

GURU KASHI UNIVERSITY



**Bachelor of Science
(Agriculture) Session: 2020-21**

University College of Agriculture

GURU KASHI UNIVERSITY										
University College of Agriculture (Code:5)										
B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 1st										
Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501101	Fundamentals of Genetics	T	2	0	0	2	50	50	100
2	B501103	Soil and Water Conservation Engineering	T	2	0	0	2	50	50	100
3	B501105	Fundamentals of Soil Science	T	2	0	0	2	50	50	100
4	B501107	Fundamentals of Plant Pathology	T	3	0	0	3	50	50	100
5	B501109	Comprehension & Communication Skills in English	T	1	0	0	1	50	50	100
6	B501111	Introductory Agriculture and Agricultural Heritage*	T	1	0	0	1	50	50	100
7	B501112	Introductory Agro-meteorology & Climate Change	T	2	0	0	2	50	50	100
8	B501117	Agri- Informatics	T	1	0	0	1	50	50	100
9		Elective-I								
10	B501102	Lab. Fundamentals of Genetics	P	0	0	2	1	60	40	100
11	B501104	Lab. Soil and Water Conservation Engineering	P	0	0	2	1	60	40	100
12	B501106	Lab. Fundamentals of Soil Science	P	0	0	2	1	60	40	100
13	B501108	Lab. Fundamentals of Plant Pathology	P	0	0	2	1	60	40	100
14	B501110	Lab. Comprehension & Communication Skills in English	P	0	0	2	1	60	40	100
15	B501113	Lab. Introductory Agro-meteorology & Climate Change	P	0	0	2	1	60	40	100
16	B501118	Lab. Agri- Informatics	P	0	0	2	1	60	40	100
17	B501119	Lab. NSS/NCC/Physical Education & Yoga Practices**	P	0	0	2	1(NC)			
Total No. of Credits							24 +1 (NC)			
Elective-I (Students with non medical background at +2 will take Botany and with medical background will take Mathematics)										
Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501116	Mathematics-I	T	3	0	0	3	50	50	100
2	B501114	Fundamentals of Botany-I	T	2	0	0	2	50	50	100
	B501115	Lab. Fundamentals of Botany-I	P	0	0	2	1	60	40	100

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University College of Agriculture (Code:5)										
B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 2nd										
Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501201	Fundamentals of Plant Biochemistry and Biotechnology	T	2	0	0	2	50	50	100
2	B501203	Fundamentals of Horticulture	T	1	0	0	1	50	50	100
3	B501205	Agricultural Microbiology	T	2	0	0	2	50	50	100
4	B501210	Environmental Studies and Disaster Management	T	2	0	0	2	50	50	100
5	B501212	Fundamentals of Agricultural Economics	T	2	0	0	2	50	50	100
6	B501213	Fundamentals Of Agronomy	T	2	0	0	2	50	50	100
7	B501215	Fundamentals of Entomology-I	T	2	0	0	2	50	50	100
8	B501217	Communication Skills and Personality Development	T	1	0	0	1	50	50	100
9		Elective-II								
10	B501202	Lab. Fundamentals of Plant Biochemistry and Biotechnology	P	0	0	2	1	60	40	100
11	B501204	Lab.Fundamentals of Horticulture	P	0	0	2	1	60	40	100
12	B501206	Lab.- Agricultural Microbiology	P	0	0	2	1	60	40	100
13	B501211	Lab- Environmental Studies and Disaster Management	P	0	0	2	1	60	40	100
14	B501214	Lab.-Fundamentals Of Agronomy	P	0	0	2	1	60	40	100
15	B501216	Lab. Fundamentals of Entomology-I	P	0	0	2	1	60	40	100
16	B501218	Lab. Communication Skills and Personality Development	P	0	0	2	1	60	40	100
Total No. of Credits							24			

Elective-II (Students with non medical background at +2 will take BotanyI and with medical background will take Mathematics)

Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501209	Mathematics-II	T	3	0	0	3	50	50	100
2	B501207	Fundamentals of Zoology	T	2	0	0	2	50	50	100
	B501208	Lab- Fundamentals of Zoology	P	0	0	2	1	60	40	100

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University College of Agriculture (Code:5)										
B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 3rd										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501301	Fundamentals of Entomology II	T	2	0	0	2	50	50	100
2	B501303	Crop Production Technology – I (Kharif Crops)	T	1	0	0	1	50	50	100
3	B501305	Fundamentals of Plant Breeding	T	3	0	0	3	50	50	100
4	B501307	Agricultural Finance and Cooperation	T	2	0	0	2	50	50	100
5	B501309	Farm Machinery and Power	T	2	0	0	2	50	50	100
6	B501311	Production Technology for Vegetables and Spices	T	1	0	0	1	50	50	100
7	B501313	Fundamentals of Crop Physiology	T	2	0	0	2	50	50	100
8	B501315	Livestock and Poultry Management	T	2	0	0	2	50	50	100
9	B501302	Lab. Fundamentals of Entomology II	P	0	0	2	1	60	40	100
10	B501304	Lab. Crop Production Technology – I (Kharif Crops)	T	0	0	2	1	60	40	100
11	B501306	Lab. Fundamentals of Plant Breeding	T	0	0	2	1	60	40	100
12	B501308	Lab. Agricultural Finance and Cooperation	T	0	0	2	1	60	40	100
13	B501310	Lab. Farm Machinery and Power	T	0	0	2	1	60	40	100
14	B501312	Lab. Production Technology for Vegetables and Spices	T	0	0	2	1	60	40	100
15	B501314	Lab. Fundamentals of Crop Physiology	P	0	0	2	1	60	40	100
16	B501316	Lab. Livestock and Poultry Management	P	0	0	2	1	60	40	100
17	B501317	Human Values & Ethics (non gradial)**	P	0	0	2	1(NC)			
Total No. of Credits							23+1(NC)			

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University College of Agriculture (Code:5)										
B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 4th										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501401	Crop Production Technology –II (<i>Rabi Crops</i>)	T	1	0	0	1	50	50	100
2	B501403	Production Technology for Ornamental Crops, MAP and Landscaping	T	1	0	0	1	50	50	100
3	B501405	Renewable Energy and Green Technology	T	1	0	0	1	50	50	100
4	B501407	Problematic Soils and their Management	T	2	0	0	2	50	50	100
5	B501408	Production Technology for Fruit and Plantation Crops	T	1	0	0	1	50	50	100
6	B501410	Principles of Seed Technology	T	1	0	0	1	50	50	100
7	B501412	Farming System & Sustainable Agriculture	T	1	0	0	1	50	50	100
8	B501413	Agricultural Marketing Trade & Prices	T	2	0	0	2	50	50	100
9	B501415	Introduction to Forestry	T	1	0	0	1	50	50	100
10	B501417	Fundamentals of Agricultural Extension Education	T	2	0	0	2	50	50	100
11	B501419	Intellectual Property Rights	T	1	0	0	1	50	50	100
12	B501402	Lab. Crop Production Technology –II (<i>Rabi Crops</i>)	P	0	0	2	1	60	40	100
13	B501404	Lab. Production Technology for Ornamental Crops, MAP and Landscaping	P	0	0	2	1	60	40	100
14	B501406	Lab. Renewable Energy and Green Technology	P	0	0	2	1	60	40	100
15	B501409	Lab. Production Technology for Fruit and Plantation Crops	P	0	0	2	1	60	40	100
16	B501411	Lab. Principles of Seed Technology	P	0	0	4	2	60	40	100
17	B501414	Lab. Agricultural Marketing Trade & Prices	P	0	0	2	1	60	40	100
18	B501416	Lab. Introduction to Forestry	P	0	0	2	1	60	40	100
19	B501418	Lab. Fundamentals of Agricultural Extension Education	P	0	0	2	1	60	40	100
Total No. of Credits							23			

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University College of Agriculture (Code:5)										
B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 5th										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501501	Principles of Integrated Pest and Disease Management	T	2	0	0	2	50	50	100
2	B501503	Manures, Fertilizers and Soil Fertility Management	T	2	0	0	2	50	50	100
3	B501505	Pests of Crops and Stored Grain and their Management	T	2	0	0	2	50	50	100
4	B501507	Diseases of Field and Horticultural Crops and their Management -I	T	2	0	0	2	50	50	100
5	B501509	Crop Improvement-I (<i>Kharif Crops</i>)	T	2	0	0	2	50	50	100
6	B501511	Entrepreneurship Development and Business Communication	T	1	0	0	1	50	50	100
7	B501513	Geoinformatics and Nano-technology and Precision Farming	T	1	0	0	1	50	50	100
8	B501515	Statistical Methods	T	2	0	0	2	50	50	100
9	B501502	Lab. Principles of Integrated Pest and Disease Management	P	0	0	2	1	60	40	100
10	B501504	Lab. Manures, Fertilizers and Soil Fertility Management	P	0	0	2	1	60	40	100
11	B501506	Lab. Pests of Crops and Stored Grain and their Management	P	0	0	2	1	60	40	100
12	B501508	Lab. Diseases of Field and Horticultural Crops and their Management -I	P	0	0	2	1	60	40	100
13	B501510	Lab. Crop Improvement-I (<i>Kharif Crops</i>)	P	0	0	2	1	60	40	100
14	B501512	Lab. Entrepreneurship Development and Business Communication	P	0	0	2	1	60	40	100
15	B501514	Lab. Geo-informatics and Nanotechnology and Precision Farming	P	0	0	2	1	60	40	100
16	B501516	Lab. Statistical Methods	P	0	0	2	1	60	40	100
17	B501517	Lab. Practical Crop Production – I (<i>Kharif crops</i>)	P	0	0	4	2	60	40	100
Total No. of Credits							24			

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B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 6th										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501601	Rainfed Agriculture & Watershed Management	T	1	0	0	1	50	50	100
2	B501603	Protected Cultivation and Secondary Agriculture	T	1	0	0	1	50	50	100
3	B501605	Diseases of Field and Horticultural Crops and their Management-II	T	2	0	0	2	50	50	100
4	B501607	Post-harvest Management and Value Addition of Fruits and Vegetables	T	1	0	0	1	50	50	100
5	B501609	Management of Beneficial Insects	T	1	0	0	1	50	50	100
6	B501611	Crop Improvement-II (<i>Rabi crops</i>)	T	2	0	0	2	50	50	100
7	B501614	Principles of Organic Farming	T	1	0	0	1	50	50	100
8	B501616	Farm Management, Production & Resource Economics	T	1	0	0	1	50	50	100
9	B501618	Principles of Food Science and Nutrition	T	2	0	0	2	50	50	100
10	B501619	Rural Sociology & Educational Psychology	T	1	0	0	1	50	50	100
11	B501602	Lab. Rainfed Agriculture & Watershed Management	P	0	0	2	1	60	40	100
12	B501604	Lab. Protected Cultivation and Secondary Agriculture	P	0	0	2	1	60	40	100
13	B501606	Lab. Diseases of Field and Horticultural Crops and their Management-II	P	0	0	2	1	60	40	100
14	B501608	Lab. Post-harvest Management and Value Addition of Fruits and Vegetables	P	0	0	2	1	60	40	100
15	B501610	Lab. Management of Beneficial Insects	P	0	0	2	1	60	40	100
16	B501612	Lab. Crop Improvement-II (<i>Rabi crops</i>)	P	0	0	2	1	60	40	100
17	B501613	Lab. Practical Crop Production –II (<i>Rabi crops</i>)	P	0	0	4	2	60	40	100
18	B501615	Lab. Principles of Organic Farming	P	0	0	2	1	60	40	100
19	B501617	Lab. Farm Management, Production & Resource Economics	P	0	0	2	1	60	40	100
Total No. of Credits							23			

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B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 7th (Group-I Crop Production)										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501701	Seed Production Technology	T	2	0	0	2	50	50	100
2	B501703	Production of Commercial Crops	T	1	0	0	1	50	50	100
3	B501706	Weed Management	T	2	0	0	2	50	50	100
4	B501702	LAB- Seed Production Technology	P	0	0	2	1	60	40	100
5	B501704	LAB- Production of Commercial Crops	P	0	0	2	1	60	40	100
6	B501705	LAB- Analytical Techniques in Soil, Plant, Fertilizer and water Analysis	P	0	0	4	2	60	40	100
7	B501707	Lab-Weed Management	P	0	0	2	1	60	40	100
Total No. of Credits							10			
Modules:										
8	B501708	Soil, Plant, Water and Seed Testing	P	0	0	10	5(NC)			
9	B501709	Organic Production Technology	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

Semester: 7th (Group-II Crop Protection)										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501710	Bio-control and Integrated pest Management	T	2	0	0	2	50	50	100
2	B501712	Pesticides and Plant Protection Equipments	T	2	0	0	2	50	50	100
3	B501714	Bio-pesticides&Bio-fertilizers	T	2	0	0	2	50	50	100
4	B501711	LAB- Bio-control and Integrated pest Management	P	0	0	2	1	60	40	100
5	B501713	LAB-Pesticides and Plant Protection Equipments	P	0	0	2	1	60	40	100
6	B501715	Lab- Bio-pesticides&Bio-fertilizers	P	0	0	2	1	60	40	100
7	B501716	Lab- Techniques of diagnosis of plant diseases	P	0	0	4	2	60	40	100
Total No. of Credits							11			
Modules:										
8	B501717	Commercial Beekeeping/ Commercial Sericulture	P	0	0	10	5(NC)			
9	B501718	Production Technology for Bioagents for pest control	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

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B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 7th (Group-III Horticulture)										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501719	Commercial Fruit Production	T	1	0	0	1	50	50	100
2	B501721	Vegetable breeding and Seed Production	T	2	0	0	2	50	50	100
3	B501723	Protected Cultivation	T	2	0	0	2	50	50	100
4	B501725	Hi-tech. Horticulture	T	2	0	0	2	50	50	100
5	B501720	Lab- Commercial Fruit Production	P	0	0	2	1	60	40	100
6	B501722	LAB- Vegetable breeding and Seed Production	P	0	0	2	1	60	40	100
7	B501724	Lab- Protected Cultivation	P	0	0	2	1	60	40	100
8	B501726	Lab- Hi-tech. Horticulture	P	0	0	2	1	60	40	100
Total No. of Credits							11			
Modules:										
9	B501727	Floriculture and Landscaping	P	0	0	10	5(NC)			
10	B501728	Food Processing and preservation	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

Semester: 7th (Group-IV Plant Breeding and Genetics and Biotechnology)										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501729	Theory and Practice of Plant Breeding	T	2	0	0	2	50	50	100
2	B501731	Crop Experimentation	T	1	0	0	1	50	50	100
3	B501733	Principles and Procedure of Molecular Biotechnology and Genomics	T	2	0	0	2	50	50	100
4	B501735	Commercial Plant Breeding	T	2	0	0	2	50	50	100
5	B501730	LAB-Theory and Practice of Plant Breeding	P	0	0	2	1	60	40	100
6	B501732	Lab- Crop Experimentation	P	0	0	2	1	60	40	100
7	B501734	LAB- Principles and Procedure of Molecular Biotechnology and Genomics	P	0	0	2	1	60	40	100
8	B501736	Lab- Commercial Plant Breeding	P	0	0	2	1	60	40	100
Total No. of Credits							11			
Modules:										
9	B501737	Seed Production and Technology	P	0	0	10	5(NC)			
10	B501738	Hybrid Seed Production	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

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B. Sc. AGRICULTURE (HONS) -4 Year (Code: 501)										
Study Scheme										
Semester: 7th (Group-V Agri-Business and Extension Management)										
Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501739	Retailing and Supply Chain Management	T	2	0	0	2	50	50	100
2	B501740	Communication and Extension Teaching Methods	T	2	0	0	2	50	50	100
3	B501741	Behavior Skills For Human Resource Development	T	2	0	0	2	50	50	100
4	B501742	Agri-business Management	T	2	0	0	2	50	50	100
5	B501744	Administration of agriculture extension programmes	T	2	0	0	2	50	50	100
6	B501743	Lab- Agri-business Management	P	0	0	2	1	60	40	100
Total No. of Credits							11			
Modules:										
9	B501745	Development of Entrepreneurial skills in Agribusiness	P	0	0	10	5(NC)			
10	B501746	Communication and extension teaching methods	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

Semester: 7th (Group-VI Post Harvest Technology And Value Addition)										
Sr.	Subject Code	Subject Name	Type of Subject	(Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501747	Fruit and Vegetable Technology	T	2	0	0	2	50	50	100
2	B501749	Cereal Technology	T	2	0	0	2	50	50	100
3	B501751	Engineering Principles in Food Processing	T	2	0	0	2	50	50	100
4	B501753	Fundamentals of food microbiology	T	2	0	0	2	50	50	100
5	B501748	Lab- Fruit and Vegetable Technology	P	0	0	2	1	60	40	100
6	B501750	Lab- Cereal Technology	P	0	0	2	1	60	40	100
7	B501752	Lab- Engineering Principles in Food Processing	P	0	0	2	1	60	40	100
Total No. of Credits							11			
Modules:										
9	B501754	Food Processing	P	0	0	10	5(NC)			
10	B501755	Food Preservation	P	0	0	10	5(NC)			
Total No. of Credits							10(NC)			

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Study Scheme										
Semester: 8th										
Sr.	Subject Code	Subject Name	Type of Subject	Hours Per			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	B501801	RAWEP I: Village Attachment	P	NA	NA	NA	3	50	50	100
2	B501802	ELP II. Specialized Experiential Learning Programme (On-Campus)	P	NA	NA	NA	12	50	50	100
3	B501803	ELP III. Industrial Attachment (Off-Campus)	P	NA	NA	NA	4	50	50	100
4	B501804	ELP IV. Project Documentation and Report Preparation, Presentation (On-Campus)	P	NA	NA	NA	1	50	50	100
Total No. of Credits							20			

Semester VIII. RAWE-cum-Experiential Learning Programme			
	Period	Activity	Remarks
1	3 weeks	RAWEP I: Village Attachment (0+3)	All final year students of B.Sc. Agri.(Hons) 4-year and 6-year programmes will be divided into groups of 5-10students each. Formulation and implementation of selected projects for study of rural situation. Planning and implementation of projects for dissemination of agricultural innovations to ameliorate site specific problems. Each group will work in a selected village
		ELP II. Specialized Experiential Learning Programme (On-Campus) (0+12) Elective-wise 'Experimental Learning Programme (ELP)': 1. Elective: Crop Production (i) Module for evaluating soil health and irrigation water quality (ii) Practical seed production (iii) Nursery production of important agro-forestry tree species 2. Elective: Crop Protection (i) Production of bioagents against plant pathogens (ii) Production of important parasitoids and arthropod predators as bioagents against insect pests of important field crops (iii) Handling of pesticides and plat protection equipment	

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2	12 weeks	(iv) Commercial apiculture (v) Mushroom Production 3. Elective: Horticulture (i) Protected cultivation of vegetables and nursery raising technique (ii) Nursery production of important ornamental plants /fruits/vegetable III) Mushroom production 4. Elective: Plant Breeding, Genetics and Biotechnology (i) Hybrid seed production of sunflower (ii) Biotechnological tools in crop improvement 5. Elective: Post Harvest Technology and Value Addition (i) Production of value added processed food (Students opting for a particular elective programme will opt for any one activity (ELP) within the elective products) (ii) Mushroom production 6. Elective: Agri-Business and Extension Management (i) Designing and preparation of facilitating material and organizing activities (ii) Marketing of agricultural produce, preparing enterprise & financial budgets and identification of adoption gaps (iii) Case studies related to financial, project, retail and supply chain management, and preparation of project profile	Students opting for a particular elective programme will opt for any one activity (ELP) within the elective
3	4 weeks	ELP III. Industrial Attachment (Off-Campus) (0+4)	Students will attend 4 weeks off-campus activities (elective wise). Student will opt for only one of the listed activities within his/ her elective
4	1 week	ELP IV. Project Documentation and Report Preparation, Presentation (On-Campus) (0+1) -	

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Semester VIII. Elective-wise Off-campus RAWE-cum-Experiential Learning Activities(ELP <i>Industrial Attachment</i> , 4 weeks period, 4 credit hours: 0+4)		
S. No	Elective	Industrial attachment
1	Crop Production	(i) Seed production and marketing organisations (ii) Fertilizer industries in public, private and cooperative sectors (iii) Vermicompost units (iv) Mineral mines (v) Mentha distillation plants (vi) Units for production and marketing of agrochemicals (vii) Soybean processing units (viii) Plywood manufacturing industries (ix) Hi-tech industry (tree planting stock production) (x) Biofertilizers (xi) Farm School
2	Crop Protection	i) Pesticide and biopesticide industries (ii) Sericulture units (iii) Biocontrol agents production units (iv) Plant Quarantine Station (v) Potato seed production unit (vi) Commercial honey production, hive and other apicultural equipment and honey processing plants manufacturing units (vii) Mushroom production units
3	Horticulture	(i) Commercial nurseries – Fruits, flowers and vegetable crops (ii) Flower seed production and landscaping units (iii) Flower marketing firms (iv) Waxing and package house
4	Breeding, Genetics and Biotechnology	(i) Biotechnological industries and tissue culture labs (ii)Seed production units, seed Farms
5	Post Harvest Technology and Value Addition	(i) Agriculture & Food processing and packaging units (ii) Mushroom production units (iii) Biofertilizer units
6	Agri-Business and Extension Management	(i) Attachment with various public, private and cooperative organisations engaged in agricultural development. (CAO, Deputy Director(Horticulture), Soil Conservation, PAMETI, ATMA,IFFCO, KRIBHCO, MARKFED, DRDA, Zila Parishad, Refinery, Thermal plant units for sulphur marketing etc.) (ii) Agricultural Financial Institutions / branches of Commercial Banks / Co-operative Banks, Co-operative Agricultural Service Societies (CASS), market committees (iii) Agri-business industry in Public/ Private sector to study Agri-business Management practices/ processes Student will opt for only one of the above listed activities within his/her elective

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(Course Contents)
Semester 1st

(B501101) Fundamentals of Genetics

2

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosomes and their types. Chromosomal theory of inheritance, cell cycle and types of cell division. Probability and Chi-square. Dominant and recessive characters, epistatic interactions.

Multiple alleles, pleio-tropism and pseudo alleles, Sex determination and sex linkage, Blood group genetics, Linkage and its estimation, crossing over mechanisms. Structural and numerical variations in chromosome and their implications, Uses of haploids, diploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene structure, function and regulation, LAC and TRP operons.

(B501102) Lab- Fundamentals of Genetics

1

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on mono-hybrid, di-hybrid, tri-hybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structures.

(B501103) Soil and Water Conservation Engineering

2

Surveying: survey equipment, chain survey, plotting procedure, calculations of area of regular and irregular fields. Levelling –types of leveling,levelling equipment, methods of calculation of reduced levels, contouring. Irrigation, classification of projects, flow irrigation and lift irrigation. Water source, Introduction to Water lifting devices. Irrigation water measurement – weirs, flumes and orifices and methods of water measurement and instruments. Water conveyance systems, open channel and underground pipeline. Irrigation methods – drip and sprinkle irrigation systems.

Introduction to Soil and Water Conservation, causes of soil erosion, water erosion and their forms. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

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(B501104) Lab- Introductory Soil and Water Conservation Engineering **1**

Acquaintance with chain survey equipment; Ranging and measurement of offsets; Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading; Study of centrifugal pumping system and irrigation water measuring devices; Study of different components of sprinkler irrigation systems; Study of different components of drip and sprinkler irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss.

(B501105) Fundamentals of Soil Science **2**

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

(B501106) Lab - Fundamentals of Soil Science **1**

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Estimation of organic matter content of soil.

(B501107) Fundamentals of Plant Pathology **3**

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

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Fungi: characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes. *Bacteria*: morphological characters, classification and reproduction.

Viruses: nature, structure, replication and transmission.

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

Dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis; Role of enzymes, toxins and growth regulators in disease development. Defence mechanism in plants. Principles and methods of plant disease management. Chemical control; classification, mode of action and formulations of fungicides and antibiotics.

(B501108) Lab - Fundamentals of Plant Pathology

1

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

(B501109) Comprehension and Communication Skills in English

1

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

(B501110) Lab - Comprehension and Communication Skills in English

1

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

(B501111) Introductory Agriculture and Agricultural Heritage

1

Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture: growth, contrasting food chains and diversity. Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Farming Systems approach, value addition, requirements in new technology; Agriculture scope: Importance of agriculture and agricultural resources available in India; Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects. Indian agricultural heritage: Ancient practices, Relevance of heritage to present day agriculture. Past and present status of agriculture and farmers in society; crop production and protection through the ages. Women in Agriculture: Nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology; Empowerment of women.

(B501112) Introductory Agro-meteorology & Climate Change

2

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

(B501113) Lab - Introductory Agro-meteorology & Climate Change

1

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Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapour 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 wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

B501114 Fundamentals of Botany

2

Classification of plant kingdom with salient features of each group. Cell-structure and its types. Cell division, types of cell division. Meristematic and permanent tissues and their types. Parts of angiosperm plant. External morphology of root. Tap root and adventitious root system. Modified tap and adventitious roots. Morphology of stem. Modifications and functions of stem. Leaf structure, leaf venation, phyllotaxy, modifications and functions of leaves. Types of inflorescence, types of fruits and ovules. Vegetative reproduction (natural and artificial). Pollination and fertilization. Structure of monocot and dicot seed. Seed germination. Factors affecting seed germination and seed dormancy. Types of seed dormancy and factors affecting it. Basic knowledge of crop growth and development. Brief account of phyto-hormones and their use in Agriculture.

B501115 Lab-Fundamentals of Botany

1

Study of different plant parts. Description of at least two plant species from each group of plants. Preparation of slides of cell and its inclusions. Study of different types of roots and their modifications. Stem types and their modifications. Parts of leaf. Leaf types, leaf venation. Phyllotaxy and modifications of leaves. Flower structure, insertion of floral whorls on thalamus, floral diagrams, racemose, cymose and types of inflorescence. Fruit types, structure and germination of monocot and dicot seeds

(B501116) Mathematics-I

3

Straight 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, 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, logarithmic differentiation, differentiation by substitution, 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).

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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.

(B501117) Agri-Informatics

1

Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.

E-Agriculture, concepts and applications in Agriculture. Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions.

(B501118) Lab-Agri-Informatics

1

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management. 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). Hands on Crop Simulation Models (CSM).

(B501119) Lab- NSS/NCC/Physical Education & Yoga Practices **1**

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

NSS programmes and activities

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

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

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

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

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

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

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

Semester I: Physical Education and Yoga Practices

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

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14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

National Cadet Corps Credit hours: 2(0+2) Semester I: National Cadet Corps

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

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Semester 2nd

(B501201) Fundamentals of Plant Biochemistry and Biotechnology **2**

Importance of Biochemistry. Carbohydrates: Importance and classification. Monosaccharides: Structure and properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipids: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Nucleotides: DNA, RNA.

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation.

(B501202) Lab- Fundamentals of Plant Biochemistry and Biotechnology **1**

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

(B501203) Fundamentals of Horticulture **1**

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

(B501204) Lab- Fundamentals of Horticulture **1**

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Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

(B501205) Agricultural Microbiology

2

Introduction. Applied areas of Microbiology, Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers(Bacterial Cyanobacterial and Fungal),biopesticides, biofuel production and biodegradation of agro-waste. Microbiology of food: microbial spoilage and principles of food preservation

(B501206)Lab- Agricultural Microbiology

1

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

(B501207) Fundamentals of Zoology

2

Origin of life and evolution. Structure of animal cell and its organelles. Differences between animal and plant cell. Mitosis cell division. Elementary knowledge of chemical constituents of living bodies- proteins, carbohydrates, lipids, nucleic acids and enzymes. Types of animal tissues. Salient features of classification of animals (non-chordates upto phylum level and chordates upto class level with examples). Binomial nomenclature. Study of external characters, habits and habitat of Amoeba, ent-amoeba, a sponge, Hydra, liver fluke, Ascaris, tape worm, earthworm, cockroach, grass-hopper, snail, starfish, fish, frog, snake, lizard, pigeon and rabbit. Study of different systems of earthworm and cockroach. Zoological parks and museums.

(B501208) Lab- Fundamentals of Zoology

1

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Microscopic study of animal cell, cell division and animal tissues. General survey of animal kingdom. Study of the characteristic features of different animal types. Dissection of earthworm and cockroach. Visit to a Zoological museum/park.

B501209 MATHEMATICS-II

3

Definition of function. Limit. Continuity. Differentiation, successive differentiation, geometrical interpretation of derivative. Indefinite integration, integration by substitution, partial fractions and their use in integration. Integration by parts.

Tutorials on: limit, continuity, differentiation, successive differentiation, indefinite integration, integration by substitution, partial fractions and their application in integration. Integration by parts.

(B501210) Environmental Studies and Disaster Management

2

Definition, scope and importance of environment. Natural resources and associated problems. a) Forest resources, water resources, mineral resources, food resources, food problems associated with agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies; Energy resources: growing energy needs, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Equitable use of resources for sustainable lifestyles.

Ecosystems: Concept of an ecosystem, Structure and functioning of various types of ecosystem (forests, grasslands, deserts and aquatic systems). Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Biodiversity, its conservation and bio-geographical classification of India. Hot-spots of biodiversity and threats to biodiversity. Conservation of biodiversity. Environmental Pollution: definition, causes, types, effects and control measures. Nuclear hazards, Solid Wastes, prevention and management. Environmental ethics: Issues and possible solutions. Public awareness and Environment Protection Acts (Water, soil, air and wild life) and their enforcement. *Disaster Management*: Impact of various natural and man-made disasters, issues related with environment disasters. Concept of disaster management, role of NGOs, community based organizations and media.

(B501211) Lab - Environmental Studies and Disaster Management

1

Pollution case studies. Case Studies- Field work: Visits in local areas to document environmental assets river/ forest/ grassland/ hill/ mountain, visits to polluted sites -Urban/Rural/Industrial/ Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

(B501212) Fundamentals of Agricultural Economics

2

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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 behaviour. Agricultural planning and development in the country. *Demand:* meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Laws of returns, Laws of costs and supplies. Market structure and Price determination, Distribution theory, National income. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Role of Money and Banking 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.

(B501213) Fundamentals of Agronomy

2

Agronomy and its scope, seeds and sowing, tillage and tith, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.

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

(B501214) Fundamentals of Agronomy

1

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveller, seed drill.

(B501215) Fundamentals of Entomology I

2

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum arthropoda up to classes. Relationship of class Insecta with other classes of arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of

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larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptors.

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.

(B501216) Lab - Fundamentals of Entomology I

1

Methods of collection and preservation of insects including immature stages; External features of grasshopper/blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); dissection of male and female reproductive systems in insects (grass-hopper);

Visit to meteorological observatory / automatic weather reporting station; Study of terrestrial and pond ecosystems of insects; Studies on behavior of insects and orientation; Insect surveillance and sampling techniques for the estimation of pest population and damage.

(B501217) Communication Skills and Personality Development

1

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

(B501218) Lab - Communication Skills and Personality Development

1

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

Semester 3rd

(B501301) Fundamentals of Entomology II

2

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Neuroptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera.

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Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control: importance, hazards and limitations. Recent methods of pest control, repellents,

Antifeedants, hormones, attractants and gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of pesticides. Symptoms of poisoning, first aid and antidotes.

(B501302) Lab - Fundamentals of Entomology II **1**

Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage, Practicable IPM practices, Mechanical and physical methods, Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/concentrations of insecticides, compatibility and phyto-toxicity of pesticides.

(B501303) Crop Production Technology-I (Kharif Crops) **1**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and Napier.

(B501304) Lab-Crop Production Technology-I (Kharif Crops) **1**

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

(B501305) Fundamentals of Plant Breeding **3**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and

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methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

(B501306) Lab- Fundamentals of Plant Breeding

1

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

(B501307) Agricultural Finance and Co-Operation

2

Agricultural Finance, Agricultural credit, Credit analysis and sources of agricultural finance. Commercial banks, social control and nationalization of commercial banks. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

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

(B501308) Lab - Agricultural Finance and Co-Operation

1

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case

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study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

(B501309) Farm Machinery and Power

2

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.

(B501310) Lab - Farm Machinery and Power

1

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 trans-planter Familiarization with different types of sprayers and dusters Familiarization with different intercultivation equipment, Familiarization with harvesting and threshing machinery.

(B501311) Production Technology for Vegetables and Spices

1

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

(B501312) Lab- Production Technology for Vegetables and Spices

1

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Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation.

(B501313) Fundamentals of Crop Physiology **2**

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Photoperiodism and vernalization. Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

(B501314) Lab- Fundamentals of Crop Physiology **1**

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis: production of Oxygen and utilization of CO₂ (Moll's half-leaf experiment). Respiration: production of CO₂ During respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

(B501315) Livestock & Poultry Management **2**

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. Management of growers and layers.

Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

(B501316) Lab - Livestock & Poultry Management **1**

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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. Computation of rations for livestock. Formulation of concentrate mixtures. 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.

(B501317) Human Value and Ethics

1

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

Semester 4th

(B501401) Crop Production Technology-II (*Rabi* crops)

1

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-Mentha, lemon grass and Citronella, Forage crops- Barseem, Lucerne and oats.

(B501402) Lab- Crop Production Technology-II (*Rabi* crops)

1

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

(B501403) Production Technology for Ornamental Crops, MAPs & Landscaping **1**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamum, periwinkle,

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isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

(B501404) Lab- Production Technology for Ornamental Crops, MAPs & Landscaping 1

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visits to commercial flower/MAP units.

(B501405) Renewable Energy and Green Technology 1

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, bio-alcohol, 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.

(B501406) Lab- Renewable Energy and Green Technology 1

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 and solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

(B501407) Problematic Soils and their Management 2

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

Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

(B501408) Production Technology for Fruit and Plantation Crops 1

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Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond, several minor fruits and plantation crops, like coconut, arecanut, cashew, tea, coffee & rubber.

(B501409) Lab- Production Technology for Fruit and Plantation Crops **1**

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

(B501410) Principles of Seed Technology **1**

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seeds. Seed production, seed certification procedure, Seed Act and Seed Act enforcement. Seeds Control Order 1983. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Seed drying, seed testing for quality assessment, seed treatment, seed packing and Seed storage. Measures for pest and disease control during storage. Seed marketing, Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

(B501411) Lab- Principles of Seed Technology **2**

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd bean, Moong bean, Pigeon pea, Lentil, Gram, Field bean and peas. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

(B501412) Farming System and Sustainable Agriculture **1**

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

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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, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

(B501413) Agricultural Marketing, Trade and Prices

2

Agricultural Marketing: Concepts, classification and characteristics of agricultural markets. Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products. Product life cycle (PLC) and competitive strategies. Pricing and promotion strategies and their merits & demerits. Exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark). Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

(B501414) Lab- Agricultural Marketing, Trade and Prices

1

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

(B501415) Introduction to Forestry

1

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives,

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diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

(B501416) Lab- Introduction to Forestry

1

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

(B501417) Fundamentals of Agricultural Extension Education

2

Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning in India. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership, extension administration, Monitoring and evaluation. ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

(B501418) Lab - Fundamentals of Agricultural Extension Education

1

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

(B501419) Intellectual Property Rights

1

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent procedure. Patent Cooperation Treaty, Patent search and patent database. Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Semester 5th

(B501501) Principles of Integrated Pest and Disease Management

2

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

(B501502)Lab- Principles of Integrated Pest and Disease Management

1

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Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of bio-control agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomonas*, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. Crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers' fields.

(B501503) Manures, Fertilizers and Soil Fertility Management

2

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

(B501504) Lab-Manures, Fertilizers and Soil Fertility Management

1

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils. Estimation of soil extractable S in soils.. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

(B501505) Pests of Crops, Stored Grains and their Management

2

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 and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with

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stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

(B501506) Lab- Pests of Crops, Stored Grains and their Management **1**

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

(B501507) Diseases of Field & Horticultural Crops & their Management-I **2**

Symptoms, aetiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

(B501508) Lab- Diseases of Field & Horticultural Crops & their Management-I **1**

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

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(B501509) Crop Improvement – I (*Kharif crops*) **2**

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

(B501510) Lab - Crop Improvement – I (*Kharif crops*) **1**

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Moongbean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

(B501511) Entrepreneurship Development and Business Communication **1**

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 Agri-business/ 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.

(B501512) Lab- Entrepreneurship Development and Business Communication **1**

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.

(B501513) Geo-informatics, Nanotechnology and Precision Farming **1**

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

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture;

(B501514) Lab- Geo-informatics, Nano-technology and Precision Farming **1**

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

(B501515) Statistical Methods **2**

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and

Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

(B501516) Lab- Statistical Methods **1**

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data).

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Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2 × 2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

(B501517) Lab-Practical Crop Production-I (Kharif Crops) 2

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

Semester 6th

(B501601) Rain-fed Agriculture and Water-shed Management 1

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

(B501602) Lab- Rainfed Agriculture and Watershed Management 1

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

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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.

(B501603) Protected Cultivation and Secondary Agriculture

1

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, circulatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

(B501604) Lab- Protected Cultivation and Secondary Agriculture

1

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 greenhouse equipment. 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.

(B501605) Diseases of Field & Horticultural Crops & their Management-II

2

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

Field Crops:

Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle;
Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Sunflower: Sclerotinia stem rot and Alternaria blight; **Mustard:** Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; **Gram:** wilt, grey mould and Ascochyta blight; **Lentil:** rust and wilt; **Cotton:** anthracnose, vascular wilt, and black arm; **Pea:** downy mildew, powdery mildew and rust.

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Horticultural Crops:

Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic;

Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

(B501606) Lab- Diseases of Field & Horticultural Crops & their Management-II 1

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

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

(B501607) Post-harvest Management and Value Addition of Fruits and Vegetables 1

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; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning -- Concepts and Standards, packaging of products.

(B501608) Lab- Post-harvest Management and Value Addition of Fruits and Vegetables 1

Applications of different types of packaging, containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

(B501609) Management of Beneficial Insects 1

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

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

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

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.

(B501610) Lab- Management of Beneficial Insects **1**

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

(B501611) Crop Improvement – II (*Rabi crops*) **2**

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

(B501612) Lab- Crop Improvement – II (*Rabi crops*) **1**

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

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(B501613) Lab- Practical Crop Production-II (*Rabi Crops*) **2**

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

(B501614) Principles of Organic Farming **1**

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.

(B501615) Lab- Principles of Organic Farming **1**

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermin-compost, 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.

(B501616) Farm Management, Production and Resource Economics **1**

Meaning and concept of farm management, objectives and relationship with other sciences. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income. Farm business analysis, Meaning and importance of farm planning and budgeting, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture.

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(B501617) Lab- Farm Management, Production and Resource Economics **1**

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

(B501618) Principles of Food Science and Nutrition **2**

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.

(B501619) Rural Sociology & Educational Psychology **1**

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. Behaviour: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Semester 7th

(GROUP- I CROP PRODUCTION)

(B501701) SEED PRODUCTION TECHNOLOGY **2**

Introduction, importance, impact of seed production technology on production and productivity of crops. Definition of seed, seed technology and quality parameters of seed. Different classes of seed and its production. Seed certification, state seed certification agency, inspection. Seed viability, seed vigour seed dormancy, and breaking of dormancy. Varietal identification through grow-out tests and electrophoresis. Seed production of commercial and different classes of seed varietal and hybrid seed production of major self and cross pollinated crops. Seed processing including drying, cleaning, grading, testing, packing and labeling.

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(B501702)Lab- SEEDPRODUCTION TECHNOLOGY **1**

Seed treatment and equipment used for seed treatment (Slurry and Mist-o-Matic-Treater). Seed packing and storage methods. Factors affecting seed longevity during storage and conditions required for storage. Tests of seed vigour and viability. Pest and disease control, temperature control. Seed marketing. Grow out tests. Seed germination tests.

(B501703) PRODUCTION OF COMMERCIAL CROPS **1**

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield and processing of commercial crops, cotton, maize,, jute , sunhemp, soybean, sugarcane, sugarbeet, potato ginger, turmeric, mentha etc.

(B501704)Lab- PRODUCTION OF COMMERCIAL CROPS **1**

Cultural practices for commercial crops. Effect of seed size and sowing depth on germination. Morphological characteristics of commercial crops. Identification of weeds of commercial crops. Identification propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

(B501705)Lab- ANALYTICAL TECHNIQUES IN SOIL, PLANT, FERTILIZER AND WATER ANALYSIS **2**

Colorimetric and flame photometric methods. Atomic absorption spectrophotometry. Cation and Anion exchange phenomenon and their importance. Ion adsorption, desorption and fixation in soils. Fertilizer control order. Planning and formulation of project on establishment of soil water and plant testing laboratory. Preparation of standard solutions. Collection and analysis of soil, water, plant and fertilizer samples. Soil, water and fertilizer analysis reports for recommendation purposes. Analysis of forms of nitrogen, phosphorous, potassium and sulphur in soils. Determination of DTPA extractable micronutrients. Plant analysis for total N, P, K and micro-nutrients.

(B501706) Weed Management **2**

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

(B501707) Lab- Weed Management **1**

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Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agrochemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Modules:

(B501708) Soil, Water and Seed Testing **5**

(B501709) Seed Production **5**

GROUP - II CROP PROTECTION

(B501710) BIOCONTROL AND INTEGRATED PEST MANAGEMENT **2**

History and concept of biological control, different groups of biological control agents and bio-pesticides-macrobials (parasitoids and predators), microbials (bacteria, viruses, fungi, protozoa and nematodes) and botanicals- neem, pyrethrum, nicotine, rotenone and others, their use in pest management along with advantages and limitations. Methods of mass production for each of these groups. National and international agencies dealing with biological control. IPM-history, definition and concept. Concept of economic threshold. Pest monitoring and surveillance. Different tools of IPM including physical, mechanical, resistance, botanical, chemical, bio-rationals and biotechnological approaches. Integration of different IPM tactics. Decision making systems. Potential of IPM, its implementation and constraints. Successful example in IPM.

(B501711) Lab- BIOCONTROL AND INTEGRATED PEST MANAGEMENT **1**

Identification of important groups of parasitoids, predators and microbial control agents. Laboratory multiplication of parasitoids, predators and microbial control agents. Determination of economic threshold levels. Demonstration of cultural and mechanical control measures of different pests. Use of pheromones, colour, sticky and light traps for monitoring and surveillance of pests. Study of IPM module in cotton, rice, sugarcane, maize, fruits and vegetables.

(B501712) PESTICIDES AND PLANT PROTECTION EQUIPMENT **2**

Pesticides- classification, properties, entry and mode of action. Formulations and toxicity of pesticides. Factors affecting toxicity of pesticides. Compatibility and synergism. Antidotes. Problems associated with the use of pesticides. Role of repellents, attractants, pheromones, hormones, chemo-sterillants and antifeedants in pest control. Pest control equipment – history of development, classification, constructional features and principles of working, operation, maintenance and selection. Planning of pest control operations.

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(B501713) Lab- PESTICIDES AND PLANT PROTECTION EQUIPMENT 1

Familiarization with different formulations of pesticides, their preparation and use. Toxicity to insects and plants. Calculation of dosages of pesticides and fumigants. Practice in the use of various types of pest-control equipments. Study of factors affecting efficacy of pesticide spray. Calibrations of plant protection equipments. Common troubles in the use of pest-control equipment and their remedies. Estimation of pesticide residue in food commodities

(B501714) Biopesticides & Biofertilizers 2

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomo-pathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticides.

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilisation and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

(B501715) Lab- Bio-pesticides&Bio-fertilizers 1

Isolation and purification of important bio-pesticides: *Trichoderma*, *Pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production. Identification of important botanicals. Visit to bio-pesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomo-pathogenic entities in field condition. Quality control of bio-pesticides.

Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of bio-fertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

(B501716) Lab- Techniques of diagnosis of plant diseases 2

Field diagnosis of important diseases of *Rabi* and *Kharif* crops, vegetables, fruits, forest and ornamental plants. Estimation of losses and methods for assessing the intensity of diseases like angular leaf spot of cotton, *Tikka* disease of groundnut, yellow mosaic of beans, downy mildew of *bajra*, rusts and loose smut of wheat, *Alternaria* blight, downy mildew of

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mustard and powdery mildew of pea. Methods of soil sterilization for raising healthy nursery plants. Solar heat treatment. Methods of producing virus-free citrus and potato. Diagnosis and differentiation of disorders due to viruses, nutritional imbalances, genetic variations and toxaeimias. Types of chemicals used for the control of plant diseases and methods of their application. Cultural and biological methods of plant disease control.

Modules:

(B501717) Beekeeping and Sericulture	5
(B501718) Mushroom Cultivation	5

GROUP - III HORTICULTURE

(B501719) COMMERCIAL FRUIT PRODUCTION	1
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Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horticultural techniques, production, plant protection measures and special problems in fruits such as citrus, mango, guava, apple, pear, peach, plum, ber, litchi, grapes, pomegranate, papaya, pineapple, phalsa, banana and sapota. Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation of orchard management

(B501720) Lab-COMMERCIAL FRUIT PRODUCTION	1
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Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation of orchard management.

(B501721) VEGETABLE BREEDING AND SEED PRODUCTION	2
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Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources. Principles and methods of breeding self-pollinated, often cross-pollinated and cross-pollinated vegetable crops. Plant introduction, selection, hybridization, population improvement, mutation and polyploidy. Seed production of conventional varieties. Production of F1 hybrids using male sterility, self-incompatibility, various sex-forms etc. Methods of production of nucleus, breeder, foundation and certified

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seeds isolation, pollination, seed harvesting, processing and storage. Seed testing and certification. Seed Act. Vegetable seed industry and its problems.

(B501722) Lab- Vegetable breeding and seed production **1**

Study of inflorescence and flower structures. Practice in emasculation and artificial pollination. Inspection and rouging. Testing of seeds for purity and germination. Project formulation and evaluation for seed production of vegetable crops.

(B501723) Protected Cultivation **2**

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lily, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

(B501724) Lab- Protected Cultivation **1**

Raising of seedlings and saplings under protected conditions, use of pro-trays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging and misting.

(B501725) Hi-tech. Horticulture **2**

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

(B501726) Lab- Hi-tech. Horticulture **1**

Types of poly-houses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-pro trays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Modules:

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(B501727) Floriculture and Landscaping **5**

(B501728) Fruit Processing and preservation **5**

GROUP- IV PLANT BREEDING AND GENETICS

(B501729) Theory and practice of plant breeding **2**

Role of plant breeding. Centres of origin of crop plants. Plant genetic resources and their utilization. Breeding systems. Breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops and their genetic basis. Heterosis and its exploitation. Male sterility and self-incompatibility. Mutation and polyploidy. Breeding for quality traits. Breeding for abiotic and biotic stresses. Wide hybridization. Procedures for the release of new varieties. Plant breeding for sustainable agriculture. Plant Variety Protection and Breeders' Rights.

(B501730) Lab- Theory and practice of plant breeding **1**

Emasculation, crossing and selfing in various crops. Collection, viability and germination of pollen. Handling of breeding materials. Study of variability, male sterility and self incompatibility. Quality testing in crop plants. Screening for disease resistance.

(B501731) Crop experimentation **1**

Experiments in Plant Breeding – objectives, analysis and interpretation of results. Statistics in relation to crop experimentation. Principles of experimental designs. Uniformity trials, progeny rows trials, compact family block design, completely randomized block design (CRBD) randomized block design (RBD), incomplete block designs. Simple lattice. Augmented designs. Varietal trials over years and locations. G x E and estimation of genetic components. Analysis of co-variance. Determination of yield through its components.

(B501732) Lab- CROP EXPERIMENTATION **1**

Statistical parameters and tests of significance. Use of computer packages for analysis. Layout of field experiments. Analysis of experimental designs. Character association. Analysis of varietal trials and G x E interaction

(B501733) Principles and procedure of molecular biotechnology and genomics **2**

Classification, properties and uses of restriction endonucleases. Characteristics and uses of plasmids in molecular biology. Recombinant DNA technology. Construction and uses of genomic and cDNA libraries. Genome organization of prokaryotes and eukaryotes. Southern, Northern and Western hybridization. RFLPs. Polymerase chain reaction. PCR-based markers like RAPDs, SSRs, ISSRs, STS, and Scars. Generation of molecular maps. Applications

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of biotechnology in crop improvement. DNA sequencing. Gene cloning approaches. Functional genomics, proteomics and bioinformatics.

(B501734) Lab- Principles and procedure of molecular biotechnology and genomics 1

Isolation, purification and fractionation of DNA and proteins. Isolation and purification of plasmids. Measurement of protein and nucleic acid concentration using photospectrometer. DNA amplification using RAPD/SSR primers and its fractionation in agarose gel. Generation of linkage maps and mapping of qualitative genes using important web sites on computer.

(B501735) Commercial Plant Breeding 2

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

(B501736) Lab- Commercial Plant Breeding 1

Floral biology in self and cross pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. Learning techniques in hybrid seed production using male-sterility in field crops. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

Modules:

(B501737) Seed Production and Technology 5

(B501738) Hybrid Seed Production 5

GROUP - V AGRI-BUSINESS AND EXTENSION MANAGEMENT

(B501739) Retailing and supply chain management

2

Introduction to retailing- definition, concept and overview. Types of retail institutions related to agri-business. Changing food consumption patterns in India. Store location and site selection. Managing retail operations procurement and inventory management. Store design- the exterior, interior, layout and display. Promoting store. Introduction to customer relationship management in retail business. Supply chain management- concept, definition and importance. Elements of physical distribution systems, building and operating supply chains in agribusiness. Role of IT in supply chain management.

(B501740) Communication and extension methods

2

Communication - Concept and importance in Agricultural Extension Elements of Communication process - Sender, Message, Channel, message treatment and receiver and their role in improvement of communication fidelity / effectiveness. Teaching - learning process as applicable in agricultural extension individual group and mass contact extension teaching methods - their choice and use under different field situations. Role of application of computer in production and presentation of audio, visual and audio-visual aids. Cyber extension its role and application.

(B501741) Behaviour skills for human resource development

2

Concept of human behaviour. Taxonomy of behavioural domains. Human needs and their hierarchy. Attitude, its characteristics and measurement. Perception and its principles, selectivity in perception. Motivational skills for attitudinal and perceptual changes. Problem-solving skills. Innovativeness in human behaviour, response and resistance to change. Concept of self, Johari's window model. Defence mechanism. Group dynamics. Group behaviour and conflict management. Decision-making process. Concept of human resource development and human relations. Human interaction, its importance and types. Interpersonal perception and social behaviour.

(B501742) Agri-business Management

2

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional

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arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

(B501743) Lab- Agri-business Management **1**

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

(B501744) Administration of agriculture extension programmes **2**

Contributors to agricultural development - Scientific technology and its dissemination; inputs, finance, marketing, processing of farm produce and conducive policies. Leadership - types and theories Identification and role of key - communicators opinion leaders in dissemination of scientific technology among farmers. Qualities of a good extension worker. Planning and implementation of agricultural extension projects.

Modules:

(B501745) Development of Entrepreneurial skills in Agribusiness **5**

(B501746) Communication and extension methods **5**

GROUP - VI POST HARVEST TECHNOLOGY AND VALUE ADDITION

(B501747) Fruit and vegetable technology **2**

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Present status and scope of Fruit & Vegetable Industry in India. Principles and preservation of fruits and vegetables by thermal processing, low temperature, chemicals, irradiation, salt, sugar and high pressure. Preparation of jams, jellies, marmalades, juices, squashes, ketchup, pickles, chutneys, wine and vinegar. Role of pectin in gel formation. Quality characteristics of fruit and vegetable products. Selection of site, design, layout, equipment, machinery and buildings. Plant sanitation. Disposal of wastes from fruit and vegetable processing plants. Project formulation and evaluation.

(B501748) Lab- Fruit and vegetable technology **1**

Canning of fruits and vegetables. Dehydration of fruits and vegetables. Preparation of fruit juices, squashes, jams, jellies, marmalades, ketchup, pickles, chutneys, preserve, candy, wine and vinegar. Organoleptic evaluation of fruit and vegetable products. Visit to food industry.

(B501749) Cereal technology **2**

Structure of different grains-wheat, rice, barley, oat, corn and millets. Milling of grains. Flour and its use in bakery products- bread, biscuits, cakes, dough nuts and buns. Milling and parboiling of paddy. Rice bran oil. Pearling and malting of barley. Preparation of oat flakes and dalia. Wet and dry milling of corn. Preparation of extruded products. Sanitation of cereal processing plant. Project formulation and evaluation.

(B501750)Lab- Cereal technology **1**

Determination of quality characteristics of wheat, wheat flour and atta. Rice milling and parboiling. Pearling and malting of barley. Preparation of chapattis, bread, biscuits, cakes, buns, rusks, flat bread, broken wheat i.e. porridge, puffed and extruded products.

(B501751) Engineering principles in food processing **2**

Unit and Dimensions. Material and energy balances, Size reduction and related energy laws, cleaning, grading, sorting, mixing and material handling. Elementary fluid dynamics and statics, heat transfer, exchanger and psychometrics. Principles of thermal processing, pasteurization, sterilization, refrigeration, freezing, evaporation, dehydration and centrifugal separation.

(B501752) Lab- Engineering principles in food processing **1**

Temperature and moisture content measurements. Performance characteristics of size reduction, separating, mixing and drying equipment. Study of parallel and counter current heat exchangers. Enthalpy calculations of a vat pasteurizer. Energy auditing and canning operations.

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Determination of boiling point rise in concentrated solutions. Measurement of water activity of foods

(B501753) Fundamentals of food microbiology **2**

Introduction and historical development of food microbiology. Food spoilage - sources and prevention by physical and chemical means. Microbiology of food - cereals, meat, poultry, egg, fruits, vegetables, milk, milk products, salt, sugar, etc. Role of microorganisms in fermented foods - bread, malt beverages, wine, vinegar, butter and cheese etc. Microbial enzymes in food processing. Waste water from food industries. Quality control of processed food. Pathogenic bacteria in milk and milk products. Food poisoning and its control.

Modules:

(B501754) Food processing **5**

(B501755) Food preservation **5**

Semester 8th

Rural Agricultural Work Experience (RAWE) **0+20**

After the completion of course work, the students of B.Sc. Agri. (Hons.) will receive training under the compulsory RAWE programme for 20 weeks. The students will attend the one day orientation each in electives: (a) Crop production; (b) Crop Protection. (c) Horticulture; (d) Plant Breeding, and Genetics (e) Post Harvest Technology and Value addition (f) Agri-business Management. The students will attend three weeks Village Attachment Training. Further, they will undergo 12 weeks on-campus training in: (a) Bee-keeping; (b) Mushroom cultivation; (c) Plant Clinic Activities (d) Seed/Nursery Production; (e) Food Processing & Preservation; and (f) Biotechnological Tools in Crop Improvement (g) Soil Testing. Students will also attend 4-week off-campus training in different elective-wise activities. During the last week of the training, the students will submit the report whose evaluation will be done by the concerned teachers on the basis of their performance in orientation, village attachment, on and off-campus training.

RAWE Component-I

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Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

**RAWE Component –II Agro
Industrial Attachment**

1. Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
2. Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing value addition, Agri-finance institutions, etc.

**Activities and Tasks during Agro-Industrial Attachment
Programme**

1. Acquaintance with industry and staff
2. Study of structure, functioning, objective and mandates of the industry
3. Study of various processing units and hands-on trainings under supervision of industry staff
 - Ethics of industry
4. Employment generated by the industry,
 - Contribution of the industry promoting environment
 - Learning business network including outlets of the industry
5. Skill development in all crucial tasks of the industry
6. Documentation of the activities and task performed by the students
 - Performance evaluation, appraisal and ranking of students