planting materials of Horticultural crops
26.	Visit to tissue culture laboratory
27.	Visit to Commercial Propagation Nurseries & Farms

### Inputs required for practical works

Sl.No.	Inputs/Material	Quantity	Rate	Amount	Remarks
1	Red soil	6 tractor loads	2,500.00	15,000.00	For conducting practical classes of HER 421 (0+10)
2	FYM / Compost	3 tractor loads	6,000.00	18,000.00	
3	Polythene bags/ covers 7×6, 10×8 (each 25+25 kg)	50 Kg	250.00	12,500.00	
4	Seeds/planting material of fruits/vegetable/flower/Pl antation/medicinal and aromatic crops	Kg/Nos.	-	30,000.00	
5	Fertilizer (Urea, DAP, SSP, MOP and Micro nutrients)	2 bags each	-	15,000.00	
6	PP chemicals	-	-	10,000.00	
7	Formaldehyde	50 lts	-	10,000.00	
8	Spagnum moss	25 Kg	-	7,500.00	
9	PVC pots- different sizes	1000 No's	-	25,000.00	
10	Pro-trays	1000	-	15,000.00	
11	Weed control mat/ mulch sheets		-	10,000.00	
12	Cocopeat/media			10,000.00	
	<b>Total</b>			<b>1,83,000.00</b>	

**EHR 422**

**Floriculture and Landscape Gardening**

**(0+10)**

**Sl.No.**

**Syllabus**

1. Nursery raising techniques
2. Bed preparation, sterilization and mulching
3. Seed sowing and raising seedlings in polybags and portrays
4. Production technology of flower crops in open field - Marigold, Chrysanthemum, China aster, Crossandra, Tuberose and Gladiolus
5. Intercultural operations and nutrition management in flowers crops
6. Specimen collection and identification of disease, pest and disorders in flower crops and their management
7. Harvesting and postharvest handling of cut and loose flowers
8. Identification of ornamental plants
9. Training and pruning of ornamentals plants
10. Establishment of lawn and its management
11. Planning and layout of formal and informal gardens
12. Establishment of garden components, adornments,
13. Establishment of vertical and terrace gardens

14. Preparation of bonsai and terrarium
15. Creation of topiary
16. Practice on flower arrangements
17. Production of potted plants, Cacti and Succulents
18. Visit to ornamental gardens

#### Estimation for inputs/materials

Sl.No.	Inputs/Material	Quantity	Rate	Amount
1	Red soil	5 Tractor load	2,500.00	12,500.00
2	Flower seeds (annuals)	Each 2 packets	-	7,500.00
3	Lawn seeds (10 species)	Each 500gm	3000/kg	15,000.00
4	Formaldehyde (37-41% )	20 ltr	250/ltr	5,000.00
5	Polyethylene Mulch Film	2 Roles	2500/role	5,000.00
6	Fungicides and pesticides	-	-	10,000.00
7	Fertilizers (Urea, SSP, MOP, DAP and Micronutrients)	1 bag each	-	10,000.00
8	FYM/Compost	10 ton	6000/ton	60,000.00
9	Nylon thread	5 rolls	500/roll	2,500.00
10	Polythene bags 7x6 and 10 x8 (each 20+20 kg)	50 Kg	250/Kg	12,500.00
11	Bonsai pots / arrangement trays	30 No.	450/piece	25,000.00
12	Terrarium jars	5 No.	750/piece	3,750.00
13	Flower arrangements materials	-	-	7,500.00
14	Different sized PVC pots	500 No.	75/piece	37,500.00
15	Training by farmer/scientists/ experts for Bonsai, flower arrangement (Ikebana), Topiary, Terrarium etc., arts			75,000.00
	<b>Total</b>			<b>2,88,750.00</b>

**EHR 423**

**Practicing Protected Horticulture**

**(0+10)**

Study of scope and importance of protected cultivation, various types of protected structures, designs and components, orientation and construction of protected structures. Study of covering and roofing materials and ventilation systems. Study of different media, for protected

cultivation. Pro tray nursery raising. Raised bed preparation inside the protected structures. Planting methods in protected structures. Training and pruning methods for protected cultivation of vegetables / flowers. Fertigation and nutrient managements in protected structures for vegetables / flowers. Application of growth regulators in vegetables / flowers. Pest and diseases management in protected structure for vegetable / flowers. Study of Protected cultivation techniques of tomato / capsicum/ cucumber. Study of Protected cultivation techniques of rose / gerbera/carnation. Study of protected cultivation techniques of anthurium / Dendrobium Orchids. Economics of protected cultivation. Visit to protected cultivation units.

#### **Estimation of Inputs / materials**

Sl.No.	Inputs/Material	Quantity	Rate	Amount
1	Red soil	6 Tractor load	2,500.00	15,000.00
2	FYM/Compost	2 Tractor load	5,000.00	10,000.00
3	Media	-	-	25,000.00
4	Pro trays	1000	15.00	15,000.00
5	Flower seeds/planting materials	-	-	60,000.00
6	Formaldehyde	35 liters	250/ Ltr	8,750.00
7	Mulching sheet	2 roll	2500.00	5,000.00
8	Fertilizers (including water soluble)	-	-	15,000.00
9	PP Chemicals	-	-	10,000.00
10	Growth regulators	-	-	7,500.00
11	Packaging materials	-	-	10,000.00
12	Training materials/supporting (netting materials)	-	-	20,000.00
	<b>Total</b>			<b>2,01,250.00</b>

**\*\* For conducting practical classes**

#### **EHR 424**

#### **Commercial Vegetable Production**

**(0+10)**

1. Vegetable seed collection and preservation for identification purpose
2. Nursery raising techniques of vegetable crops
3. Bed preparation and sterilization methods
4. Direct seed sowing and transplanting



5. Seed germination and viability test
6. Seed treatment
7. Production practices of vegetable crops viz., Tomato, Brinjal, Chilli, Capsicum, Cucumber, Onion, Radish, Cauliflower, Palak, Amaranthus, Drumstick and Okra
8. Kitchen gardening
9. Specimen collection of disease and disorders in vegetable crops
10. Identification and management of pest and disease vegetable crops
11. Study of physiological disorders of vegetable crops
12. Intercropping in vegetable crops
13. Fertilizers calculation method of application in vegetables crops
14. Determination of maturity indices and harvesting of vegetable crops
15. Method of seed extraction in vegetables crops
16. Economics of vegetables cultivation
17. Preparation of bankable projects on production of tomato and capsicum under protected condition
18. Visit to vegetable farmer fields
19. Visit to vegetable markets to study marketing problems in Karnataka

### Estimation of inputs/materials

Sl.No.	Inputs/Material	Quantity	Rate	Amount
1	Red soil	6 tractor loads	2500.00	15,000.00
2	Formaldehyde (37-41% )	25 ltr	250/ltr	6,250.00
3	Polyethylene Mulch Film	2 Roles	2500/role	5,000.00
4	Blotting papers	200	5/sheet	1,000.00
5	Seed display unit	10	200/unit	2,000.00
6	Fungicides and pesticides	-	-	10,000.00
7	Fertilizers (Urea, SSP, MOP, DAP and Micronutrients)	2 bags each	-	10,000.00
8	FYM/Compost	5 tones	6000/ton	30,000.00
9	Nylon thread	5 roles	350/roles	1,750.00
10	Training material	-	-	5,000.00
11	Cocopeat/madia			20,000.00
<b>Total</b>				<b>48,200.00</b>

**EHR 425**

**Post-harvest Processing and Product  
Development of Horticulture Crops**

**(0+10)**

1. Importance of post harvest processing of fruits and vegetables
2. Principles and methods of preservation
3. Study of containers used for shelf life extension of processed foods
4. Chilling and freezing injury in vegetables and fruits
5. Study of judging the maturity indices of fruits & vegetables
6. Study of construction and working of zero energy cool chamber (ZECC)
7. Estimation of TSS and determination of physiological loss in weight (PLW) in fruits and vegetables
8. Study of equipments used in processing of fruits and vegetables
9. Extraction and preservation of pulp, juices and cordial
10. Preparation of **Ready-To-Serve (RTS) beverages**
11. Preparation and preservation of tomato ketchup and sauce
12. Preparation and preservation of jam and jelly
13. Preparation of squash and syrup
14. Preparation of fruit nectar
15. Preparation of candied and crystalized products
16. Preparation of pickles
17. Drying and dehydration of fruits and vegetables
18. Preparation of wine
19. Canning of fruits and vegetables
20. Quality evaluation of products (Quality standards and quality control of fresh and processed products)
21. Packaging
22. Marketing of processed products
23. Visit to processing units/ industries

**FOOD SCIENCE AND NUTRITION**

**EFS 421**

**Food Processing and Food Safety Standards**

**(0+10)**

**Importance of food processing. Different processing methods- primary, secondary and tertiary processed foods.**

**Processing of grains:** Primary processing of grains: dehusking, dehulling, milling, roasting, popping and malting. Fortified flours and foods. Energy food mix (Ragi, maize, wheat and millets). Malt drink. Supplementary foods, fortified composite flour and instant flour mixes.

**Processing of fruits, vegetables and plantation crops:** Principles involved in

processing. Different processing methods. Different value added products from fruits, vegetables and plantation crops.

**Bakery technology:** Preparation of different types of bread, buns, biscuits, cookies, cakes, pasta products, pizza and rolls.

**Quality analysis:** Standard procedures for analysis (physic-chemical and sensory) for raw materials and processed food products. FSSAI standards of important food products.

**Packaging technology:** Study of suitability of different packaging materials for processed food products and label design.

**Marketing:** Development of questionnaire, data collection, market survey on different processed and health foods. Project planning and presentation. Cost analysis.

## **BIOTECHNOLOGY**

**EBT 421**

**Plant Tissue Culture Technologies**

**(0+10)**

Preparation of different kinds of media required for raising aseptic cultures. Selection of the mother plants and preparation of explants suitable for raising various kinds of cultures. Methods for aseptic establishment of explants under in vitro conditions including surface sterilization and transfer of explants in laminar air flow hood. In vitro techniques such as axillary shoot culture in jackfruit, node culture in pummelo (Citrus), meristem culture in strawberry, anther culture in Datura, leaf culture in anthurium, embryo culture in garden peas and special emphasis on the commercial micropropagation protocol in banana. Incubation of the culture and monitoring growth response by the explants in due course of time. Hardening of in vitro raised cultures.

General aspects of tissue culture, History terminologies, orientation and establishment of tissue culture laboratory, facilities required for tissue culture work. Preparation of glass wares and cotton plugs for tissue culture work, different tissue culture media and their composition. Stock solution preparation for different tissue culture media. Sterilization of glass wares required for tissue culture work. Familiarization of working with different equipments used in tissue culture work. Studying aseptic techniques followed in tissue culture work. Preparation of calls induction media for inoculation of seeds, leaves and stem in tobacco and finger miller. Induction of calls and subculture maintenance of calli from above different explants. Study the concept of morphogenesis. Preparation of direct and

indirect morphogenetic/regeneration medium and studying the regeneration potential of calli of different explants like seed, leaf, cotyledon, stem roots etc., in tobacco and finger millet and also direct regeneration from the different explants like leaf and stem in tobacco. Micropropagation techniques in commercially important crops like sugarcane, stevia etc., preparation of multiple shoot production media, pH adjustment, digestion of media, sterilization of media. Inoculation of axillary nodes of sugarcane and stevia for mass production of shootlets, subculturing of shootlets, rooting of shootlets by root induction media. Establishment of plantlets in vitro condition and gradual acclimatization of *in vitro* plantlets by gradual hardening technique and field establishment. Application of tissue culture in crop improvement programme like developing drought/salinity tolerant. *In vitro* regeneration of finger millet and groundnut etc., through calli under PEG and NaCl stress and testing their stress tolerance under PEG and NaCl stress at laboratory conditions. Plant tissue culture of jackfruits (Auxiliary shoot culture), potato (inter node culture) Strawberry (Meristem tip culture), Banana (Commercial micro propagation), Datura (Anther culture), Anthurium (leaf culture) and Groundnut (Embryo culture)-preparation of media, Mother plant selection and preparation of planting material (Explants) including surface sterilization, Aseptic culture transfer in vitro under Laminar Air flow hood. Culture incubation in growth room. Observation of responses seen in previous culture. Visits to tissue culture laboratories.

Study of scope and importance of protected cultivation, various types of protected structures, designs and components, orientation and construction of protected structures. Study of covering and roofing materials and ventilation systems. Study of different media, for protected cultivation. Pro tray nursery raising.

## **AGRONOMY**

**EAG 421**

**Organic Production Technology**

**(0+10)**

1. Organic production of selected crops by the student: Each student has to raise crops in an area of 200msq, organically (field bean, French bean, baby corn, radish, bhendi, ragi, brinjal, cabbage, tomato, leafy vegetables, vegetable cowpea, green chillies, cucumber, coriander, cauliflower, ridge gourd, etc and comparative study and package difference (Production, Harvesting and grading/processing, packing and marketing)

2. Compost production.
3. Production of bio digested liquid manure
4. Preparation of indigenous organic additives: Panchagavya, Beejamruta, jeevamruta, and Vermiwash and their use
5. Vermicompost production and its usage
6. Preparation of botanical extracts against pest and disease control and also assess the nutrient value.
7. Post harvest technologies in organic farming Quality assessment of organic produce
8. **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, organic logos used in organic produce packages. Preparation of the project report and presentation. Organic standards, Quality, Certification, labeling and marketing of organic products. Nutrient status of organic farms, Studies on soil microbial and earthworm activities of organic farms.
9. Visit to organic farms of farmer's field and documentation of successful organic farmers practices.

**EAG 422                                      Agriculture Waste Management                                      (0+10)**  
**/ Management of Organic Resources in Agriculture**

1. Collection of crop residues-Bulky organic residues, concentrated organic residues. Green leaf manures, Agro industrial waste urban waste, sewage and sludge
2. Analysis of different organic residues, concentrated organic residues. Green leaf manures, Agro industrial waste, urban waste, sewage and sludge
3. Composting of organic residues. Conventional and mechanized techniques of composting(Areca husk, maize residues and Tobacco waste)
4. Vermicomposting of organic residues and assessing for its quality
5. Preparation of liquid manures and their analysis
6. Analysis of physical, chemical, biological and biochemical properties of different composts
7. Evaluation of different types of compost /liquid manures through field study, soil and crop analysis, presentation and submission of report.

## **AGRICULTURAL EXTENSION**

**EEX 421**

**Agro-Advisory Services**

**(0+10)**

The following activities / skill development programmes were carried out during the course period.

1. The students were oriented about the concept, importance and various institutions conducting Agro-advisory services.
2. The students were allotted different villages for collecting basic information such as general information about the villages, important crop grown, problems in each crop and Agro-advisory service requirements.
3. The problems identified were categorised into crop wise problems, technology problems like problems related to varietal selection, problems related plant protection, problems related to nutrient management etc.
4. The students were asked to concert the expert for advice to be given / solution for identified.
5. The students were sent to various institutions providing Agro-advisory visits like KVKs, FTCs, Developmental Departments, Input dealers etc.
6. The students were asked to prepare report on the above mentioned activities.
7. Each student presented the work done report during the course period.

## **AGRICULTURAL ECONOMICS**

**EEC 421**

**Agribusiness Management**

**(0+10)**

1. Entrepreneurship development: Qualities of entrepreneur (creativity, educational, financial, technical, cultural, social background), ways and methods of entrepreneurship development (training from experts, exposure visits, motivation), skill development programmes
2. Thrust areas in agribusiness: Enlisting of location specific agribusiness/agri-enterprises
3. Selection of suitable agribusiness/agri-enterprise: Social, cultural, technical feasibility and economic/financial viability of the agribusiness. Market survey: Assessment of demand and supply of crucial inputs of agribusiness, demand and supply of product/product services of the agribusiness in relation to competing environment.
4. Planning of agri-enterprise: Decision regarding product/product services (product planning, product development), scale of production (break even analysis), location of the agribusiness,

description of processes involved in manufacturing of product. Project networking: Networking of activities of project indicating duration and cost required for its completion. Application of PERT and CPM models for project networking and evaluation.

5. Input management: Procurement of raw materials, decision regarding optimum use of inputs, human resource management (organizational hierarchy, staffing, coordination, controlling, directing, organizational ethics, organizational behavior), financial management (quantity of credit, source of credit, use of credit, repayment, insurance etc.), technologies (types of machinery)
6. Inventory management
7. Marketing management: Product life cycle, market mix, market segmentation, market efficiency, market integration, SWOT analysis
8. Application of operation research in production and marketing management
9. Policies of the government to be followed for agri-business start-up such as environmental policy, production policy, pricing policy, subsidies, marketing policy etc.
10. Project preparation and report writing

Application of management/business principles to selected agribusiness/agri-enterprises: Planning, organizing, staffing, directing, coordinating, controlling, budgeting, reporting functions to be carried out for selected agribusiness/agri-enterprise

## **AGRICULTURAL ENGINEERING**

**EEG 421**

**Applied Hi-Tech Horticulture**

**(0+10)**

Introduction to Hi-Tech Horticulture. Components of Hi-Tech Horticulture: Protected structure, Irrigation system, Fertigation system, Automation system. **Protected structure:** Design, Layout and Maintenance- Types of greenhouses, site selection, water source. Planning and design of different types of Green houses. Tools and technique for operation of green house, greenhouse equipments and their operations. Installation of greenhouse structure, maintenance of greenhouse. Maintaining health and safety at work place. Different components of greenhouse, maintaining various green house components, managing greenhouse operation. Tasks and sub-tasks involved in Pre-cultivation operation, cultivation operation and post cultivation operation management in green house. Different types of loads on greenhouse and there estimation. different types of fastening devices.

Different types of covering materials and their importance. Design criteria of greenhouse for heating and cooling. **Irrigation system:** Irrigation equipments and their operation. Design and layout of fogger, Design and layout of micro irrigation, Sprinkler irrigation, Poly pipe irrigation in greenhouse. Installation of micro irrigation, Sprinkler irrigation, Poly pipe irrigation in green house. Repair and maintenance of micro irrigation, Sprinkler irrigation, Drip irrigation system. **Fertigation system:** Fertigation equipments and their operation. Planning and design of fertigation system in green house. Repair and maintenance of fertigation system. **Automation system:** Different types of Automation devices for control of Greenhouse environment. Measurement of various climatic factors inside and outside the greenhouse. Plant protection equipments for green house and their operation. Visit to Hi-Tech greenhouse. Visit to Cut flower auction markets. Visit to floriculture Industries.

**EEG 422**

**Post harvest handling of Agricultural  
and Horticultural Produce**

**(0+10)**

Importance of Post harvest handling of Agricultural and Horticultural produce. Design and development of Post Harvest Processing system for different Agricultural crops. **Paddy:** Different types of cleaner, sorting and grading, dryers, dehulling machineries, polishing, packing. Size reduction machineries-Attrition mill, Grit/Rava making, different types of packaging machineries. Parboiling of paddy-Different methods of parboiling, dehulling, Packing and Labeling. Popping /roasting methods, packing. **Maize:** Machines/Equipments use to separate grain from the shank, cleaning machineries, different methods of drying, Size reduction- flour making machines, rava/grit making machines, flak making machines and their operation. Packaging and labeling, Storage methods. **Red gram:** Cleaning, grading machines, drying. Pre treatments for processing, dhal making machineries and methods, polishing of dhal, packing and labeling. Storage methods. **Green gram:** Cleaning, grading machines, drying. Pre treatments for processing, dhal making machineries and methods, polishing of dhal, packing and labeling. Storage methods. **Groundnut:** Different types of shellers, cleaning, drying, sorting and grading machines, packaging and labeling, storage methods. Oil extraction: different types of oil expellers and methods, packing and labeling. Storage methods. **Sessamum:** cleaning, drying, sorting and grading machines, packaging and labeling, storage methods. Oil extraction: different types of oil expellers and methods, packing and labeling. Storage methods. Design and development of Post Harvest Processing system for different Horticultural crops.



**Pineapple:** Cleaning/washing machineries, grading, peeling machineries, slicing, Canning, Sterilization / Pasteurization / Irradiation process, Juice extracting machines, Pulp making machines, Filling machines, Packing/Sealing machines and methods, packing and labeling, Storage.

**Banana:** Cleaning/washing machineries, grading, Packaging containers, packing methods, packing and labeling, Storage methods.

**Mango:** Cleaning/washing machineries, grading, Packing materials and methods. Peeling machineries, Pulp making machines, Filling machines, Canning, Sterilization / Pasteurization / Irradiation process, Cooling, packing and labeling, Storage methods.

**Jackfruit:** Cleaning/washing machineries, Peeling machineries, Pulp making machines, Filling machines, Canning, Sterilization / Pasteurization / Irradiation process, Cooling, packing and labeling, Storage methods.

**Tomato:** Cleaning/washing machines, sorting and grading, Packing containers and methods. Pulp making machines, Filling machines, Canning, Sterilization / Pasteurization / Irradiation process, Cooling, packing and labeling, Storage methods.

**Beans:** Cleaning/washing machines, sorting and grading, Packing. Minimal processing methods, packing methods, labeling, storage methods.

**Jasmine:** Pre-cooling, packing methods. Packing and labeling, storage. Essential oil extraction methods, procedure. Oil extraction, filling containers, labeling and storage.

**Pepper:** Cleaning, sorting and grading, dryers, packing materials and method, labeling, Storage. Pepper powder making machines, packing and labeling, Storage.

**Arecanut:** Cleaning, Sorting and grading, Dehusking machines and methods, Pretreatments, Boiling, drying methods, Packing materials and methods, Storage. Quality assessment for Agricultural and Horticultural produce processing as approved by (FSSAI/FDA/FAO/HACCP/WHO/GOI/ GOK/BIS/any other) Indian regulatory agency. Visit to commercial rice mill. Dhal mill. Fruits and Vegetable processing industries. Assessment of students.

<b>EST 421</b>	<b>Seed production &amp; technology</b>	<b>(0+10)</b>
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1. Agronomy of Principles seed production
2. Genetics principles of Principles seed production
3. Economic principles of Principles seed production
4. Assessment of high seed multiplication places in Karnataka
5. Seed production of important cereals, pulses, oil seeds, vegetable crops, plantation and fruit crops and in vegetable, plantation and fruit crops
6. Seed extraction in vegetable and fruit crops

7. Important seed borne diseases of cereals, pulses, oil seeds, vegetables, plantation and fruit crops in Karnataka
8. Economics of seed production of crops possessing medium and high seed multiplication ratio.
9. Study and documentation for the construction of seed godowns for cereals, pulses, oil seeds, plantation crops under ambient conditions and best storage places in Karnataka.
10. Survey of prominent varieties / OPV high volume and low value crops cultivable area in Karnataka
11. Guest lecture or training programme on construction of seed godown and dehumidified cold storage on
  - Power requirement
  - Construction of godown
  - Advance equipments and automation of agriculture tax
  - Survey and documentation of seed requirement using SPSS software of low volume and high value crops in Karnataka
  - Maintenance breeding in self pollinated, cross pollinated and often cross pollinated varieties / open pollinated varieties.
  - Duties & responsibility of seed inspector and Indian seed legislation
  - Export opportunities for the seed of high volume and low value crops/ international food demand
12. Exposeer visit seed testing laboratories, seed industries, Agrobased industries
13. Survey on low diversity, medium and high diversity districts and seed requirement in Karnataka.
14. Qualities of successful seed entrepreneurs
15. Seed testing and quality assurance.
16. Indian minimum seed certification standards.
17. Any other relevant topics.

**EST 422                      Hybrid seed production & technology                      (0+10)**

- 01 Exploitation of male sterility in different crops
- 02 Important hybrids released in public and private sectors
- 03 Documentation of important hybrids registered with PPV & FRA- New Delhi.

- 04 Documentation of productivity of hybrids released in public sector.
- 05 Documentation of productivity of hybrid seed production technology in important hybrids, cereals, pulses, oil seeds, vegetables crops, plantation and fruit crops.
- 06 Rights of plant breeder and guidelines.
- 07 Guidelines for the seed merchants purchased technology for seed production, distribution or nursery production distribution
- 08 Rights of farmers according to seed bill 2004.
- 09 Assessment of hybrid seed production using endowment factors.
- 10 Assessment and documentation of techniques for the hybrid seed production in the protected cultivation for low volume and high value crops.
- 11 Study and documentation of seed godowns for low volume and high value crops- conditioned seed storage units / dehumidified / cold storage units.
- 12 Survey on low volume and high value hybrid cultivable area in Karnataka.
- 13 Guest lecture or training programme on construction of seed godown and dehumidified cold storage on
  - Power requirement
  - Construction of godown
  - Advance equipments and automation of agriculture tax
  - Survey and documentation of seed requirement using SPSS software of low volume and high value crops in Karnataka
  - Maintenance breeding in self pollinated, cross pollinated and often cross pollinated varieties / open pollinated varieties
  - Duties & responsibility of seed inspector and Indian seed legislation
  - Export opportunities for the seed of low volume and high value crops and their food demand in the national and international senerio.
  - Export opportunities for the seed of low volume and high value crops and their food demand in the national and international senerio.
- 14 Exposeer visit seed testing laboratories, seed industries, Agrobased industries

- 15 Survey on low diversity, medium and high diversity districts and seed requirement in Karnataka.
- 16 Qualities of successful seed entrepreneurs
- 17 Seed testing and quality assurance.
- 18 Indian minimum seed certification standards.
- 19 Any other relevant topics.

## **EAS 421**

## **Poultry Production**

**(0+10)**

- 1 Orientation
2. Introduction about poultry industry
3. Management of backyard poultry- Different varieties/breeds. Brooding, medication, feeding and feed preparation by using locally available materials vaccination and disease control.
4. Commercial broiler production-Chick management, deep litter system housing, feed formulation for different phases, medication, vaccination schedule, diseases and their control. Project preparation, FCR, body weight recording, Marketing. Visit /placement at commercial broiler farms.
5. Management of commercial layers Chick, grower and layer management. Cage system, Lighting management, vaccination schedule, different diseases and their control, feeding at different stages. Visit /placement at commercial layer farms
6. Artificial incubation and hatching-Factors affecting hatching %, Fumigation, sanitization , bio security, visit / placement at commercial hatchery unit
7. Quality egg production. Factors affecting egg quality. Assessment of egg quality.
8. Poultry farm equipments and Record Maintenance.
9. Farm waste Management; composting; vermi composting; biogas production. importance of poultry manure in soil fertility
10. Economic analysis of poultry production. Maintaining the register for income and expenditure on the birds allotted to work out the economics.
11. First Aid, post-mortem of birds and diagnosis of diseases and Flock health Management.

**ELP 421                      International training - Agriculture                      0+10**

International training in Agriculture from a selected Recognized Foreign Institution in the Field of Agriculture.

**ELP 422      Internet of Things (IOT) - ‘SMART AGRICULTURE’                      0+10**

Basics of Electricity/electronic measurement and safety precaution, Characteristics of various analogue circuits, Designing various digital circuits using basic gates, Apply the principle of sensors and transducers used in IoT applications, sensors used in Smart Agriculture, Cloud applications in smart agriculture, Smart Green houses and protected cultivation systems, Applications of drones. Project Work/Industrial Visit.

**ELP 423                      Programming for Agriculture Sciences                      0+10**

**PROGRAMMING IN C:** Introduction to computer Hardware and software, introduction to C Language, Branching and Looping, Functions, Arrays and Strings, Functions, Structures and File Management, Pointers and Pre-processors, Introduction to Data Structures.

**PROGRAMMING IN PYTHON :** Introduction to Python, Control Statements, Data Structures, Functions, File Handling, Python Modules and Packages, Python Object oriented programme, Exception Handling, Regular Expressions, Database.

### Course contents for student READY Programme

Sl. No	Course No.	Credit hr.	Title	Duration (weeks)	Concerned departments for monitoring and evaluation
			Orientation	1	
1	SRA 411	(0+4)	Crop production and crop improvements interventions	12	Agronomy, Horticulture, Soil Science & Agril. Chemistry, Seed Science and technology, Genetics and Plant Breeding, Agril. Microbiology, Crop Physiology, plant Biotechnology
2	SRA 412	(0+3)	crop protection interventions		Plant pathology, Agril. Entomology, Apiculture & Sericulture
3	SRA 413	(0+3)	Social and allied sciences interventions		Agril. Economics, Agril. Statistics, Agril. engineering, Food Sciences & Nutrition, Animal Science, Forestry & Environmental Science
4	SRA 414	(0+4)	Agril. Extension and transfer of technologies		Agril. Extension
5	SRA 415	(0+2)	Plant Clinic/ information center / crop museum		Agril. Extension with concerned specialists
6	SRA 416	(0+2)	Placement in KVKs/ Research Stations and other units	2	Coordinator and three Associate Coordinators (nominated by the Dean (agri.))
7	SRA 417	(0+2)	Agro Industrial placements	3	Concerned teacher of the respective Department
			Project Report, Presentation and Evaluation	2	Coordinators / concerned Teachers
	<b>Total -</b>	<b>20</b>		<b>20</b>	

## **RAWE Programme**

**SRA 411**

**Crop Production and Crop Improvement  
interventions**

**(0+4)**

### **Agronomy**

Study of Different methods of FYM/Compost production and vermin compost, Integrated approaches in crop, water, nutrient and weed management, Contingent crop planning for aberrant weather situations, Identification of ITKs on soil and water management etc.,

### **Soil Science and Agricultural Chemistry**

Study of Methods of soil sampling for soil testing, Interpretation of soil test reports, Fertilizer recommendation based on soil test reports, Methods of irrigation water sampling for water analysis, Interpretation of irrigation water test report and recommendation, Simple methods to detect fertilizers adulteration and quality assessment, Enhancement of fertilizer use efficiency, Identification and management of problematic soils, Identification of plant nutrient deficiency symptoms and nutrient recommendation.

### **Genetics and Plant Breeding**

Study of Improved varieties /hybrids, Relevance of local Germplasm conservation, Identification of local and native varieties, Recent developments of IPR and Farmers right issues.

### **Biotechnology**

Study of knowledge level of the village farmers with respect to the agricultural biotechnology products viz, plant tissue culture, genetically modified plants, plant varieties, biofertilizers, biopesticides etc. and their knowledge dissemination to the farming community through group discussions, group meetings etc.

### **Agricultural Microbiology**

Study of Use of different bio-fertilizers and biocontrol agents in Agriculture and Horticulture, Demonstration on method of bio-fertilizers to different crops, Mass production of Mycorrhizal bio-fertilizers in field conditions, Use of Azola in rice production, Demonstration on method of production of different types of mushroom

### **Crop Physiology**

Study of Seed hardening to improve drought resistance infield crops, Use of growth regulators, Use of micronutrients, To understand the use of new technologies especially use of hormones, micronutrients to field and plantation crops, Learning location specific problems

### **Horticulture**

Propagation and nursery management techniques; Production technologies for major vegetables, spices, spices and fruit crops; management of plantation/orchards; Importance and establishment of nutritional/kitchen garden; High-tech horticulture; Harvesting, handling and post -harvest technologies including processing of horticultural crops; etc.

### **Seed Science and technology**

Different sources of seeds and characteristics of quality seeds. Seed production technologies hybrids, high yielding varieties of crops including vegetables; post-harvest technologies related to seed production- hybrids and high yielding varieties of crops including vegetables; seed quality testing for germination, physical and genetic purities; seed treatment techniques, storage, marketing and distribution; seed replacement. Etc.

**SRA 412**

**Crop Protection interventions**

**(0+3)**

### **Plant Pathology**

Study of Important diseases and their severity, Collection of diseased plants and plant parts, Disease management practice and their frequency, Use of fungicides, bactericides, antibiotics, Different types of non-chemical inputs used, Sources of information on plant protection practices, Information regarding storage practices, Types of sprayers/dusters and their availability, Preparation of Bordeaux mixture, Cultural and biological management of soil borne disease, Seed treatment with fungicides / antibiotics, Preparation of spray solutions, proprietary fungicides and their applications, Calculations of spray volume requirement, Preparation of NSKE and vegetable oils for spraying, Use of nylon nets in nurseries, Use of biological agents, Root feeding of fungicides, Hot water treatment and furdon or thimet application against nematodes.



## **Agricultural Entomology**

Study of Understanding local situation and indigenous farmers practices, Recording the local pesticide consumption, Recording different types of non-chemical inputs used in pest management, Recording sources of information for insect pest identification and for taking management practices, Recording storage practices of farm produces to prevent insect damage, Recording pest management tools prevalent in the area. Selection of demonstration plot and Training farmers on the need for surveillance of pest and natural enemies Conducting method demonstrations on various local problems to train the farmers.

**SRA 413**

**Social and allied Science interventions**

**(0+3)**

### **Agricultural Economics**

Study of Estimation of economics of annual crops, Estimation of economics of perennial crops Estimation of economics of livestock enterprises (Dairy, poultry, fishery, goat rearing, sheep rearing, piggery etc.), Study of economics of special enterprises (sericulture, apiculture, horticultural nurseries, protected cultivation etc.), Determination of economic feasibility of perennial crops and livestock enterprises, study of various marketing aspects: marketing channels adopted by marginal, small and large farmers, estimation of marketing costs, margins, price spread and efficiency, Study of financial institutions located in the RAWEP area, Examining economic feasibility of farm technologies using partial budgeting analysis.

### **Food Science and Nutrition**

Study of Preparation of nutrient rich food, Balanced diet for different age groups, Value added products Identification and documentation of ITKs, understand the importance of food, value addition and health aspect of food, Learning about the value addition of food for complete dietary requirement of the villagers, Demonstration of Value addition to locally available raw material, ITKs in food preparation and preservation is available in each house hold collection and popularization is essential conserve the technology.

### **Animal Science**

Study of Dairy farming problems, Dairy nutrition to enhance the productivity, Consequences of imbalance of energy and protein,

Consequence of underfeeding of energy, Consequence of over feeding of protein, study of FORAGE and FODDER, Backyard poultry supplementary feeding.

### **Forestry and Environmental Sciences.**

Study of importance of social/agro forestry crops, Visit farmers field and assess the agro forestry program, Study important forestry species available in the village.

### **Agricultural Engineering**

Improved agricultural implements available for different operations; Demonstration on use of new implements for different operations; identification and improvements ITK's identification of food adulteration etc.

#### **SRA 414                      Agricultural Extension and transfer                      (0+4)    of Technologies**

Study of Extension programme planning and Execution, Leadership in rural areas and identification of leaders to use in Extension work, Participatory Rural Appraisal (PRA) techniques for efficient extension work, Extension teaching methods like General meeting, Farm and Home Visit, Group discussion meeting, Method Demonstration, Result demonstration, Campaign, Farmers Training, Exhibition, field Visits, Field days, Community work etc.

#### **SRA 415                      Plant clinic/Information Centre/                      (0+2)    crop Museum Establishment**

The students shall be given an opportunity to establish plant clinic at RSK and plant clinic cum Information Centre along with Crop Museum at allotted villages as part of village stay practical. Activities of Plant Clinic includes Soil and Water sample collection and analysis. Display of specimens or objects related to nutrient deficiency, pest and disease problems, weeds etc., at RSK and in the information centre in the village. Further, they have to establish Information Centre depicting village information, farming system, major crops/enterprises, problems identified and plan of work in the centre. In addition to this, they are suppose to establish crop museum using latest varieties of local important crops, some skill teaching activities like seed germination test, vermin compost preparation, detection of fertilizer adulteration etc., apart from providing advisory service to farmers.

**SRA 416    Placement in KVKs/Research Stations and other units    (0+2)**

Under this Group, the students shall be given an opportunity to work in KVKs, research Stations and other Units to study the objectives, activities, staffing pattern, plan of work of institute funding, challenges and constraints etc. visit to KVKs and Research Stations under University Jurisdiction presentations, report submission.

**SRF 417    Agro-Industrial Attachment    (0+2)**

The placement in Agro Industrial Attachment is intended to provide an opportunity to the students to get acquainted with the day to day activities of the Agro Industries related to agriculture and Horticulture. The 16 departments of the college namely, Agronomy, Horticulture, Seed Science, Genetics and Plant Breeding, Agriculture. Microbiology, Crop Physiology, Plant Pathology, Agricultural entomology, Agricultural Engineering, Agricultural Microbiology, Soil Science and Agricultural Chemistry, Plant Bio-technology, Forestry and Environmental Sciences, Agricultural Economics, Food Science and Nutrition and Animal Science. Agricultural Extension Department will arrange for the placement in identified Agro Industrial Attachment related to their subject matter areas like Processing Centres Financial Institution, Areca leaf plating Units, Dairy Enterprise, Bakery Training Unit, Horticulture nursery, mushroom cultivation and Bio-fertilizers, Training Institution, DATC, RUDSETI, value addition of Food industries etc. Protected cultivation, cold storage, poultry, sheep and goat rearing, fishery unit, sweet making unit, rubber processing unit, cashew processing unit, composting unit, pickle making unit, custom hiring centre. Fruit processing unit, vermicelli making unit, Hydroponic centres and IFS unit etc.





**College of Agriculture  
Shivamogga**

**College of Agriculture Sciences  
Iruvakkki**



**College of Forestry  
Ponnampet**

**College of Horticulture  
Mudigere**



**College of Horticulture  
Hiriyyur**

**Main Campus : Iruvakkki, Sagara Taluk, Shivamogga District,  
Karnataka-577412**