COURSE CURRICULUM

B.Sc. (Hons.) Agriculture

(As per 5th Dean's Committee)

FACULTY OF AGRICULTURE

AGRICULTURE UNIVERSITY, JODHPUR

JODHPUR - 342304, RAJASTHAN

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FOREWORD

Agriculture University, Jodhpur was established under Act No. 21 of 2013 for the development of agricultural sciences with objective to achieve excellence in the field of teaching, research and extension. This University has its responsibility in the creation of best human resources having scientific visions to serve for the public and private sectors in the State and the Nation according to the University mandates. The **"Course Curriculum"** of Undergraduate Programme has been compiled and upgraded as per the recommendations of the 5th Dean's Committee formulated by ICAR, New Delhi for the result and skill-oriented quality agricultural education systems to meet the present needs and future challenges of Human Resource Development.

This Curriculum have been prepared semester wise distribution of subjects including course outlines of theory and practical, lecture schedules along with relevant books. Dr. S.R. Kumhar, Dean & Faculty Chairman with his team did splendid work in the compilation of Course Curriculum of UG Programme and I congratulate and appreciate for the publication of syllabi in the present shape on behalf of Agriculture University, Jodhpur. I also acknowledge the contribution of Heads of the Departments and all the Faculty members and supporting staff who helped in the publication of this booklet.

I am sure that booklet **"Course Curriculum"** has covered all the UG courses with syllabus. I believe that this **"Course Curriculum"** will be worthwhile to the students and faculty members of Agriculture faculty.

Date: 27 February, 2023
Place: Jodhpur

(B.R. Choudhary)

Prof. Sita Ram Kumhar
Dean & Faculty Chairman
Faculty of Agriculture
Agriculture University, Jodhpur

MESSAGE

I am delighted to write this message about Course Curriculum for Agriculture faculty of Agriculture University, Jodhpur. The **Course Curriculum** of UG Programme has been prepared as per recommendation of 5th Dean's Committee under the auspices of Indian Council of Agricultural Research, New Delhi. The present document contains syllabus with semester wise distribution of subjects, lecture schedules and suggested relevant reference books and being published as per the suggestions of Course Committee and approval of Academic Council and Board of Management of the University. This is upgraded version of Course Curricula, which includes some additional and important topics related to local requirement in Agriculture.

I express my deep sense of gratitude to Prof. B.R. Choudhary, Hon'ble Vice-Chancellor, Agriculture University, Jodhpur for inspiration, guidance and encouragement to publish this document. I take this opportunity to express my sincere appreciation to all Heads of Departments for their valuable suggestions in the publication of the Course Curriculum. Further, I must appreciate the work of Academic cell to give this shape of the Course Curriculum.

I am sure that this publication would prove useful for the Teachers, Students and the entire faculty of Agriculture University, Jodhpur.

Date: 27 February, 2023
Place: Jodhpur

(Sita Ram Kumhar)

Programme: B.Sc. (Hons.) Agriculture

SEMESTER WISE DISTRIBUTION OF COURSES

Semester-I			
Course No.	**Course Title**	**Credits**	**Page No.**
HORT-111	Fundamentals of Horticulture	2(1+1)	6-7
BIOCHEM-111	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)	7-9
SSAC-111	Fundamentals of Soil Science	3(2+1)	9-11
FORT-111	Introduction to Forestry	2(1+1)	12-13
ENG-111	Comprehension and Communication skills in English	2(1+1)	14-15
AGRON-111	Fundamentals of Agronomy	3(2+1)	15-17
BIO-111/ MATHS-111	Introductory Biology*/Elementary Mathematics*	2(1+1)*/ 2(2+0)*	18-19 19-20
AGHR-111#	Agricultural Heritage*	1(1+0)*	21
EXT-111	Rural Sociology and Educational Psychology	2(2+0)	22-23
HVE-111	Human Values and Ethics (non gradial)	1(1+0)**	23
NSS/NCC/PEYP	NSS/NCC/Physical Education and Yoga Practices**	-	24
TOTAL		**17+03*+01****	

***R: Remedial course; **NC: Non-gradial courses #Course shall be taught by Agronomy**

Note: Biology and Agriculture streams students (As per 10 + 2) should opt MATH-111 and *vice-versa*. However, if student have studied both (Biology and Math in 10 + 2), he/she may opt any one out of two on choice basis.

Note: NSS/NCC/ PEYP shall run *w.e.f.* 1st semester but Grades will be submitted at the end of 4th semester.

Semester-II			
Course No.	**Course Title**	**Credits**	**Page No.**
GPB-121	Fundamentals of Genetics	3(2+1)	25-27
AGENGG-121	Soil and Water Conservation Engineering	2(1+1)	27-28
PPHY-121	Fundamentals of Crop Physiology	2(1+1)	28-30
AGECON-121	Fundamentals of Agricultural Economics	2(2+0)	30-32
PPATH-121	Fundamentals of Plant Pathology	4(3+1)	32-34
PPATH-122@	Agricultural Microbiology	2(1+1)	35-36
ENTO-121	Fundamentals of Entomology	4(3+1)	36-40
EXT-121	Fundamentals of Agricultural Extension Education	3(2+1)	40-42
AGRON-121	Farming System and Sustainable Agriculture	2(1+1)	42-44
NSS/ NCC/PEYP	NSS/NCC/Physical Education and Yoga Practices**	To be continued	45
TOTAL		**24(16+8)**	

@Course shall be shared with Soil Science

Semester-III			
Course No.	**Course Title**	**Credits**	**Page No.**
AGRON-211	Crop Production Technology – I (*Kharif* Crops)	2(1+1)	46-47
GPB -211	Fundamentals of Plant Breeding	3(2+1)	47-50
AGECON-211	Agricultural Finance and Cooperation	3(2+1)	50-52
AGRINFO-211©	Agricultural Informatics	2(1+1)	52-54
AGENGG-211	Farm Machinery and Power	2(1+1)	54-55
HORT-211	Production Technology for Vegetables and Spices	2(1+1)	56-57
ESDM-211©	Environmental Studies and Disaster Management	3(2+1)	58-61
STAT-211	Statistical Methods	2(1+1)	61-62
LPM-211	Livestock and Poultry Management	4(3+1)	63-64
NSS/NCC/PEYP	NSS/NCC/Physical Education and Yoga Practices**	To be continued	65
	Total	**23(14+9)**	

©**Common course**

Semester-IV				
Course No.	**Course Title**		**Credits**	**Page No.**
AGRON-221	Crop Production Technology –II *(Rabi Crops)*		2(1+1)	66-67
HORT-221	Production Technology for Ornamental Crops, MAP and Landscaping		2(1+1)	67-69
AGENGG-221	Renewable Energy and Green Technology		2(1+1)	69-70
SSAC-221	Problematic Soils and their Management		2(1+1)	70-72
HORT-222	Production Technology for Fruit and Plantation Crops		2(1+1)	72-73
GPB -221	Principles of Seed Technology		3(1+2)	74-76
AGECON-221	Agricultural Marketing, Trade and Prices		3(2+1)	76-79
EXT-221	Communication Skills and Personality Development		2(1+1)	79-80
AGRON-222	Introductory Agro-Meteorology and Climate Change		2(1+1)	81-82
NSS/NCC/PEYP	NSS/NCC/Physical Education and Yoga Practices**		2(0+2)**	83
Elective course	**Course No.**	**Course Title**		
Group-I	HORT-223	Hi-tech Horticulture	3(2+1)*	84-85
Group-II	ENTO-221#	Bio-pesticides and Bio-fertilizers	3(2+1)*	85-87
Group-III	GPB -222	Commercial Plant Breeding	3(1+2)*	87-89
	Total		**20(10+10)+ 2** + 3* (Elective)**	

#Course shall be shared with Soil Science

***Elective, ****NC:** Non-gradial courses

***Note:** A student shall be required to opt any one of the group out of the three listed group. He/she shall be required to submit preferences for these groups and no *inter-alia* group course will be permitted during 5th and 6th semester respectively.

Semester-V				
Course No.	**Course Title**		**Credits**	**Page No.**
PPATH-311#	Principles of Integrated Pest and Disease Management		3(2+1)	90-91
SSAC-311	Manures, Fertilizers and Soil Fertility Management		3(2+1)	92-93
ENTO-311	Pests of Crops and Stored Grain and their Management		3(2+1)	94-96
PPATH-312	Diseases of Field and Horticultural Crops and their Management –I		3(2+1)	96-99
GPB -311	Crop Improvement-I *(Kharif Crops)*		2(1+1)	99-101
EXT-311	Entrepreneurship Development and Business Communication		2(1+1)	101-103
AGRON-311	Geoinformatics and Nano-technology and Precision Farming		2(1+1)	103-105
AGRON-312	Practical Crop Production – I (*Kharif* crops)		2(0+2)	105
GPB -312	Intellectual Property Rights		1(1+0)	106-107
Elective course	**Course No.**	**Course Title**		
Group-I	HORT-311	Protected Cultivation	3(2+1)*	108-109
Group-II	AGRON-313	Weed Management	3(2+1)*	109-111
Group-III	GPB -313	Micro Propagation Technologies	3(1+2)*	111-112
	Total		**21(12+9)+3* (Elective)**	

#Course shall be shared with Entomology

Semester-VI				
Course No.	**Course Title**		**Credits**	**Page No.**
AGRON-321	Rainfed Agriculture and Watershed Management		2(1+1)	113-115
AGENGG-321	Protected Cultivation and Secondary Agriculture		2(1+1)	115-116
PPATH-321	Diseases of Field and Horticultural Crops and their Management-II		3(2+1)	117-119
HORT-321	Post-harvest Management and Value Addition of Fruits and Vegetables		2(1+1)	119-121
ENTO-321	Management of Beneficial Insects		2(1+1)	121-123
GPB-321	Crop Improvement-II *(Rabi crops)*		2(1+1)	123-125
AGRON-322	Practical Crop Production –II (*Rabi* crops)		2(0+2)	126
AGRON-323#	Principles of Organic Farming		2(1+1)	127-128
AGECON-321	Farm Management, Production and Resource Economics		2(1+1)	128-130
FSN-321	Principles of Food Science and Nutrition		2(2+0)	130-131
Elective course	**Course No.**	**Course Title**		
Group-I	HORT-322/ FSN-322	Landscaping/ Food Safety and Standards	3(2+1)*	132-133 134-135
Group-II	ENTO-322#/ AGRON-324	Agrochemicals/ System Simulation and Agro-advisory	3(2+1)*	135-137 137-139
Group-III	AGECON-322/ EXT-321	Agribusiness Management / Agricultural Journalism	3(2+1)*	140-141 142-143
ET-321	Educational Tours		2(0+2)**	143
	Total		**21(11+10) + 3* (Elective) +2****	

#Course shall be shared with Soil Science
*Elective course, ****NC:*** Non-gradial courses

Semester-VII (STUDENT READY)				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA)				
S.No.	**Activities**	**No. of weeks**	**Credit Hours**	**Page No.**
1.	General Orientation & On Campus Training by different Faculties	1	14	144
2.	Village Attachment	8		
3.	Unit Attachment in University/ College/ KVK/Research Station Attachment	5		
4.	Plant Clinic	2	2	
5.	Agro-Industrial Attachment	3	4	
6.	Project Report Preparation, Presentation and Evaluation	1	-	
	Total weeks for RAWE & AIA	20	**20**	

Agro- Industrial Attachment: The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.

Semester-VIII (STUDENT READY)			
Experiential Learning Programme (ELP)/ Hands on Training (HOT)			
S.No.	**Module**	**Credit Hr.**	**Page No.**
1.	Module-I	0+10	145-147
2.	Module-II	0+10	
	Total	**20 (0+20)***	

*Students shall opt only two modules from 12 listed ELP/HOT courses (At Page No. 145-147).

Modules for Skill Development and Entrepreneurship: This program will be undertaken by the students preferably during the eighth semester for a total duration of 24 weeks with a weightage of **0+20** Credit Hours. The students will register for any of two modules, listed below, of **0+10** credit hours each. The student undergoing ELP has to be allowed to register for a maximum two courses.

Module No.	Course No.	Title of the module	Credits	Page No.
Module-I	GPB-421	Seed Production and Technology	0+10	145
Module-II	PPATH-421	Mushroom Cultivation Technology	0+10	145
Module-III	PPATH-422*	Production Technology for Bio-agents and Bio-fertilizer	0+10	145
Module-IV	SSAC-421	Soil, Plant and Water Testing	0+10	145
Module-V	ENTO-421	Commercial Beekeeping	0+10	145
Module-VI	LPM-421	Poultry Production Technology	0+10	146
Module-VII	HORT-421	Commercial Horticulture	0+10	146
Module-VIII	HORT-422	Floriculture and Landscaping	0+10	146
Module-IX	FP-421	Food Processing	0+10	146
Module-X	SSAC-422#	Agriculture Waste Management	0+10	147
Module-XI	AGRON-421	Organic Production Technology	0+10	147
Module-XII	ENTO-422	Commercial Sericulture	0+10	147
		Total	**0+20**	

* To be shared with Soil Science, #To be shared with Agronomy

Semester wise breakup of credit hours

Semester No.	Regular Courses	Remedial Courses	Non-Gradial Courses	Electives Courses	RAWE	Modules for Skill Development and Entrepreneurship	Total credit hours
I	17	3	1	-	-	-	**21**
II	24	-	-	-	-	-	**24**
III	23	-	-	-	-	-	**23**
IV	20	-	2	3	-	-	**25**
V	21	-	-	3	-	-	**24**
VI	21	-	2	3	-	-	**26**
VII	-	-	-	-	20	-	**20**
VIII	-	-	-	-	-	20	**20**
Total	**126**	**3**	**5**	**9**	**20**	**20**	**183**

B.Sc. (Hons.) Agriculture
Part- I, Semester-I

HORT-111	Fundamentals of Horticulture	2 (1+1)

Theory

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; nursery raising and its importance; importance of plant bio-regulators in horticulture; Irrigation – methods, Fertilizer application in horticultural crops.

Practical

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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Horticulture- Its definition and branches, importance and scope	1
2.	Horticultural and botanical classification	1
3.	Climate and soil for horticultural crops	1
4.	Nursery raising and its importance	1
5.	Plant propagation methods	2
6.	Propagating structures	1
7.	Seed dormancy and seed germination	1
8.	Principles of orchard establishment	2
9.	Principles and methods of training and pruning	1
10.	Juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy	1
11.	Nursery raising and its importance	2
12.	Importance of plant bio-regulators in horticulture	1
13.	Irrigation – methods, fertilizer application in horticultural crops	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of horticultural crops	2
2.	Identification of garden tools	1
3.	Preparation of seed bed/nursery bed	1

4.	Practice of sexual methods of propagation	1
5.	Practice of asexual methods of propagation	1
6.	Micro-propagation	1
7.	Layout and planting of orchard	2
8.	Training and pruning of fruit trees	1
9.	Preparation of potting mixture	1
10.	Fertilizer application in different crops	1
11.	Layout and components of a model nursery	2
12.	Visits to commercial nurseries/orchard	2

Suggested Readings:

1. Singh, Jitendra. 2011. Basic Horticulture. Kalyani Publications, New Delhi.
2. Kumar, N. 1990. Introduction to Horticulture. Rajyalakshmi publications, Nagarcoil, Tamilnadu.
3. Misra, K. K. and Kumar, R. 2014. Fundamentals of Horticulture. Biotech Books.
4. Peter, K. V. 2009. Basic Horticulture. New India Publishing Agency.
5. Prasad, K. and Kumar, U. 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
6. Prasad, S. and Kumar, U. 2010. A Handbook of Fruit Production. Agrobios (India).
7. Salunkhe, D. K. and Kadam, S. S. 2013. A Handbook of Fruit Science and Technology. CRC Press.
8. Singh, N. P. 2005. Basic Concepts of Fruit Science. IBDC Publishers.

BIOCHEM-111 Fundamentals of Plant Biochemistry and Biotechnology 3(2+1)

Theory

Importance of Biochemistry; Properties of Water, pH and Buffer; Carbohydrate: Importance and classification, Reducing and Non-reducing sugars, Structures and properties of Monosaccharides, Disaccharides and Polysaccharides; Lipid: Importance and classification, Structures and properties of fatty acids including membrane lipids; Proteins: Importance and classification, Structures, titration and zwitter ions nature of amino acids, Structural organization of proteins; Enzymes: General properties, Classification, Mechanism of action, Allosteric enzymes; Nucleic acids: Importance and classification, Structure of Nucleotides, Secondary and Tertiary structures; Metabolism of carbohydrates including Glycolysis, TCA cycle and Electron transport chain; Metabolism of lipids: Beta oxidation and Biosynthesis; Plant Biotechnology; Concepts, Scope and applications; Scope and applications of organ cultures, embryo, cell suspension, callus, anther, pollen and ovule culture; Micro-propagation methods: Organogenesis, Embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance, Somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement and Cryo-preservation; Introduction to recombinant DNA methods: Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics: PCR techniques and its applications including Molecular Markers in crop improvement and Biotechnology regulations.

Practical

Preparation of solution, pH and buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Estimation of amino acids/lipids, 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 and gel electrophoresis techniques.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance of biochemistry: Properties of water, pH and buffer	1
2.	Carbohydrate: Importance and classification, reducing and non-reducing sugars	1
3.	Structures and properties of monosaccharides, disaccharides and polysaccharides	2
4.	Lipid: Importance and classification	1
5.	Structures and properties of fatty acids including membrane lipids	1
6.	Proteins: Importance and classification, structures	2
7.	Titration and zwitter ion nature of amino acids	1
8.	Structural organization of proteins	1
9.	Enzymes: General properties, classification	1
10.	Mechanism of action, allosteric enzymes	1
11.	Nucleic acids: Importance and classification, structure of nucleotides	1
12.	Secondary and tertiary structures of nucleic acids	1
13.	Metabolism of carbohydrates including glycolysis	1
14.	TCA cycle and electron transport chain	2
15.	Metabolism of lipids: Beta oxidation and biosynthesis	1
16.	Plant Biotechnology: Concepts, scope and applications	1
17.	Scope and applications of organ cultures, embryo, cell suspension, callus, anther, pollen and ovule culture	2
18.	Micro-propagation methods: Organogenesis, embryogenesis, synthetic seeds and their significance	2
19.	Embryo rescue and its significance	1
20.	Somatic hybridization and cybrids	2
21.	Somaclonal variation and its use in crop improvement and cryo-preservation	1
22.	Introduction to recombinant DNA methods: Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods	2
23.	Transgenics: PCR techniques and its applications	1
24.	Molecular Markers in crop improvement and biotechnology regulations	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Preparation of solution, pH and buffers	2
2.	Qualitative tests of carbohydrates	1
3.	Qualitative tests of amino acids	1
4.	Quantitative estimation of glucose/ proteins	1
5.	Estimation of amino acids/lipids	1
6.	Paper chromatography	1
7.	TLC demonstration for separation of amino acids/ monosaccharides	1
8.	Sterilization techniques	1
9.	Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium	1
10.	Callus induction from various explants	1
11.	Micro-propagation, hardening and acclimatization	1
12.	Demonstration on isolation of DNA	2
13.	Demonstration of gel electrophoresis techniques	2

Suggested Readings:

1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2nd Edn, Oxford IBH Publishing New Delhi.
2. Goodwin, T. W. and Mercer, E. L. 1998. Introduction to Plant Biochemistry. CBS Publishers and Distributors, New Delhi.
3. Lehninger, A. L. 2004. Principles of Biochemistry. Freeman and Company, USA.
4. Nelson, D. L. and Michael, M. C. 2004. Principles of Biochemistry. Freeman Publishers Narayanan L M. Biochemistry. Saras Publications.
5. Purohit, S. S. 2004. Biotechnology: Fundamentals and Applications. 3rd Edn, Student Edition, Jodhpur.
6. Rameshwar, A. 2006. Practical Biochemistry (3 rd edit), Kalyani Publishers, New Delhi.
7. Sadashiv, S. and Manickam, A. 1996. Biochemical methods for Agricultural sciences. New age International publishers, New Delhi.
8. Sahney, S. K. and Singh, R. R. 2002. Introductory Practical Biochemistry. Narosa Publishing House, New Delhi.
9. Singh, B. D. 2007. Biotechnology: Expanding Horiozon, Kalyani Publishers.
10. Yadav, V. K. and Yadav, N. 2007. Biochemistry and Biotechnology-A Laboratory Manual, Pointer Publishers, Jaipur.

SSAC-111 Fundamentals of Soil Science 3 (2+1)

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistency and plasticity; 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 organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Soil as a natural body, pedological and edaphological concepts of soil	1
2.	Origin of earth crust, definition and composition	1
3.	Soil genesis: soil forming rocks and their classification	1
4.	Minerals and their classification	1
5.	Weathering: Physical, chemical and biological weathering of rocks	1
6.	Factors of soil formation	1
7.	Pedogenic processes/soil forming processes	2
8.	Soil profile, components of soil	1
9.	Soil physical properties: Soil texture, classifications of soil separates, particle size analysis, stoke's law	2
10.	Soil structure and classification	1
11.	Soil consistency: Dry, moist and wet soil consistence, agricultural significance, factors affecting it, Atterberg's limit	1
12.	Bulk density, particle density and porosity, factors affecting them, agricultural significance and manipulation	1
13.	Soil colour and significance	1
14.	Soil taxonomy classification	2
15.	Soils of India	1
16.	Soil water classification, soil water retention	1
17.	Movement of soil water-infiltration, percolation, permeability and drainage and factors affecting it	1
18.	Methods of soil moisture determination: - Gravimetric method, electrical resistance and neutron scattering method	1
19.	Soil air, composition, gaseous exchange, problem and plant growth	1
20.	Soil temperature: Source, amount and flow of heat in soil	1
21.	Soil reaction-pH, effect of pH on nutrient availability	1
22.	Soil acidity and alkalinity, buffering	1
23.	Soil colloids: types, properties and their significance	1
24.	1:1, 2:1and 2:1:1 types of layer silicates, their structure and characteristics	1
25.	Sources of charges on soil colloids	1

26.	Cation and anion exchange phenomenon and factors influencing ion exchange and significance, base saturation	1
27.	Soil organisms: macro and micro-organisms, their beneficial and harmful effects	1
28.	Soil pollution behaviour of pesticides and inorganic contaminants	1
29.	Prevention and mitigation of soil pollution	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of soil profile in field	1
2.	Study of soil sampling tools, collection of representative soil sample, its processing and storage	2
3.	Study of soil forming rocks and minerals	2
4.	Determination of bulk density of undisturbed soil by core sampler method	1
5.	Determination of bulk density of disturbed soil sample	1
6.	Determination of particle density of soil & computation of total pore space of soil	1
7.	Estimation of soil moisture by direct method (Gravimetric method)	1
8.	Determination of soil texture by feel method	2
9.	Determination of soil texture by Bouyoucos hydrometer method	1
10.	Determination of soil pH and electrical conductivity	1
11.	Determination of cation exchange capacity of soil	1
12.	Determination of soil colour by Munsell colour chart	1
13.	Estimation of organic matter content of soil	1

Suggested Readings:

1. Biswas, T. D. and Mukherjee, S. K. 2006. Text Book of Soil Science. Tata McGraw Hill publishing Co. Ltd, New Delhi.
2. Brady, N. C. and Well, R. R. 2014. Nature and properties of soils. Pearson Education Inc., New Delhi.
3. Chopra, S. L., Kanwar, J. S. and Rakshit, A. 2013. Analytical Agricultural Chemistry, Kalyani Publishers Ludhiana.
4. Das, D. K. 2011. Introductory Soil Science (3rd Edition), Kalyani publisher, Ludhiana (India).
5. Gupta, P. K. 2009. Soil, Plant, Water and Fertilizer Analysis (2nd Edition), Agrobios, Jodhpur (India).
6. Indian Society of Soil Science (ISSS) 2002. Fundamentals of Soil Science, IARI, New Delhi.
7. Mehra, R. K. 2004. Text Book of Soil Science, ICAR, New Delhi.
8. Rakshit, A., Raha, P. and Bhadoria, P. B. S. 2015. Principles of Soil Science. Kalyani Publishers, Ludhiana.
9. Sehgal, J. A. 2005. Textbook of Pedology: Concepts and Applications. Kalyani Publishers, New Delhi.
10. हनुमान प्रसाद परेवा एवं अमिताव रक्षित, 2019. मृदा विज्ञान के मूलभूत सिद्धान्त। साईन्टिफिक पब्लिषर्स, जोधपुर।

FORT-111	**Introduction to Forestry**	**2(1+1)**

Theory

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies; Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations; Crown classification; Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning; Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees; Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens; Cultivation practices of two important fast growing tree species of the region i.e. Neem (*Azadirachta indica*) and Ardu (*Ailanthus excelsa*).

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction-definitions of basic terms related to forestry, objectives of Silviculture	1
2.	Forest classification, salient features of Indian Forest Policies	1
3.	Forest regeneration, natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers	2
4.	Artificial regeneration-objectives, choice between natural and artificial regeneration, essential preliminary considerations	2
5.	Crown classification	1
6.	Tending operations-weeding, cleaning, thinning-mechanical, ordinary, crown and advance thinning	1
7.	Forest mensuration-objectives, diameter measurement, instruments used in diameter measurement	1
8.	Non instrumental methods of height measurement - shadow and single pole method	1
9.	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	2

10.	Agroforestry-definitions, importance, criteria of selection of trees in agroforestry, benefits of agroforestry	2
11.	Different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens	1
12.	Cultivation practices of two important fast growing tree species of the region i.e. Neem (*Azadirachta indica*) and Ardu (*Ailanthus excelsa*)	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of tree species	1
2.	Diameter measurements using calipers and tape	2
3.	Diameter measurements of forked, buttressed, fluted and leaning trees	2
4.	Height measurement of standing trees by shadow method, single pole method and hypsometer	2
5.	Volume measurement of logs using various formulae	2
6.	Nursery lay out, seed sowing, vegetative propagation techniques	4
7.	Forest plantations and their management	2
8.	Visits of nearby forest-based industries	1

Suggested Readings:

1. Champion, H. G. and Seth, S. K. 1968. A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi.
2. Chaturvedi, A. N. and Kanna, L. S. 1982. A Handbook on Forest Mensuration. International Book Distributors.
3. Dwivedi, A. P. 1992. Agroforestry: Principles and Practices. Oxford and IBH Publication Co., New Delhi.
4. Dwivedi, A. P. 1992. Principles and Practice of Indian Silviculture, Surya Publication, 420 p.
5. Dwivedi, A. P. 2004. A Text Book of Silviculture. IBD Publishers.
6. Grebner, D. L., Bettinger, P. and Siry, J. P. 2012. Introduction to Forestry and Natural Resources. Academic Press. 508p (Google eBook).
7. Khanna, L. S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi.
8. Mitchell, Beazly. 1981. The International Book of the Forest. Mitchell Beazly Publishers, London.
9. Nair, P. K. R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers.
10. Persson, R. 1992. World Forest Resources. Periodical Experts, New Delhi.
11. Westoby, J. 1991. Introduction to World Forestry. Wiley, 240 p.

ENG-111 Comprehension and Communication Skills in English 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	War Minus Shooting- The sporting Spirit	1
2.	A Dilemma-A layman looks at Science Raymond B. Fosdick	1
3.	You and Your English – Spoken English and broken English G. B. Shaw	1
4.	Reading comprehension	1
5.	Vocabulary: Antonyms, synonyms	1
6.	Homophones, homonyms and words often confused	1
7.	Exercises to help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations	1
8.	Functional grammar: Articles, prepositions, verb, subject verb agreement	1
9.	Transformation, synthesis	1
10.	Direct and indirect narration	1
11.	Written skills: Paragraph writing, precise writing, report writing, proposal writing and letter writing - mechanics of good letter, effective business correspondence, personal correspondence	2
12.	The Style: Importance of professional writing	1
13.	Preparation of curriculum vitae and job applications	1
14.	Synopsis writing	1
15.	Interviews: kinds, importance and process	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures

1.	Listening comprehension: listening to short talks lectures	1
2.	Speeches (scientific, commercial and general in nature)	1
3.	Oral communication – phonetics	1
4.	Stress, intonation	1
5.	Conversation practice	1
6.	Conversation: rate of speech, clarity of voice	1
7.	Speaking and listening – polite conversation	1
8.	Reading skills: reading dialogues	1
9.	Rapid reading	1
10.	Intensive reading	1
11.	Improving reading skills	1
12.	Mock interviews: testing initiative	1
13.	Team spirit	1
14.	Leadership	1
15.	Intellectual ability	1
16.	Group discussion	1

Suggested Readings:

1. Jain, B. S. English Communication Skills, College Book Centre, A-19, Sethi Colony, Jaipur.
2. Lewis, N. 2009. Word Power Made Easy. Goyal Publishers, New Delhi.
3. Mohanraj, J. 2015. Let Us Hear Then Speak. Saje Publishers, New Delhi.
4. Pinker, S. 2014. The Sense of Style: The Thinking Persons' Guide to Writing in the 21st Century. Penguin Publishers, New York.
5. Saxena, Vivek. 2010. English & Communication Skills, Neelkanth Publishers (P) Ltd. B-1178, Mangal Marg, Bapu Nagar, Jaipur.
6. Shukla, Punit. 2011. English Communication Skills (In English & Hindi) - College Book House (P) Ltd. Chaura Rasta, Jaipur.
7. Thomson and Martinet. 1997. "A Practical English Grammar, Exercise Books Vol. I & II" OUP Publication.

AGRON-111 Fundamentals of Agronomy 3(2+1)

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, 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, 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.

Practical

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, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Agronomy- Meaning and its scope	1
2.	Types of seeds, dormancy of seeds	1
3.	Viability of seeds, seed treatment	1
4.	Sowing- Methods, depth, plant density	1
5.	Nursery bed and transplanting	1
6.	Tillage- Definition and types of tillage including minimum and no tillage	1
7.	Tilth- Definition and characteristics of good tilth	1
8.	Crop density and geometry	1
9.	Crop nutrition- Essential nutrients classification, nutrient mobility in plants, factors affecting nutrient availability	1
10.	Functions and deficiency symptoms of primary nutrients	1
11.	Manures and fertilizers	2
12.	Nutrient use efficiency and water resources; soil-plant-water relationship	1
13.	Crop water requirement, water use efficiency, irrigation efficiency; different terms used and their importance	1
14.	Scheduling of irrigation: meaning and different approaches for scheduling irrigation in field crops	1
15.	Surface methods of irrigation; border, furrow, check basin and basin methods	1
16.	Sprinkler and drip methods; their layout, adaptability, advantages and limitations	1
17.	Quality of irrigation water; water logging	1
18.	Weeds – Definition, importance and classification	1
19.	Ecology of weeds, reproduction and seed dissemination	1
20.	Crop-weed competition-concept	1
21.	Concepts of weed prevention, eradication and weed control	1
22.	Concepts of weed management- Principles, physical and cultural methods of weed control	1
23.	Chemical and biological methods of weed control, integrated weed management - An introduction	1
24.	Introduction to herbicides, advantages and limitations of herbicides usages; Allelopathy	1
25.	Classification of herbicides	1
26.	Herbicidal selectivity and resistance	1
27.	Growth and development of crops, factors affecting growth and development	1
28.	Plant ideotypes, crop rotation and its principles	1

29.	Adaptation and distribution of crops	1
30.	Crop management technologies in problematic areas	1
31.	Harvesting and threshing of crops	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of crops, seeds, fertilizers and weeds	1
2.	Identification of common pesticides in agriculture	1
3.	Study of agro-climatic zones of India	1
4.	Methods of herbicide and fertilizer application	1
5.	Study of yield contributing characters and yield estimation	1
6.	Seed germination and viability test	1
7.	Numerical exercises on fertilizer requirement of crops	1
8.	Plant geometry and plant population of various crops	1
9.	Herbicides requirement calculations	1
10.	Calculation of water requirements	1
11.	Identification of tillage implements and use of reversible plough, one way plough, harrow, leveler, seed drill	1
12.	Study of soil moisture measuring devices	1
13.	Measurement of field capacity	1
14.	Measurement of bulk density	1
15.	Measurement of infiltration rate	1
16.	Measurement of irrigation water	1

Suggested Readings:

1. Balasubramaniyan, P. and Palaniappan, S. P. 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
2. De, Gopal Chandra. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.
3. Gupta, O. P. 2005. Weed Management: Principles and Practices (2nd Ed) Agribios (India), Jodhpur.
4. Michael, A. M. 1987. Irrigation - Theory and Practice. Vikas Publishing House Pvt. Ltd., New-Delhi.
5. Mishra, R. D. and Ahmed, M. 1987. Manual on Irrigation Agronomy. Oxford & IBH Publishing Co. Pvt. Ltd., New-Delhi.
6. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
7. Porwal, B. L. and Sharma, D. D. 1991. Sasya Vigyan Ke Aadhunik Sindhant (Hindi). Alka Publishers, Ajmer.
8. Rao, V. S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.
9. Reddy, S. R. 2012. Principles of Crop Production (4th edition). Kalyani Publishers, Ludhiana.
10. Reddy, T. Y. and Reddy, G. H. S. 2016. Principles of Agronomy (2nd edition). Kalyani Publishers, Ludhian.
11. Yawalkar, K. S. and Agarwal J. P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House. Nagpur.

BIO-111 Introductory Biology 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to the living world	1
2.	Diversity and characteristics of life	1
3.	Origin of life	1
4.	Evolution and eugenics	1
5.	Binomial nomenclature and classification, cell and cell division	2
6.	Morphology of flowing plants	2
7.	Seed and seed germination	1
8.	Plant systematic- viz; *Brassicaceae*	2
9.	Plant systematic- viz. *Fabaceae*	2
10.	Plant systematic- viz. *Poaceae*	2
11.	Role of animals in agriculture	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Morphology of flowering plants	1
2.	Morphology of root, stem and leaf and their modifications	2
3.	Study of Inflorence	1
4.	Study of flower	1
5.	Study of fruits	1
6.	Microscopic examination of cell and tissues	1
7.	Mitotic cell division using onion root tip	1
8.	Meiotic cell division using PMCs of pearl millet	1
9.	Microscopic study of internal structure of root	1
10.	Microscopic study of internal structure of stem	1
11.	Microscopic study of internal structure of leaf	1
12.	Study of specimens and slides	1
13.	Description of plants — *Brassicaceae* (mustard)	1
14.	Description of plants - *Fabaceae* (mungbean/cowpea)	1
15.	Description of plants — *Poaceae* — (sorghum/pearl millet)	1

Suggested Readings:

1. Agarwal, P. K. 1999. Seed Technology, ICAR, New Delhi.
2. Allard, R. W. 2000. Principles of Plant Breeding. John Willey & Sons, New York.
3. Arora, B. B. and Sabharwal, A. K. 2017. Modern's ABC of Biology. Modern Publishers, Lucknow.
4. Arora, D. K. and Trivedi, P. C. A Text Book of Botany. Ramesh Book Depot, Jaipur.
5. Joshi, A. K. and Singh, B. D. 2005. Seed Technology. Kalyani Publishers, New Delhi.
6. Sharma, R. C. 2014. Systematic Biology. Kalyani Publisher.
7. Singh, B. D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

MATHS-111 Elementary Mathematics 2(2+0)

Theory

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

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

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Straight lines : Distance formula, section formula (internal and external division), change of axes (only origin changed), equation of co-ordinate axes, equation of lines parallel to axes	1
2.	Slope intercept form of equation of line, slope-point form of equation of line, two point form of equation of line, intercept form of equation	2

	of line, normal form of equation of line, general form of equation of line, point of intersection of two st. lines	
3.	Angles between two st. lines, parallel lines, perpendicular lines, angle of bisectors between two lines, area of triangle and quadrilateral	1
4.	Circle: Equation of circle whose centre and radius is known, general equation of a circle, equation of circle passing through three given points, equation of circle whose diameters is line joining two points (x_1, y_1) and (x_2, y_2), tangent and normal to a given circle at given point (Simple problems), condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$	2
5.	Functions, evaluation of functions, operations with functions	2
6.	Limits, continuity, $\lim_{x \to a} \frac{x^n - a^n}{x - a}$ $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$	2
7.	Problems on continuity	1
8.	Differentiation of $x^n, e^x, \sin x$ & $\cos x$ from first principle	2
9.	differentiation of sum and product of functions	1
10.	Quotient Rule, function of functions	2
11.	Differentiation of function of functions, parametric equation	2
12.	Logarithmic differentiation	1
13.	Differentiation of inverse trigonometric functions	1
14.	Successive differentiation, maxima and minima	2
15.	Integration formulae	1
16.	Integration by substitution	1
17.	Integration by parts	1
18.	Definite integration	1
19.	Area under curves	1
20.	Matrices, matrix addition, equality of matrices, square matrix, identity, null matrix	2
21.	Subtraction, scalar multiplication, matrix multiplication, transpose of a matrix	1
22.	Determinants	1
23.	Inverse up to 3rd order	1

Suggested Readings:

1. Gokhroo, D. C. and Jain, Krishi Ganita, Alka Publication, Ajmer.
2. Gokhroo, D.C. Differential calculus.
3. Gokhroo, D.C. Integral calculus.
4. Pandey R.K. Basic Mathematics.

AGHR-111 Agricultural Heritage 1 (1+0)

Theory

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to indian agricultural heritage	1
2.	Ancient agricultural practices	1
3.	Relevance of heritage to present day agriculture	1
4.	Past and present status of agriculture and farmers in society	2
5.	Journey of Indian agriculture and its development from past to modern era	1
6.	Plant production and protection through indigenous traditional knowledge	2
7.	Crop voyage in India and world	1
8.	Agriculture scope- Importance of agriculture and agricultural resources available in India	2
9.	Crop significance and classifications	2
10.	National agriculture setup in India	1
11.	Current scenario of Indian agriculture	1
12.	Indian agricultural concerns and future prospects	1

Suggested Readings:

1. ICAR, 1989. Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
2. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi. (http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf)
3. Kumari, D. and Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy, Udaipur.
4. Nene, Y. L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri- Histroy Foundation, Secunderabad, Andhra Pradesh.
5. Nene, Y. L. and Choudhary, S. L. 2002. Agricultural Heritage in India. Asian Agri-History Foundation (AAHF), Secunderabad, Rajasthan Chapter of AAHF, Udaipur
6. Nene, Y. L., Choudhary, S. L. and Saxena, R. C. 2010. Textbook on Ancient History of Indian Agriculture, Asian Agri-History Foundation.
7. Mohammed, Noor. 1992. Origin, diffusion and development of agriculture. In: Noor Mohammed (ed.), New Dimensions in Agricultural Geography: Vol.1.Historical Dimensions of agriculture. Concept publishing Co., New Delhi. Pp 29-75.
8. Randhawa, M. S. 1980-1986. A History of Agriculture in India Vol I to IV Indian Council of Agricultural Research, New Delhi.

EXT-111 Rural Sociology and Educational Psychology 2(2+0)

Theory

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 and Development. Educational psychology: Meaning and its importance in agriculture extension. Behaviour: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Sociology and rural sociology: Meaning, definition and scope, its significance in agriculture extension	1
2.	Social ecology: Definition, objectives, history and social ecology in Indian context	2
3.	Rural society: Important characteristics, differences, relationship between rural and urban societies	2
4.	Social groups: Meaning, definition, classification, factors considered in formation and organization of groups	2
5.	Social stratification: Meaning, definition, functions, forms of social stratification	2
6.	Culture concept: Culture, customs, folkways, mores, taboos, rituals and traditions - meaning, definition and their role in agricultural extension	3
7.	Social institution: Meaning, definition, major institutions in rural society, functions	3
8.	Social change and development: Meaning, definition, nature of social change and factors of social change	2
9.	Educational psychology: meaning and its importance in agriculture extension.	3
10.	Behavior: Cognitive, affective, psychomotor domain	2
11.	Personality- Meaning, definition, types, factors influencing the personality and role of personality in agricultural extension	2
12.	Teaching learning process - Meaning and definition of teaching, learning, learning experience and learning situation, elements of learning situation and its characteristics	4
13.	Motivation; Meaning, definition, importance in extension, theories of motivation	2
14.	Intelligence - Meaning, definition, types, factors affecting intelligence	2

Suggested Readings:

1. Bhatia, H. R. 1965. A Text Book of Educational Psychology. Asia Publishing House, New Delhi.
2. Bhushan, V. and Sachdeva, D. R. 2010. An Introduction to Sociology. Kitab Mahal , New Delhi.

3. Chidambaram, J. B. 1973. Introductory rural sociology. New York, John Wilex and Sons.
4. Chitamber, J. B. 1990. Introductory Rural Sociology. Willey Easter Ltd. New Delhi.
5. Dahama, O. P. and Bhatnagar, O. P. 1985. Education and Communication for Development. Oxford and IBH Publishing Company, New Delhi.
6. Doshi, S. L. 2007. Rural sociology. Rawat Publishers, Delhi.
7. Pujari, D. 2002. Educational Psychology in Agriculture. Agrotech Publishing Academy, Udaipur (Raj.).
8. Rao, C. N. S. 2015. Sociology, S. Chand & Company, New Delhi.
9. Sharma, K. L. 1997. Rural Society in India. Rawat Publishers, Delhi.

HVE-111 Human Value and Ethics 1 (1+0)

Theory

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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Values and ethics-An introduction	1
2.	Goal and mission of life	1
3.	Vision of life	1
4.	Principles and philosophy	1
5.	Self exploration, self awareness	2
6.	Self satisfaction, decision making	2
7.	Motivation, sensitivity, success, selfless service	3
8.	Case study of ethical lives, positive spirit, body, mind and soul	2
9.	Attachment and detachment	1
10.	Spirituality quotient	1
11.	Examination	1

Suggested Readings:

1. Gaur, R. R., Sangal R. and Bagaria G. P. 2011. A Foundation Course in Human Values and Professional Ethics. Excel Books.
2. My Idea of Education: Dr. Kiran Walia, The General Secretary, Ramakrishna math and Ramakrishna Mission. Belur Math. Howrah District West Bengal 71 1202 India.
3. Sharma, R. P. and Sharma M. 2011. Value Education and Professional Ethics. Kanishka Publishers.
4. Srivastava, S. 2011. Human Values and Professional Ethics. S K Kataria & Sons.
5. Swami Vivekananda, Youth and Modern India, Ramakrishna Mission, Chennai.

NSS	National Service Scheme I	-

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

NCC	National Cadet Corps	-

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

PEYP	Physical Education and Yoga Practices	-

Teaching of skills of Football, Basketball, Kabaddi, Badminton and Table Tennis – their demonstration, practice of the skills, correction, involvement in game situation; Teaching of advance skills of Football, Basketball, Kabaddi, Badminton and Table Tennis – involvement of all the skills in game situation with teaching of rules of the game; Teaching of some of Asanas – demonstration, practice, correction and practice; Teaching – Meaning, Scope and importance of Physical Education; Teaching – Definition, Type of tournaments; Teaching– Physical Fitness and Health Education; Construction and layout of the track and field.

B. Sc. (Hons.) Agriculture
Part- I, Semester-II

GPB-121	Fundamentals of Genetics	3 (2+1)

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity; Cell division-mitosis and meiosis; Probability and Chi-square; Dominance relationships, gene interaction; Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping; Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics; Mutation, classification, Methods of inducing mutations and CIB technique, mutagenic agents and induction of mutation; Qualitative and Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples; Cytoplasmic inheritance; Genetic disorders; Nature, structure and replication of genetic material; Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Pre and post mendelian concepts of heredity	1
2.	Mendelian principles of heredity	1
3.	Cell division- mitosis	1
4.	Cell division- meiosis	1
5.	Probability and Chi-square	1
6.	Dominance relationships and gene interaction	1
7.	Epistatic gene interactions with examples (complementary, supplementary, duplicate gene interactions)	1
8.	Epistatic gene interactions with examples (masking, inhibitory, polymeric and additive gene interactions)	1
9.	Multiple alleles, pleiotropism and pseudo alleles and blood group genetics	1
10.	Sex determination	1
11.	Sex limited, sex influenced and sex-linked traits	1
12.	Sex linkage	1
13.	Linkage and its estimation	1
14.	Crossing over- introduction and mechanisms	1

15.	Chromosome mapping	1
16.	Structural variations in chromosome and their implications	1
17.	Numerical variations in chromosome and their implications	1
18.	Use of haploids, dihaploids and doubled haploids in Genetics	1
19.	Mutation- introduction, characteristics and classification	1
20.	Methods of inducing mutations and CIB technique, mutagenic agents and induction of mutation	1
21.	Qualitative and quantitative traits	1
22.	Polygenes and continuous variations	1
23.	Multiple factor hypothesis	1
24.	Cytoplasmic inheritance	1
25.	Genetic disorders	1
26.	Nature, structure and replication of genetic material	1
27.	Proof for DNA as genetic material	1
28.	Replication of genetic material	1
29.	Genetic code & protein synthesis	1
30.	Transcription and translational mechanism of genetic material	1
31.	Gene concept: Gene structure and function	1
32.	Gene regulation, operon concept, Lac and Trp operons	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of microscope: parts and types	1
2.	Study of cell structure	1
3.	Mitosis and meiosis cell division	1
4.	Experiments on monohybrid, test cross and back cross	1
5.	Experiments on dihybrid, test cross and back cross	1
6.	Experiments on trihybrid, test cross and back cross	1
7.	Experiments on epistatic interactions including test cross and back cross	2
8.	Practice on mitotic cell division	1
9.	Practice on meiotic cell division	1
10.	Experiments on probability	1
11.	Experiments on Chi-square test	1
12.	Determination of linkage and cross-over analysis (through two-point test cross and three-point test cross data)	1
13.	Study on sex linked inheritance in Drosophila	1
14.	Study of models on DNA and RNA structures	2

Suggested Readings:

1. Gardner, J., Simmons, M. J. and Snustad, D. P. 2009. Principles of Genetics (8th Ed.). Wiley India Pvt. Ltd., New Delhi.
2. Gupta, P. K. 2016. Cytology, Genetics and Evolution. Rastogi Publications, Meerut. (Hindi Edition).

3. Klug, W. W. and Cummings, M. R. 2005. Concepts of Genetics. Pearson Education (Singapore) Pvt. Ltd., Indian Branch, Pratapganj, New Delhi.
4. Ramchandra, R. K. 2015. Princilpes of Genetics. Jaya Publishing House, Delhi.
5. Singh, B. D. 2001. Fundamentals of Genetics. Kalyani Publishers, Ludhiana.
6. Singh, B. D. 2015. Genetics. Kalyani Publishers, New Delhi.
7. Singh, Pundhan. 2000. Elements of Genetics. Kalyani Publishers, Ludhiana.
8. Strickberger, M. W. 2004. Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

AGENGG-121 Soil and Water Conservation Engineering 2(1+1)

Theory

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

Practical

Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion. Numerical problems on friction head, velocity head, total head and horse power calculation of pumps. Measurement of irrigation water in the field by different methods and related numerical. Study of components of drip and sprinkler system. Study of watershed area.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	General status of soil conservation in India Rajasthan	1
2.	Introduction to soil and water conservation, causes of soil erosion	1
3.	Definition and agents of soil erosion	1
4.	Water erosion: Forms of water erosion	1
5.	Forms of soil erosion-rain drop, sheet, rill and gully erosion: factor affecting soil erosion	1
6.	Gully classification and control measures	1
7.	Soil loss estimation by universal Loss Soil Equation	1
8.	Soil loss measurement techniques	1
9.	Principles of erosion control	1
10.	Introduction to contouring, strip cropping	1
11.	Contour bund. Graded bund and bench terracing	1
12.	Grassed water ways and their design	1
13.	Water harvesting and its techniques	1
14.	Wind erosion: mechanics of wind erosion, types of soil movement	1
15.	Principles of wind erosion control and its control measures	1
16.	Pumps for irrigation	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Calculation of erosion index	1
2.	Estimation of soil loss	1
3.	Measurement of soil loss	1
4.	Preparation of contour maps	1
5.	Design of grassed water ways	1
6.	Design of contour bunds	1
7.	Design of graded bunds	1
8.	Design of bench terracing system	1
9.	Problem on wind erosion	1
10.	Numerical problems on friction head, velocity head, total head and horse power calculation of pumps	2
11.	Measurement of irrigation water in the field by different methods and related numerical	2
12.	Study of different components of drip irrigation system	1
13.	Study of different components of sprinkler irrigation system	1
14.	Visit to nearby watersheds	1

Suggested Readings:

1. Mahnot, S. C., Singh, P. K. and Chaplot, P. C. 2010. Soil and Water Conservation Water Management. Apex Publication House, Udaipur.
2. Mal, B. C. 2014. Introduction to Soil and Water Conservation Engineering. Kalyani Publishers.
3. Michael A. M. 2012. Irrigation: Theory and Practices. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Michael, A. M. and Ojha, T. P. 2012. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
5. Murthy, V. V. N. 1982. Land and Water Management Engineering. Kalyani Publishers, New Delhi.
6. Singh, G., Venkataraman, C., Sastry, G. and Joshi, B. P. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

PPHY-121 Fundamentals of Crop Physiology 2(1+1)

Theory

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, C_3, C_4 and CAM plants. Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Physiology of flowering, 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.

Practical

Preparation of solutions and buffers. 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, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA).

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction: Definition of crop physiology and its importance in Agriculture	1
2.	Plant cell: an Overview	1
3.	Mechanism of diffusion and osmosis, types and significance in plant physiology	1
4.	Absorption of water, transpiration and stomatal physiology	1
5.	Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, Nutrient uptake mechanisms	2
6.	Photosynthesis: Light reactions	1
7.	Dark reactions:C_3, C_4 and CAM plants	1
8.	Respiration: Glycolysis	1
9.	TCA cycle and electron transport chain	1
10.	Fat Metabolism: Fatty acid synthesis and breakdown	1
11.	Physiology of flowering	1
12.	Plant growth regulators: Physiological roles and agricultural uses	2
13.	Physiological aspects of growth and development of major crops	1
14.	Growth analysis, Role of physiological growth parameters in crop productivity	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Preparation of standard solutions; safe laboratory practices	1
2.	Study of plant cells	1
3.	Structure and distribution of stomata in leaf	1
4.	Demonstration of diffusion and imbibitions	1
5.	Demonstration of osmosis	1
6.	Demonstration of plasmolysis	1
7.	Demonstration of root pressure	1
8.	Measurement of transpiration rate	1
9.	Separation of photosynthetic pigments through paper chromatography	1
10.	Estimation of chlorophyll pigments	1

11.	Measurement of photosynthetic rate	1
12.	Measurement of respiration	1
13.	Tissue test for mineral nutrients	1
14.	Estimation of relative water content in plants	1
15.	Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA)	2

Suggested Readings:

1. Bagdi, D. L. 2016. Crop Physiology. New India Publishing Agency, New Delhi.
2. Bala, M., Gupta, S. and Gupta, N. K. 2013. Practicals in Plant Physiology. Scientific Publisher, Jodhpur.
3. Devlin, R. M. and Witham F. H. 1983. Plant Physiology. 4th Ed. CBS Publishers and Distributors, New Delhi.
4. Gupta, N. K. and Gupta, S. 2005. Plant Physiology. Oxford & IBH Publication, New Delhi.
5. Kumar, A. and Purohit, S. S. 1998. Plant Physiology: Fundamental and Application. Agrobotanica 4E 176 J.N. Vyas Nagar, Bikaner.
6. Malick, C. P. and Srivastava, A. K. 2000. Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
7. Noggle, G. R. and Fritz, G. J. 1992. Introductory Plant Physiology. 2nd Ed. Prentice Hill of India (P) Ltd., New Delhi.
8. Pandey, S. N. and Sinha, B. K. 1995. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
9. Salisbury, J. B. and Ross, C. W. 1992. Plant Physiology. Wadswar Publishing Company, Belmont, California.

AGECON-121 Fundamentals of Agricultural Economics 2(2+0)

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis; Nature of economic theory; rationality assumption, concept of equilibrium; Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare; Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development; Demand: meaning, law of demand, demand schedule and demand curve, determinants, Utility theory; law of diminishing marginal utility, equi-marginal utility principle; Consumer's equilibrium, concept of consumer surplus; Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity; Production: process, creation of utility, factors of production, input output relationship; Laws of returns: Law of variable proportions and law of returns to scale; Cost: Cost concepts, short run and long run cost curves; Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply; Market structure: meaning and types of market, basic features of perfectly competitive markets; Price determination under perfect competition in short run; Distribution theory: meaning, factor market and pricing of factors of production; Concepts of rent, wage, interest and profit; National income: Meaning and importance, concepts of national income accounting and approaches to measurement; Population: Importance, Malthusian population theory, current policies and programmes on population control; Money meaning and functions of money, general price index, inflation and deflation; Banking: types of banks, functions of commercial Bank. Tax: meaning, direct and indirect

taxes, agricultural taxation, VAT & GST; Economic systems: meaning of capitalistic, socialistic and mixed economies.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Economics: Meaning, definitions, scope and subject matter	1
2.	Activities, approaches to economic analysis; micro and macro economics, positive and normative analysis	2
3.	Nature of economic theory; rationality assumption, concept of equilibrium	3
4.	Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare	1
5.	Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development	1
6.	Demand: meaning, law of demand, demand schedule and demand curve, determinants	2
7.	Utility theory; law of diminishing marginal utility, equi-marginal utility principle	1
8.	Consumer's equilibrium and derivation of demand curve, concept of consumer surplus	1
9.	Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity	1
10.	Production: process, creation of utility, factors of production, input output relationship	1
11.	Laws of returns: Law of variable proportions and law of returns to scale	1
12.	Cost: Cost concepts, short run and long run cost curves	1
13.	Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply	1
14.	Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets	1
15.	Price determination under perfect competition in short run and long run	1
16.	Distribution theory: meaning, factor market and pricing of factors of production	1
17.	Concepts of rent, wage, interest and profit	1
18.	National income: Meaning and importance, concepts of national income accounting and approaches to measurement	1
19.	Population: Importance, Malthusian and Optimum population theories	1
20.	Current policies and programmes on population control	1
21.	Money: Barter system of exchange and its problems, evolution, meaning and functions of money	1
22.	Classification of money, money supply, general price index, inflation and deflation	1
23.	Banking: types of banks	1
24.	Functions of commercial and central bank, credit creation policy	1
25.	Tax: meaning, direct and indirect taxes, agricultural taxation	1

26.	VAT & GST	1
27.	Economic systems: Concepts of economy and its functions	1
28.	Important features of capitalistic, socialistic and mixed economies, elements of economic planning	1

Suggested Readings:

1. Dewett, K. K. 2005. Modern Economic Theory. S. Chand & Company, New Delhi.
2. Dewett, K. K. and Verma, J. D. 2004. Elementary Economic Theory. S. Chand & Company, New Delhi.
3. Gupta, B. L. 1996. Introduction to Economic Theory. Arya Book Depot, New Delhi.
4. Hill, B. 1980. An Introduction to Economics for Students of Agriculture. Pergaman Press, Oxford.
5. Jathar, G. B. and Beri, S. G. 1996. Elementary Principles of Economics. Oxford University Press (10th Ed.), Delhi.
6. Mishra, S. K. and Puri, V. K. 1996. Indian Economy. Himalaya Publishing House, New Delhi**.**
7. Reddy, S., Raghuram, P., Neelakantan, T. V. and Bhavani D. I. 2004. Agricultural Economics. Oxford and IBH Publishers, New Delhi.
8. Samuelson, P. A. and Nordhaus, W. D. 1987. Economics. McGraw-Hill, Singapore.

PPATH-121 Fundamentals of Plant Pathology 4(3+1)

Theory

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology; History of Plant Pathology with special reference to Indian work; Terms and concepts in Plant Pathology; Pathogenesis; Causes and classification of plant diseases; Important plant pathogenic organisms, different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them; Diseases and symptoms due to abiotic causes; Fungi: general characters, 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; Bacteria and mollicutes: general morphological characters; Basic methods of 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,*) Role of enzymes, toxins and growth regulators in disease development; Defense mechanism in plants**;** Epidemiology: Factors affecting disease development; Principles and methods of plant disease management; Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

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

formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations**.**

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction: Importance of plant diseases, scope and objectives of Plant Pathology	1
2.	History of Plant Pathology with special reference to Indian work	1
3.	Terms and concepts in Plant Pathology. pathogenesis	2
4.	Causes and classification of plant diseases	1
5.	Important plant pathogenic organisms, different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas	2
6.	Viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them	2
7.	Diseases and symptoms due to abiotic causes	1
8.	Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus	2
9.	Reproduction of fungi (asexual and sexual)	1
10.	Nomenclature, Binomial system of nomenclature, rules of nomenclature	1
11.	Classification of fungi. Key to divisions, sub-divisions, orders and classes	1
12.	Bacteria and mollicutes: general morphological characters	1
13.	Basic methods of classification and reproduction	1
14.	Viruses: Nature, structure, replication and transmission	1
15.	Study of phanerogamic plant parasites	1
16.	Nematodes: General morphology and reproduction	1
17.	Classification, symptoms caused by nematodes	1
18.	Nature of damage caused by plant nematodes *Heterodera*	1
19.	Nature of damage caused by plant nematodes *Meloidogyne*	1
20.	Nature of damage caused by plant nematodes *Anguina*	1
21.	Growth and reproduction of plant pathogens	1
22.	Liberation / dispersal and survival of plant pathogens	1
23.	Types of parasitism and variability in plant pathogens	1
24.	Role of enzymes, toxins and growth regulators in disease development	3
25.	Defense mechanism in plants-structural & bio-chemical (Pre and post infection)	2
26.	Epidemiology and factors affecting disease development	1
27.	Diagnosis of plant diseases	1
28.	Disease triangle and tetrahedron	1
29.	Forecasting of plant diseases	1
30.	Plant Quarantine and Inspection - Rules and Regulations	1
31.	Principles of plant disease management	1
32.	Cultural methods of integrated disease management	2
33.	Physical methods – soil solarization, heat treatment etc.	1

34.	Biological methods - Role and mechanisms of biocontrol agents and PGPR	1
35.	Nature, chemical combination, general classification of fungicides and antibiotics, Mode of actions - Methods of application of fungicides	3
36.	Fungicide formulations - Characteristics of an ideal fungicide. Compatibility and phytotoxicity of fungicides - New generation fungicides	2
37.	Safety issues in fungicidal uses. Pest risk analysis	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Acquaintance with various laboratory equipments and microscopy	1
2.	Collection and preservation of disease specimen	1
3.	Preparation of media, isolation and Koch's postulates	1
4.	General study of different structures of fungi	1
5.	Study of symptoms of various plant diseases	1
6.	Study of representative fungal genera	1
7.	Staining and identification of plant pathogenic bacteria	1
8.	Transmission of plant viruses	1
9.	Study of phanerogamic plant parasites	1
10.	Study of morphological features and identification of plant parasitic nematodes	1
11.	Sampling and extraction of nematodes from soil and plant material	1
12.	Method of preparation of temporary mount of nematodes	1
13.	Method of preparation of semi permanent mount	1
14.	Study of fungicides and their formulations	1
15.	Methods of pesticide application and their safe use	1
16.	Calculation of fungicide sprays concentrations	1

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. (5th Ed.). Elsevier Academic Press. 882 p.
2. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. 2014. Introductory Mycology (4th Ed.).Wiley India Pvt Ltd.
3. Dube, H. C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
4. Dube, H. C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur.
5. Jayaraman, J. and Verma, J. P. 2002. Fundamentals of Plant Bacteriology (Reprint, 2015). Kalyani publishers, New Delhi.
6. Mehrotra, R. S. and Aggarawal, A. 2013. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
7. Mishra, A., Bohra, A. and Mishra, A. 2005. Plant Pathology. Agrobios. Jodhpur (India).
8. Nene Y. L. and Thapliyal, P. N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
9. Ravichandra, N. G. 2013. Fundamentals of Plant Pathology. PHI Learning Pvt Ltd. 639p.
10. Singh, R. S. 2013. Introduction to Principles of Plant Pathology. 4th Ed. Oxford & IBH Publishing Company, New Delhi.
11. Walkey, D. G. 1991. Applied Plant Virology (2nd Ed.). Springer.

PPATH-122@	Agricultural Microbiology	2(1+1)

Theory

Introduction to microbial world: Prokaryotic and eukaryotic microbes; Sterilization, disinfection, pasteurization and Koch's postulates; Bacteria: cell structure, growth, Gram positive and Gram negative bacteria, chemoautotrophy and photoautotrophy; Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon; Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles; Biological nitrogen fixation- symbiotic, associative and asymbiotic; Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere; Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

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

@ **Course shall be shared with Soil Science**

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction. Microbial world: Prokaryotic and eukaryotic microbes	1
2.	Sterilization, disinfection and pasteurization and Koch's postulates	1
3.	Bacteria: cell structure, growth, Gram positive and Gram-negative bacteria, chemoautotrophy and photoautotrophy	2
4.	Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon	3
5.	Role of microbes in soil fertility and crop production	1
6.	Carbon, Nitrogen, Phosphorus and Sulphur cycles	2
7.	Biological nitrogen fixation- symbiotic, associative and asymbiotic	1
8.	Azolla, blue green algae and Mycorrhiza	1
9.	Rhizosphere and phyllosphere	1
10.	Microbes in human welfare: Silage production	1
11.	Biofertilizers, biopesticides and biofuel production	1
12.	Biodegradation of agro-waste	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Introduction to microbiology laboratory and its equipments	1
2.	Microscope- parts, principles of microscopy, resolving power and numerical aperture	2

3.	Methods of sterilization	1
4.	Nutritional media and their preparations	3
5.	Enumeration of microbial population in soil- bacteria, fungi, actinomycetes	2
6.	Methods of isolation and purification of microbial cultures	2
7.	Isolation of *Rhizobium* from legume root nodule	1
8.	Isolation of *Azotobacter* and *Azospirillum*from soil	1
9.	Isolation of BGA	1
10.	Staining and microscopic examination of microbes	2

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Alexander, M. 1985. Introduction to Soil Microbiology. John Wiley & Sons, New York.
3. Biswas, T. D. and Mukherjee, S. K. 1990. Text Book of Soil Science. Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Dube, H. C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
5. Mukherjee, N. and Ghosh, T. 1998. Agricultural Microbiology. Kalyani Publishers, New Delhi.
6. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. 1997. Microbiology. Tata McGraw –Hill Edition, 1993. India.
7. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
8. Rao, N. S. 2000. Soil Microbiology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Sharma, P. D. 2010. Microbiology. 3rd edition Rastogi Publishers, Meerut
10. Subba Rao, N. S. 1995. Soil Microorganisms and Plant Growth. Oxford & IBH, New Delhi.
11. Subba Rao, N. S. 1999. Biofertilizers in Agricultural and Agroforestry. Oxford & IBH, New Delhi.
12. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1989. An Introduction to Microbiology. Wiley Publications, New Delhi.
13. Vishunavat, K. and Kolte, S. J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi.

ENTO-121 Fundamentals of Entomology 4(3+1)

Theory

Part – I: History of Entomology in India; Major points related to dominance of Insecta in Animal kingdom; Classification of phylum Arthropoda upto classes; Morphology: Structure and functions of insect cuticle and molting; 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; Major sensory organs like simple and compound eyes, chemoreceptor; Metamorphosis in insects; Types of larvae and pupae; Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (endocrine) and reproductive system, in insects; Types of reproduction in insects.

Part-II: 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, Agroecosystem.

Part-III: Categories of insect pests; IPM: Introduction, history, importance, concept, principles and limitations of IPM; Economic decision levels; Survey, surveillance and forecasting of insect pests. Assessment of insect pest population; Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological, and chemical control; Importance, hazards and limitations of chemical control. Classification, toxicity and formulations of insecticides; Insecticides Act 1968-Important provisions; Symptoms of poisoning, first aid and antidotes; Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.

Part-IV: Systematics: Taxonomy –importance, history and development and binomial nomenclature; Definitions of Biotype, Sub-species, Species, Genus, Family and Order; Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Gryllidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Bombycidae; Coleoptera: Coccinellidae, Gelerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

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 (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	History of Entomology in India	1
2.	Major points related to dominance of Insecta in Animal kingdom	1
3.	Classification of phylum Arthropoda upto classes	1
4.	Morphology: Structure and functions of insect cuticle and molting	1
5.	Body segmentation. Structure of head, thorax and abdomen of grasshopper	2
6.	Structure and modifications of insect antennae	1

7.	Structure and modifications of insect mouth parts	3
8.	Structure and modifications of insect legs	1
9.	Wing venation, modifications and wing coupling apparatus	1
10.	Structure of male and female genital organ	1
11.	Metamorphosis and diapause in insects	1
12.	Types of larvae and pupae	1
13.	Structure and functions of digestive system in insects	1
14.	Structure and functions of circulatory system in insects	1
15.	Structure and functions of excretory system in insects	1
16.	Structure and functions of respiratory system in insects	1
17.	Structure and functions of nervous system in insects	1
18.	Structure and functions of secretary (endocrine) system in insects	1
19.	Structure and functions of reproductive system in insects	1
20.	Types of reproduction in insects	1
21.	Insect Ecology: Introduction, environment and its components	1
22.	Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents	1
23.	Effect of biotic factors – food competition, natural and environmental resistance, agro ecosystem	1
24.	IPM: Categories of pests. Introduction, history, importance, concept, principles and limitations of IPM	1
25.	Economic decision levels	1
26.	Survey, surveillance and forecasting of insect pests. assessment of insect pest population	1
27.	Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological	3
28.	Chemical control: Importance, hazards and limitations. Classification, toxicity and formulations of insecticides	3
29.	Insecticides Act 1968-Important provisions	1
30.	Application techniques of insecticides, symptoms of poisoning, first aid and antidotes	1
31.	Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control	2
32.	Systematics: Taxonomy –importance, history and development and binomial nomenclature	2
33.	Definitions of Biotype, sub-species, species, genus, family and order	1
34.	Orthoptera: Acrididae, Dictyoptera: Mantidae, Blattidae Odonata, Isoptera: Termitidae; Thysanoptera: Thripidae	1
35.	Hemiptera: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae	1

36.	Lepidoptera: Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae	1
37.	Coleoptera: Coccinellidae, Cerambycidae, Curculionidae, Bruchidae	1
38.	Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae	1
39.	Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Methods of collection and preservation of insects including immature stages	1
2.	External features of Grasshopper/Blister beetle	1
3.	Types of insect antennae, mouthparts and legs	1
4.	Wing venation, types of wings and wing coupling apparatus, Types of insect larvae and pupae	1
5.	Dissection of digestive system in insects (Grasshopper)	1
6.	Dissection of male and female reproductive systems in insects (Grasshopper)	1
7.	Study of characters of orders Orthoptera, Dictyoptera and their families	1
8.	Study of characters of orders Isoptera, Thysanoptera and their families	1
9.	Study of characters of orders Hemiptera and its families	1
10.	Study of characters of orders Lepidoptera and its families	1
11.	Study of characters of orders Coleoptera and its families	1
12.	Study of characters of orders Hymenoptera and its families	1
13.	Study of characters of orders Diptera and its families	1
14.	Sampling techniques for estimation of insect population and damage	1
15.	Insecticides and their formulations	1
16.	Pesticide appliances and their maintenance	1

Suggested Readings:

1. Atwal, A. S. and Dhaliwal, G. S. 2002. Agricultural Pests of South Asia and their Management, Kalyani Publishers, New Delhi.
2. Chapman, R. F. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
3. David, B. V. and Ramamurthy, V. V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
4. Dhaliwal, G. S. and Ramesh, A. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi.
5. Dhawan, A. K., Singh, B. and Arora, B. 2012. Theory and Practice of Integrated Pest Management. Scientific Publishers, Jodhpur.
6. Larry, P. Pedigo, 1991. Entomology and Pest Management. Mc Millan Publishing Company, New York.

7. Mathur, Y. K. and Upadhyay, K. D. 2005. A Text Book of Entomology. Aman Publishing House, Meerut.
8. Metcalf, R. L. and Luckman, W. H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
9. Snodgrass, R. E. 2001. Principles of Insect Morphology. CBS Publishers and Distributors, New Delhi.
10. Yazdani, G. S. and Agarwal, M. L. 1979. Elements of Insect Ecology. Naroji Publishing House, New Delhi.

EXT-121 Fundamentals of Agricultural Extension Education 3(2+1)

Theory

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

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India; Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions; Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Education: Meaning, definition and types-Formal, informal and non-formal education	1

2.	Extension Education- Meaning, definition, scope and process; objectives and principles of Extension Education	1
3.	Extension programme planning- meaning, process	1
4.	Principles and Steps in programme development	1
5.	Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.)	2
6.	Extension efforts in post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.)	2
7.	Various extension/ agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP)	2
8.	KVK, IVLP, ORP, ND, NATP, NAIP	2
9.	NARP, ATIC, RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM	1
10.	New trends in agriculture extension: privatization extension, cyber extension/e-extension, market-led extension, farmer-led extension, expert systems, etc.	2
11.	Rural development: concept, meaning, definition; various rural development programmes launched by Govt. of India	2
12.	ICDS, IRDP, NHM, MNREGA, Rajiv Gandhi Scheme for empowerment of Adolescent girls / Boys, Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana	2
13.	Community development -meaning, definition, concept & principles	1
14.	Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context	1
15.	Extension administration: meaning and concept, principles and functions	1
16.	Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes	1
17.	Transfer of technology: concept and models	2
18.	Capacity building of extension personnel	1
19.	Extension teaching methods: meaning, classification	1
20.	Individual contact methods	1
21.	Group contact methods	1
22.	Mass contact Methods- Campaign, Exhibition, Kisan Mela	1
23.	ICT Applications in TOT (New and social media), media mix strategies	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	To get acquainted with university extension system	2
2.	Group discussion- exercise	1
3.	Handling and use of audio visual equipments/aids	1
4.	Handling of digital camera	1
5.	Handling of Liquid Crystal Display (LCD) Projector	1
6.	Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories	2

7.	Presentation skills exercise; micro teaching exercise	1
8.	A visit to village to understand the problems being encountered by the villagers/ farmers	1
9.	To study organization and functioning of DRDA and other development departments at district level	1
10.	Visit to NGO and learning from their experience in rural development	1
11.	Understanding PRA techniques and their application in village development planning	2
12.	Exposure to mass media: visit to community radio and television studio for understanding the process of programme production	1
13.	Script writing, writing for print and electronic media, developing script for radio and television	1

Suggested Readings:

1. Dahama, O. P. and Bhatnagar, O. P. 1998. Education and Communication for Development. Oxford and IBH Publishing Co. New-Delhi.
2. Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension. Concept publishing company, New Delhi.
3. Ray, G. L. 2003. Extension Communication and Management. Naya Prakash, 206 Bidhan Sarni, Calcutta.
4. Reddy, A. A. 2001. Extension Education. Shri Laxmi Press, Baptala.
5. Sharma, O. P. and Somani, L. L. 2012. Dimension of Agricultural Extension. Agroteh Publishing Academy. Udaipur.
6. Supe, S.V. 2013. (2nd Edition), A Text Book of Extension Education. Agrotech Publishing Academy, Udaipur.

AGRON-121 Farming System and Sustainable Agriculture 2(1+1)

Theory

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

Practical

Efficient cropping system and their evaluation, Tools for determining production and efficiencies in cropping and farming system, Site specific development of IFS model for different agro-climatic zones, Resource use efficiency and optimization techniques, Preparation of FYM

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Farming System-scope, importance, and concept	1
2.	Types and systems of farming system and factors affecting types of farming	1
3.	Farming system components and their maintenance	1
4.	Cropping system and pattern, multiple cropping system, efficient cropping system and their evaluation	1
5.	Allied enterprises and their importance, tools for determining production and efficiencies in cropping and farming system	2
6.	Sustainable agriculture-problems and its impact on agriculture	1
7.	Indicators of sustainability, adaptation and mitigation	1
8.	Conservation agriculture strategies in agriculture	1
9.	LEIA (Low external input agriculture), LEISA	1
10.	HEIA (High external input agriculture)	1
11.	Integrated farming system-historical background, objectives and characteristics	1
12.	Components of IFS and its advantages	1
13.	Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques	1
14.	Resource cycling and flow of energy in different farming system, Farming system and environment	1
15.	Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Efficient cropping system of India and Rajasthan	2
2.	Evaluation of efficient cropping system	2
3.	Tools for determining production and efficiencies in cropping and farming system	2
Site specific development of IFS model for different agro-climatic zones		
	(i.) IFS models for dry farming and dryland farming	1
	(ii.) IFS models for irrigated and wetland farming	1
4.	Resource use efficiency: definition, formula and calculation	2
5.	Optimization techniques for better resource use efficiency	1
6.	Preparation of FYM: Materials, methods, procedures, precautions and applications	2
7.	Preparation of vermicompost: Materials, methods, procedures,	2

	precautions and applications	
8.	Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmer's field.	1

Suggested Readings:

1. Balasubramaniyan, P. and Palaniappan, S. P. 2016. Principles and Practices of Agronomy. (2nd edition), Agrobios (India), Jodhpur.
2. Gautam, R. C. and Singh, P. 1997. Tikau Kheti, Bhartia Krishi Anusandhan Parishad, New-Delhi.
3. Palaniappan, S. P. 1985. Cropping Systems in the Tropics: Principles and Management. Wiley Easter Ltd. and TNAU, Coimbatore.
4. Palaniappan, S. P. and Sivraman, K. 1996. Cropping System in Tropics. International Pvt. New- Delhi.
5. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
6. Panda, S. C. 2014. Cropping Systems and Farming Systems. Agrobios (India), Jodhpur.
7. Reddy, S. R. 2016. Principles of Agronomy. (5th edition), Kalyani Publishers, Ludhiana.
8. Shukla, R. K. 2004. Sustainable Agriculture. Surbhee Publications, Jaipur.

NSS	National Service Scheme II	-

Importance and role of youth leadership: Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership; Life competencies: Definition and importance of life competencies, problem-solving and decision-making, inter personal communication; Youth development programmes: Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations; Health, hygiene and sanitation: Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health; Youth health, lifestyle, HIV AIDS and first aid: Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga: History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.

NCC	National Cadet Corps	2 (0+2)**

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

PEYP	Physical Education and Yoga Practices	2 (0+2)**

Teaching of skills of Hockey, Kho-Kho – demonstration practice of the skills and correction; Involvement of all the skills in games situation with teaching of rules of the game; Teaching of different track events – demonstration practice of the skills and correction; Teaching of different track and field events – demonstration practice of the skills and correction with competition among them; Teaching of different asanas – demonstration practice and correction; Teaching of weight training – demonstration practice and correction; Teaching of circuit training – demonstration practice and correction; Teaching of calisthenics – demonstration practice and correction.

B. Sc. (Hons.) Agriculture
Part- II, Semester-I

AGRON-211 Crop Production Technology – I (*Kharif* Crops) 2(1+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops; Cereals – rice, maize, sorghum, pearl millet; pulses-pigeonpea, mungbean, urdbean and mothbean; oilseeds- groundnut, sesame, castor and soybean; fibre crops- cotton; forage crops-sorghum, cowpea, clusterbean and napier.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Rice- origin, distribution, importance, production, soil and climatic requirement, improved varieties, nursery raising, seed and sowing, intercultural operations/ weed management, fertilizer and water management, protection measures, harvesting, processing and yield	2
2.	Crop production technology for maize	1
3.	Crop production technology for sorghum	1
4.	Crop production technology for pearl millet	1
5.	Crop production technology for pigeon pea	1
6.	Crop production technology for mungbean	1
7.	Crop production technology for urdbean and mothbean	1
8.	Crop production technology for groundnut	1
9.	Crop production technology for sesame and castor	1
10.	Crop production technology for soybean	1
11.	Crop production technology for cotton	2
12.	Crop production technology for sorghum	1
13.	Crop production technology for cowpea and clusterbean	1
14.	Crop production technology for napier	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of seeds, crops and other inputs of kharif season	1
2.	Sowing methods of different *kharif* crops	1

3.	Nursery bed preparation of *kharif* crops	1
4.	Working out seed rate, real value, seed size, depth and germination related numerical	1
5.	Seed treatment and preparation of seed material for sowing	1
6.	Preparation of seed material for planting of grasses	1
7.	Fertilizer application in crops, including top dressing and foliar feeding	1
8.	Identification of weeds in *kharif* season crops	1
9.	Morphological description of *kharif* season crops	1
10.	Irrigation operation in various crops	1
11.	Judging physiological maturity in standing crops	1
12.	Cotton seed treatment	1
13.	Effect of seed size on germination and seedling vigour	1
14.	Yield attributes and calculation on theoretical yield and harvest index	1
15.	Study of crop varieties and important agronomic and forage experiments at farm	1
16.	Visit of experiments at farm/research centres of related crops	1

Suggested Readings:

1. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
2. Prasad, Rajendra. 2002. Text Book of Field Crops Production. Volume- I & II. ICAR, New Delhi.
3. Rathore, P. S. 2000. Techniques and Management of Field Crop Production. Agrobios (India), Jodhpur.
4. Singh, Chhidda, Singh, P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
5. Singh, S. S. and Singh, R. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
6. Singh, S. S. and Singh, R. 2015. Principles and Practices of Agronomy. (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

GPB-211 Fundamentals of Plant Breeding 3(2+1)

Theory

Historical development, concept, nature and role of plant breeding, objectives of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and pollination, apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity. Component of Genetic variation; Heritability and genetic advance; Genetic 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 methods of breeding cross

pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; population improvement, Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses. Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

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

Lecture Schedule: Theory

S.No.	Name of topic	No. of lectures
1	Plant breeding: concept, nature, objectives and role of plant breeding	1
2	Historical development of plant breeding	1
3	Major achievements and future prospects	1
4	Genetics in relation to plant breeding	1
5	Modes of reproduction and pollination, apomixes	1
6	Self – incompatibility	1
7	Male sterility- genetic consequences	1
8	Domestication, Acclimatization, introduction, centre of origin/ diversity	1
9	Component of genetic variation; heritability and genetic advance	1
10	Genetic basis of self- pollinated crops and pure line theory	1
11	Breeding methods in self-pollinated crops- mass and pure line selection	1
12	Hybridization techniques	1
13	Handling of segregating population (pedigree, bulk and back cross method)	1
14	Multiline concept	1
15	Concepts of population genetics and Hardy-Weinberg Law	1
16	Genetic basis and methods of breeding cross pollinated crops	1
17	Population improvement and modes of selection	1
18	Heterosis and inbreeding depression	1
19	Development of inbred lines and hybrids	1
20	Composite and synthetic varieties	1

21	Breeding methods in asexually propagated crops	1
22	Clonal selection and hybridization	1
23	Wide hybridization and pre-breeding	1
24	Polyploidy in relation to plant breeding	1
25	Mutation breeding- methods and uses	1
26	Breeding for important biotic and abiotic stresses	1
27	Breeding for important abiotic stresses	1
28	Biotechnological tools-DNA markers	1
29	Marker assisted selection	1
30	Participatory plant breeding	1
31	Intellectual Property Rights and Patenting	1
32	Plant Breeders and & Farmer's Rights	1

Lecturer schedule: Practical

S.No.	Name of topic	No. of lectures
1	Plant Breeder's kit	1
2	Study of germplasm of various crops	1
3	Study of floral structure of self-pollinated crops	1
4	Study of floral structure of cross-pollinated crops	1
5	Emasculation and hybridization techniques in self pollinated crops I	1
6	Emasculation and hybridization techniques in self pollinated crops II	1
7	Emasculation and hybridization techniques in self- & cross-pollinated crops	1
8	Emasculation and hybridization techniques in self- & cross-pollinated crops	1
9	Consequences of inbreeding on genetic structure of resulting populations	1
10	Study of male sterility system	1
11	Handling of segregating populations	1
12	Methods of calculating mean, range, variance, standard deviation, heritability	1
13	Designs used in plant breeding experiment	1
14	Analysis of Randomized Block Design and components of genetic variance	1
15	To work out the mode of pollination in a given crop and extent of natural out crossing	1
16	Prediction of performance of double cross hybrids	1

Suggested Readings:

1. Allard, R. W. 2000. Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G. S. and Ghosal, S. S. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.

3. Chopra, V. L. 2012. Plant breeding: Theory and Practice. Oxford & IBH Publishing CO. Pvt. Ltd., New Delhi.
4. Jain, H. K. and Kharsckwal, M. C. 2004.Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
5. Ramchandra, R. K. 2015. Princilpes of Plant Breeding. Jaya Publishing House, Delhi.
6. Sharma, J. R. 1994. Principles and Practices of Plant Breeding. Tata McGraw Publishing Company Ltd., New Delhi.
7. Singh, B. D. 2006. Plant Breeding. Kalyani Publishing House, New Delhi.
8. Singh, Phundan, 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.

AGECON-211 Agricultural Finance and Cooperation 3(2+1)

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture; Agricultural credit: meaning, definition, need, classification; Credit analysis: 3 R's, 5C's and 7 P's of credits; Sources of agricultural finance: institutional and non-institutional sources, commercial banks and nationalization of commercial banks, Micro financing including KCC; Lead bank scheme, RRBs, Scale of finance and unit cost; An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India; Cost of credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement; Basic guidelines for preparation of project reports.

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 NAFED.

Practical

Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Agricultural Finance- meaning, scope and significance	1
2.	Credit needs and its role in Indian agriculture	1
3.	Agricultural credit: meaning, definition, need, classification	2
4.	Credit analysis: 3R's, 5C's and 7 P's of credits	2
5.	Sources of agricultural finance: institutional and non-institutional sources	1

6.	Commercial banks, nationalization of commercial banks	2
7.	Introduction to micro finance And Kishan Credit Cards	1
8.	Lead bank scheme, RRBs, Scale of finance and unit cost	2
9.	An introduction to higher financing institutions	1
10.	RBI	1
11.	NABARD	1
12.	ADB, IMF, World bank	1
13.	Insurance and Credit Guarantee Corporation of India	2
14.	Cost of credit. Preparation and analysis of financial statements	2
15.	Balance Sheet	1
16.	Income Statement	1
17.	Basic guidelines for preparation of project reports	2
18.	Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture	3
19.	Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives	2
20.	Farmers' service cooperative societies, processing cooperatives, farming cooperatives	1
21.	Cooperative warehousing	1
22.	Role of NAFED	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Optimum allocation of limited amount of capital among different enterprise	2
2.	Analysis of progress and performance of cooperatives using published data	2
3.	Analysis of progress and performance of commercial banks and RRBs using published data	2
4.	Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures	3
5.	Estimation of credit requirement of farm business	1
6.	Preparation and analysis of income statement	2
7.	Appraisal of a loan proposal	2
8.	Techno-economic parameters for preparation of projects	2

Suggested Readings:

1. Johl, S. S. 2012. Essentials of Farm Financial Management, Today and Tomorrow printers and publishers.
2. Krishnaswami, O. R. 1999. Fundamental of Cooperation. S.Chand and Sons pub., Delhi.
3. Mamoria, C. B. 2007. "Agricultural Problems of India". Kitab Mahal publisher.

4. Nelson, A. G. and Murray, W. G. 1988. "Agricultural Finance" IOWA State University Press, Amies, IOWA, USA.
5. Pandey, M. and Tewari, D. 2004. "Rural and Agriculture Marketing".
6. Pandey, U. K. 1990. An Introduction to Agricultural Finance. Kalyani Publishes, New Delhi.
7. Reddy, S. S. and Raghu Ram, P. 1996. "Agricultural Finance and Management" Oxford and IBH, New Delhi.
8. Singh, J. P. 1990. Agricultural Finance: Theory and Practice. Ashish Publishing House, New Delhi.

AGRINFO-211© Agricultural Informatics 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office for document creation & editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, 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, Use of ICT in Agriculture; Computer Models for understanding plant processes; IT application for computation of water and nutrient requirement of crops, 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; Preparation of contingent crop-planning using IT tools.

Practical

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). Introduction of programming languages. Hands on Crop Simulation Models (CSM), Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to computers, anatomy of computers	1
2.	Memory concepts, units of memory, operating system, types of operating system	1
3.	Applications of MS-Office for creating, editing and formatting a document, data presentation	1
4.	Tabulation and graph creation, statistical analysis, mathematical	1

	expressions, database, concepts and types	
5.	Creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components	1
6.	Computer Programming: General concepts, introduction to programming languages	1
7.	Concepts and standard input/output operations	1
8.	e-Agriculture, concepts and applications, Use of ICT in Agriculture	1
9.	Computer Models for understanding plant processes	1
10.	IT application for computation of water and nutrient requirement of crops	1
11.	Computer-controlled devices (automated systems) for Agri-input management	1
12.	Smart phone mobile apps in Agriculture for farm advises, market price, post-harvest management etc.	1
13.	Geospatial technology for generating valuable agri-information	1
14.	Decision support systems, concepts, components and applications in Agriculture	1
15.	Agriculture expert system, soil information systems etc for supporting farm decisions	1
16.	Preparation of contingent crop-planning using IT tools	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of computer components, accessories, practice of important DOS commands	1
2.	Introduction of different operating systems such as windows, Unix, Linux, creating files & folders	1
3.	File Management. Use of MS-WORD	1
4.	MS Powerpoint forcreating, editing and presenting a scientific document	2
5.	MS-EXCEL –Creating a spread sheet, use of statistical tools	2
6.	Writing expressions, creating graphs, analysis of scientific data	1
7.	MS-ACCESS: Creating database	1
8.	Preparing queries and reports, demonstration of Agri-information system	1
9.	Introduction to World Wide Web (WWW) and its components	1
10.	Introduction of programming languages	1
11.	Hands on Crop Simulation Models (CSM)	1
12.	Introduction of geospatial technology for generating valuable information for agriculture	1
13.	Hands on decision support system	1
14.	Preparation of contingent crop planning	1

Suggested Readings:

1. Capron, H. L. 1996. Computers tool for an information age. Benjamin/ Cummings Publishing Company, Inc. New York
2. Date, C. J. 2000. Introduction to Database System. Addison Wesley
3. Jain, S., Jain, S. and Jain, M. 2003. IT Tools and Applications (BPB Publications).
4. Minhas, D. S. and Choudhary, B. R. 2009. Dynamic Memory Computer Course. Dimond books publisher, New Delhi.
5. Nortons, P. 2001. Introduction to computers, 4th ed,Tata McGraw Hill, New Delhi
6. Parekh, R. 2006. Principles of Multimedia. Tata McGraw-Hill.
7. Rapidex Computer Course (Pustak Mahal).
8. Rob, P. and Coronel, C. 2006. Database Systems: Design, Implementation and Management. 7th ed. Thomson Learning.

AGENGG-211 Farm Machinery and Power 2(1+1)

Theory

Status of Farm Power in India, Sources of Farm Power, I. C. engines, working principles of I. C. engines, comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and numerical, 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, Estimation of field capacity and power requirements of implements, Familiarization with Primary and Secondary Tillage implement, implement for intercultural operations, Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I. C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Familiarization with different types of primary and secondary tillage implements: mould board plough, disc plough and disc harrow. Familiarization with seed metering mechanism and calibration of seed drill, Familiarization with different types of sprayers and dusters Familiarization with different inter-culture implement, Familiarization with harvesting and threshing equipments and machinery.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Sources of farm power and its status in India and Rajasthan	1
2.	I.C. engines, working principles of I. C. engines, comparison of two stroke and four stroke cycle engines	1
3.	Study of different components of I. C. engine, I. C. engine terminology and numerical	2
4.	Air supply and exhaust system- Pre cleaners, oil-soaked element type and oil bath type air cleaners; fuel supply system	1

5.	Lubricating system- splash system and forced feed system; cooling system-thermo siphon system and forced circulation system	1
6.	Transmission system- clutch, gear box, differential, final drive, P.T.O. shaft and hydraulic control system	1
7.	Tractor types, Estimation of operational cost of a tractor	1
8.	Familiarization with primary and secondary tillage implement	2
9.	Numerical on field capacity and power requirement of implements	2
10.	Familiarization with implement with intercultural operations	1
11.	Familiarization with sowing and planting equipment	1
12.	Familiarization with plant protection equipment	1
13.	Familiarization with harvesting and threshing equipment	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of different components of I. C. engine	1
2.	To study air cleaning and cooling system of engine	1
3.	Study of transmission system	1
4.	Study of transmission system-clutch, gear box, differential, final drive and P.T.O.	1
5.	Familiarization with brake, steering, hydraulic control system of engine	1
6.	Tractor driving	2
7.	Daily and periodic maintenance of tractor	1
8.	Study of power tiller and garden tractor	1
9.	Study of primary and secondary tillage implements: mould board plough, disc plough	1
10.	Study of secondary tillage implements- cultivators, harrows and hoes	1
11.	Study of seed metering mechanism and calibration of seed drill and numerical	2
12.	Study of different types of sprayers and dusters	1
13.	Study of harvesting machinery - reaper and thresher	2

Suggested Readings:

1. Kumar, S., Kumar, V. and Sahu, R. K. 2016. Fundamentals of Agricultural Engineering. Kalyani Publishers, New Delhi.
2. Michael, A. M. and Ojha, T. P. 2012. Principles of Agricultural Engineering. Vol. I. Jain Brothers, Jodhpur.
3. Nakra, C. P. 1970. Farm Machinery and Equipment. Dhanapat Rai and Sons, New Delhi.
4. Sahay, Jagdishwar. 1992. Element of Agricultural Engineering. Agro. Book Agency, New Chitragupta Nagar, Patna.
5. Singhal, O. P. 1989. Elements of Agricultural Engineering, Vol. I & III. Suraj Prakashan, Allahabad.
6. Srivastava, A. C. 1989. Elements of Farm Machinery. Oxford IBH Publ. Company, Delhi.

HORT-211 Production Technology for Vegetables and Spices 2(1+1)

Theory

Importance of vegetables and spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices; Vegetables: Okra, Tomato, Brinjal, Chilli, Capsicum, Cucumber, Pumpkin, French bean, Peas, Cluster bean; Melons (watermelon and muskmelon); Gourds (bottle gourd, round gourd and bitter gourd), Cole crops (Cabbage, Cauliflower and Knol-khol) Bulb crops (Onion and Garlic); Root crops (Carrot, Radish and Beetroot); Tuber crops (Potato); Leafy vegetables (Amaranth and Palak); Perennial vegetables- (Drumstick and pointed gourd); Spices: Cumin, Coriander, Fennel, Fenugreek, Ginger, Turmeric, Black pepper, Cardamom.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance of vegetables & spices in human nutrition and national economy	1
2.	Classification of vegetables	1
3.	Types of vegetable gardening with special reference to kitchen gardening	1
4.	Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of following important vegetable and spices:	
5.	Vegetables: Tomato, Brinjal, Chilli, Capsicum, Cucumber, French bean, Peas, Okra, Cluster bean, Pumpkin	3
6.	Melons- Watermelon, Muskmelon, Gourds- Bottle Gourd, Round Gourd, Bitter Gourd	1
7.	Cole crops: Cabbage, Knol-khol and Cauliflower	1
8.	Bulb crops: Onion and Garlic	1
9.	Root crops: Carrot, Radish and Beet-root	1
10.	Tuber crops: Potato and Sweet potato	1
11.	Leafy vegetables: Amaranthus and Palak	1
12.	Perennial vegetables: Drumstick and Pointed Gourd	1
13.	Seed spices: Cumin, Coriander, Fennel, Fenugreek, Ginger, Turmeric, Black Pepper and Cardamom	3

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of vegetables & spice crops and their seeds	1
2.	Nursery raising, direct seed sowing and transplanting	1
3.	Study of morphological characters of different vegetables & spices Solanaceous crops (Tomato, Brinjal, Capsicum)	1
4.	Cucurbitaceous crops	1
5.	Bulb crops	1
6.	Beans, Pea and Okra	1
7.	Root crops	1
8.	Tuber crop (Potato and Sweet Potato)	1
9.	Leafy vegetables	1
10.	Seed spices: cumin, coriander, fennel, fenugreek	1
11.	Ginger and Turmeric	1
12.	Black pepper and Cardamom	1
13.	Fertilizers applications	1
14.	Harvesting & preparation for market	1
15.	Economics of vegetables and spices cultivation	2

Suggested Readings:

1. Arora, J. S. 2010. Introductory Ornamental Horticulture. Kalyani Publisher, Ludhiana.
2. Bosse, T. K. 2010. Vegetable Crops. Naya Prakash, Calcutta.
3. Chadha, K. L. 2003. Handbook of Horticulture. ICAR, New Delhi
4. Chaudhary, B. 1996.Vegetables. National Book Trust, New Delhi.
5. Chauhan, D. V. S. 1996. Vegetable Production in India. Publishers Ram Prasad & sons, Agra**.**
6. Choudhary, B. R. 2009. A Text book on production technology of vegetables. Kalyani Publishers.
7. Dashora, L. K., Dashora, A. and Lakhawat, S. S. 2013. Production Technology of Plantation Crops, Spices, Aromatic & Medicinal Plants.
8. Dhaliwal, M. S. 2008. Handbook of Vegetable Crops. Kalyani Publishers.
9. Gopal krishnan, T. R. 2007. Vegetable Crops. New India Publishing Agency, New Delhi.
10. Pruthi, J. S. 1993. Major Spices of India: Crop Management & Post Harvest Technology. ICAR, New Delhi.
11. Shanmugavelu, K. G. Kumar, N. and Peter, K. V. 2005. Production Technology of Spices and Plantation Crops. Agrosis, Jodhpur.

ESDM-211 Environmental Studies and Disaster Management 3(2+1)

Theory

Environment: Definition, scope and importance; Natural Resources: Renewable and non-renewable resources, a) Forest resources, b) Water resources, c) Mineral resources, d) Food resources, e) Energy resources, f) Land resources: Land as a resource, land degradation, soil erosion and desertification; Role of an individual in conservation of natural resources; Environmental Pollution: definition, cause, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution g. Nuclear hazards; Solid Waste Management: causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution. Wasteland reclamation. *

Ecosystems: Definition, concept, structure and function, components, producers, consumers and decomposers, Energy flow in the ecosystem; Ecological succession, Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act. Forest Conservation Act; Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Threats to biodiversity. Conservation of biodiversity. **

Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme; Environment and human health: Human Rights, Value Education, HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health; Water conservation, rain water harvesting, watershed management; Disaster Management: Natural Disasters- Meaning and nature of natural disasters, their types and effects; Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion; Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents; Disaster Management- Concept of disaster management, national disaster management framework; financial arrangements; Central, state, district and local administration; NGO, Armed forces in disaster response; Disaster response; Police and other organizations.***

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.Collection, processing and storage of effluent samples; Physical, chemical and biological analysis of soil and water samples : Determination of Bio- Chemical oxygen demand (BOD) in effluent sample; Determination of chemical oxygen demand (COD) in effluent sample; Estimation of dissolved oxygen in effluent samples; Determination of total dissolved solids (TDS) in effluent samples; Estimation of species abundance of plants; Analysis of temporary and total hardness of water sample by titration.

*** Soil Science, ** Entomology, *** Agronomy**

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Environment: Definition, scope and importance	1
2.	Natural Resources: Renewable and non-renewable resources	2
3.	Environmental Pollution: definition. Cause, effects and control measures of Air pollution	1
4.	Cause, effects and control measures of Water pollution	1
5.	Cause, effects and control measures of Soil pollution	1
6.	Cause, effects and control measures of Marine and Noise pollution	1
7.	Cause, effects and control measures of Thermal pollution and nuclear hazards	1
8.	Solid Waste Management: causes, effects and control measures of urban and industrial wastes	1
9.	Role of an individual in prevention of pollution. Wasteland reclamation	1
10.	Ecosystems: Definition, concept, structure and function, components, producers, consumers and decomposers, energy flow in the ecosystem	2
11.	Ecological succession, Food chains, food webs and ecological pyramids	1
12.	Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	2
13.	Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act	3
14.	Biodiversity and its conservation: Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India	1
15.	Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values	1
16.	Threats to biodiversity. Conservation of biodiversity	1
17.	Human population and the environment: population growth, variation among nations, population explosion, Family Welfare Programme	1
18.	Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare	1
19.	Role of information technology in environment and human health	1
20.	Water conservation, rain water harvesting, watershed management	1
21.	Natural Disasters- Meaning and nature, types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion	2
22.	Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents	3
23.	Disaster Management- Concept of disaster management, national	2

	disaster management framework; financial arrangements; Central, state, district and local administration; NGO, Armed forces in disaster response; Disaster response; Police and other organizations	

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Visit to a local polluted site -Collection, processing and storage of polluted soil and water samples	2
2.	Study of simple ecosystems-pond, river, hill slopes, etc.	1
3.	Determination of physical properties of polluted water sample-colour, temperature, odour, turbidity etc.	1
4.	Determination of pH and electrical conductivity of polluted soil and water samples	1
5.	Determination of Biochemical Oxygen Demand (BOD) in effluent / polluted samples	2
6.	Determination of Chemical Oxygen Demand (COD) in effluent / polluted samples	1
7.	Determination of dissolved oxygen in effluent / polluted samples	1
8.	Determination of total dissolved solids (TDS) and total suspended solids (TSS) in effluent samples	1
9.	Estimation of nitrate and chlorine content in ground water	1
10.	Determination of carbonates and bicarbonates in water sample	1
11.	Estimation of species abundance of plants	1
12.	Analysis of temporary and total hardness of water sample by titration	1
13.	Pollution case studies- Visit to a local polluted site, observations and remedial measures	1
14.	Visit to Social Service Organization / Environmental Education Centers, study of simple ecosystems-pond, river, hill slopes, etc.- study of common plants, insects, birds etc.	1

Suggested Readings:

1. Agrawal, K. C.1999. Environmental Biology. Agro Botanica, Bikaner.
2. Ahluwalia, V. K and Malhotra, S. 2006. Environmental Science. Ane Books Pvt. Ltd. India.
3. Bamanayha, B. R., Verma, L. N. and Verma, A. 2005. Fundamentals of Environmental Studies. Yash Publishing House, Bikaner.
4. Dhaliwal, G. S., Sangha G. S. and Ralhan, P. K. 2000. Fundamentals of Environmental Science. Kalyani Publishers, New Delhi.
5. Gopal, B. and Bhardwaj, N. 2004. Elements of Ecology. Vikash Publishing House, Pvt. Ltd., New Delhi.
6. Kudesta, V. P. 1990. Pollution Everywhere, Pragatgi Prakashan, Meerut.
7. Kumar, H. D. 1997. Modern concepts of Ecology, Vikash Publishing House Pvt. Ltd. New Delhi.

8. Mishra, P. C. 2001. Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi- 110026.
9. Odum E. P. and Barrett G.W. 2007. Fundamentals of Ecology, Akash Press, New Delhi.
10. Purohit, S. S. 2006. Environmental Pollution Causes, Effects and Control. Published by Agrobios (India), Jodpur.

STAT-211 Statistical Methods 2(1+1)

Theory

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.

Practical

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). 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to Statistics and its applications in agriculture	1
2.	Graphical representation of data, measures of central tendency & dispersion	1
3.	Definition of probability, addition and multiplication theorem (without proof)	1
4.	Simple problems based on probability	1
5.	Binomial & Poisson distributions	1
6.	Definition of correlation, scatter diagram	1
7.	Karl Pearson's coefficient of correlation. linear regression equations	1
8.	Introduction to test of significance	1
9.	One sample & two sample test t for means	1
10.	Chi-Square Test of Independence of attributes in 2 × 2 contingency table	1

11.	Introduction to analysis of variance	1
12.	Analysis of one-way classification	1
13.	Introduction to sampling methods	1
14.	Sampling versus complete enumeration	1
15.	Simple random sampling with and without replacement	1
16.	Use of random number tables for selection of simple random sample	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Graphical representation of data	1
2.	Measures of central tendency (ungrouped data) with calculation of quartiles	1
3.	Deciles & percentiles	1
4.	Measures of central tendency (grouped data) with calculation of quartiles, deciles & percentiles	1
5.	Measures of dispersion (ungrouped data). measures of dispersion (grouped data)	1
6.	Moments	1
7.	Measures of skewness & kurtosis (ungrouped data)	1
8.	Moments, measures of skewness & kurtosis (Grouped Data)	1
9.	Correlation & REGRESSION ANALYSIS	1
10.	Application of one sample t-test	1
11.	Application of two sample Fisher's t- test	1
12.	Chi-Square test of goodness of Fit	1
13.	Chi-Square test of independence of attributes for 2 X 2 contingency table	1
14.	Analysis of variance one-way classification	1
15.	Analysis of variance two-way classification	1
16.	Selection of random sample using simple random sampling	1

Suggested Readings:

1. Chandel, S .R. S. 2003. Handbook of Agricultural Statistics. Achal Prakashan Mandir, Kanpur.
2. Das, M. N. and Giri, V. V. 2011. Design and Analysis of Experiments, New Age International Publishers, Daryaganj- New Delhi-110 002
3. Fisher, R. A. 1947. Design of Experiments, Oliver and Boyd, Edinburgh, London.
4. Gomez, K. A. and Gomez, A. A. 1984. Statistical procedures for Agricultural Research. John Wiley and sons, Inc., New York.
5. Gupta, S. C. and Kapoor, V. K. 1997. Fundamentals of Mathematical Statistic. Sulthan Chand Publications, New Delhi.
6. Gupta, S. P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
7. Rangaswami, R. 2006. A Text Book of Agricultural Statistics. New Age International Publishers Ltd., New Delhi.
8. Rao, G. N. 2012. Statistics for Agricultural Science. OXFORD & IBH publishing House New Delhi.

LPM-211	Livestock and Poultry Management	4(3+1)

Theory

Role of livestock in the national economy; Reproduction in farm animals and poultry; Housing principles, space requirements for different species of livestock and poultry; Management of calves, growing heifers and milch animals; Management of sheep, goat and swine; Incubation, hatching and brooding; 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.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. 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. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Role of livestock in the national economy	2
2.	Reproduction in farm animals and poultry	2
3.	Housing principles, space requirements for different species of livestock	3
4.	Housing principles, space requirements for different species of poultry	2
5.	Management of calves and growing heifers	2
6.	Management of milch animals	1
7.	Management of sheep	2
8.	Management of goat	2
9.	Management of swine	1
10.	Incubation, hatching and brooding	3
11.	Management of growers and layers	1
12.	Important Indian and exotic breeds of cattle	2
13.	Important Indian and exotic breeds of buffalo	2
14.	Important Indian and exotic breeds of sheep	2
15.	Important Indian and exotic breeds of goat	2
16.	Important Indian and exotic breeds of poultry	2
17.	Improvement of farm animals and poultry	2
18.	Improvement of poultry	1

19.	Digestion in livestock and poultry	2
20.	Classification of feedstuffs	1
21.	Proximate principles of feed	1
22.	Nutrients and their functions	2
23.	Feed ingredients for ration for livestock and poultry	2
24.	Feed supplements and feed additives	1
25.	Feeding of livestock	3
26.	Feeding of poultry	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	External body parts of cattle & buffalo sheep	1
2.	External body parts of swine & poultry	1
3.	Handling and restraining of livestock	1
4.	Identification methods of farm animals& poultry	1
5.	Visit to IDF and IPF to study breeds of livestock and poultry	1
6.	Daily routine farm operations and farm records	1
7.	Judging of cattle, buffalo &poultry	1
8.	Culling of livestock and poultry	1
9.	Planning and layout of housing for different types of livestock	1
10.	Computation of rations for livestock	1
11.	Formulation of concentrate mixtures	1
12.	Clean milk production, milking methods	1
13.	Management of chicks, growers and layers	1
14.	Debeaking, dusting and vaccination	1
15.	Economics of cattle, buffalo, sheep, goat, swine and poultry production	2

Suggested Readings:

1. Banerjee, G. C. 2011. A Text Book of Animal Husbandry. VIII ed. Oxford and IBH Publications. New Delhi.
2. Choudhary, J. L. and Gupta L. 2016. A Text Book of Animal Husbandry. Somani Publication
3. Devendra, C. and Mecleroy, G. B. 1982. Goat and Sheep Production in Tropics.
4. Dimri, U., Sharma, M. C. and Tiwari, R. 2013. Swine Production and Health Management. New India Pub Agency.
5. Sastry, N. S. R. and Thomas, C. K. 2006. Livestock Production and Management. Kalyani
6. Singh, R. A. 1996. Poultry Production. 3rd ed. Kalyani Publications. New Delhi.
7. Thomas, C. K., Sastry, N. S. R. and Singh, R. A. 1982. Farm Animal Management and Poultry Production. Vikas Publications. New Delhi.
8. Verma, D. N. 1999. Text book of Livestock Production and Management in Tropics. Kalyani Publishers, New Delhi.

NSS	National Service Scheme III	-

Vocational skill development: To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities; Each volunteer will have the option to select two skill-areas out of this list; **Issues related environment:** Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management; **Disaster management:** Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management; **Entrepreneurship development:** Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution; **Formulation of production oriented project:** Planning, implementation, management and impact assessment of project; **Documentation and data reporting:** Collection and analysis of data, documentation and dissemination of project reports.

B. Sc. (Hons.) Agriculture
Part- II, Semester-II

AGRON-221 Crop Production Technology –II *(Rabi* Crops*)* 2(1+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals – wheat and barley, pulses-chickpea, lentil, peas, oilseeds - rapeseed, mustard and sunflower; sugar crops - sugarcane; medicinal and aromatic crops - isabgol, Seed spices - fenugreek, *kasuri methi*, cumin, fennel; Forage crops - berseem, lucerne and oat.

Practical

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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of cereals – wheat and barley	3
2.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of pulses-chickpea, lentil, peas	3
3.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of oilseeds-rapeseed, mustard and sunflower	2
4.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of sugar crops-sugarcane	2
5.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of medicinal and aromatic crop- isabgol	1
6.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of seed spices - fenugreek, kasuri methi, cumin, fennel	3
7.	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Forage crops- berseem, lucerne and oat	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of seeds, crops and other inputs of *rabi* season	1
2.	Identification of weeds in *rabi* season crops	1

3.	Seed rate and related numerical	1
4.	Sowing of wheat and planting of sugarcane	1
5.	Application of herbicides and related numericals	1
6.	Fertilizer application in crops and related numerical	1
7.	Morphological difference in wheat, barley and oat, rapeseed and mustard, berseem and lucerne	1
8.	Judging physiological maturity of various crops	1
9.	Judging sugarcane maturity based on brix ratio and related calculation	1
10.	Yield attributing characters, Theoretical yield and related numerical	1
11.	Crop harvesting and related numericals on harvest index	1
12.	Working out seed index (test weight) and cost of cultivation	1
13.	Oil extraction of medicinal crops	1
14.	Study of *rabi* forage experiments	1
15.	Study of important agronomic experiments of *rabi* crops at experimental farms	1
16.	Visit to research stations of related crops	1

Suggested Readings:

1. Ahlawat, I. P. S., Sharma, O. P. and Saini, G. S. 1998. Scientific Crop Production in India. Aman Publishing House, Meerut.
2. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
3. Prasad, Rajendra. 2002. Text Book of Field Crops Production. ICAR, New Delhi.
4. Rathore, P. S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
5. Reddy, S. R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi.
6. Singh, Chhidda; Singh, P. and Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co., New Delhi.
7. Singh, S. S. and Singh, R. 2011. Principles and Practices of Agronomy, Kalyani Publishers, New Delhi.
8. Shukla, U.N. 2017. A Practical Manual on Field Crops-II (*Rabi*), Department of Agricultre, College of Agriculture, Jodhpur (Publication No.: CoA/MND/05/2017).

HORT-221 Production Technology for Ornamental Crops, MAP and Landscaping 2(1+1)

Theory

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, lilium 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, Cinnamomum, periwinkle, isabgol, senna, guggul and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

Practical

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. Visit to commercial flower/MAP unit.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance and scope of ornamental crops, medicinal and aromatic plants	1
2.	Importance, scope and principles of landscaping	1
3.	Landscape uses of trees, shrubs and climbers	1
4.	Production technology of important cut flowers like rose	1
5.	Production technology of gerbera under protected conditions	1
6.	Production technology of carnation under protected conditions	1
7.	Production technology of lilium and orchids under protected conditions	1
8.	Production technology of gladiolus, tuberose, chrysanthemum under open conditions	2
9.	Package of practices for loose flowers like marigold and jasmine under open conditions	1
10.	Production technology of important medicinal plants like ashwagandha, asparagus, safed musli	1
11.	Aloe, Cinnamon, periwinkle, isabgol, senna, guggul	2
12.	Production technology of important aromatic plants like mint, lemongrass	1
13.	Citronella, palmarosa, ocimum	1
14.	Rose, reranium, vetiver	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of ornamental plants	1
2.	Identification of medicinal and aromatic plants	1
3.	Nursery bed preparation and seed sowing	1
4.	Propagation of ornamental and MAPs	2
5.	Training and pruning of ornamental plants	2
6.	Planning and layout of garden	1
7.	Bed preparation and planting of MAP	1
8.	Protected structures – care and maintenance	1
9.	Intercultural operations in flowers and MAP	1
10.	Harvesting and post harvest handling of cut and loose flowers. processing of MAP	3
11.	Visit to commercial flower and MAP unit	2

Suggested Readings:

1. Arora, J. S. 2010. Introductory Ornamental Horticulture. Kalyani Publisher, Ludhiana.
2. Bose, T. K. and Mukherjee, D. 2004. Gardening in India, Oxford & IBH Publishers
3. Bose, T. K., Malti, R. G., Dhua, R. S. and Das, P. 2004. Floriculture and Landscaping, Nayaprakash, Culcutta.
4. Chadha, K. L. and Chaudhary, B. 1986. Ornamental Horticulture in India, ICAR
5. Lauria, A. and Victor, H. R. 2001. Floriculture – Fundamentals and Practices. Agrobios, Jodhpur.
6. Prakash, J. and Bhandari K. R. 1994. Floriculture Technology. Traders & Trends. Oxford and IBH Publishing Co. Pvt. Ltd.
7. Randhawa, G. S. and Mukhopadhyay, A. 2004. Floriculture in India, Allied Publishers Pvt. Ltd., New Delhi.
8. Sabina, G. T. and Peter, K. V. 2008. Ornamental Plants for Gardens. New India Publ. Agency.
9. Tiwari, A. K. and Kumar, R. 2012. Fundamentals of Ornamental Horticulture and Landscape Gardening. New India.

AGENGG-221 Renewable Energy and Green Technology 2(1+1)

Theory

Classification of energy sources, contribution of these sources in agricultural sector, Familiarization with biomass utilization for bio-fuel production and their application, Familiarization with different types of biogas plants and gasifiers, bio-alcohol, biodiesel; Familiarization with briquetting techniques, Introduction of solar energy, solar collectors and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application; Numerical problems on wind energy.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Classification of energy sources, contribution of these of sources in agricultural sector	1
2.	Familiarization with biomass utilization for biofuel production and their application	2
3.	Familiarization with different types of biogas plants	2
4.	Biogas production techniques and various uses of biogases	2
5.	Biomass gasification and familiarization with different gasifiers	2
6.	Concept of briquetting and familiarization with briquetting machines	1

7.	Introduction of solar energy, solar collectors and their application	1
8.	Solar thermal applications in different gadgets	2
9.	Solar photovoltaic techniques and applications	1
10.	Introduction of wind energy and their application	1
11.	Numerical problems on wind energy	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of biogas plant – fixed dome type	1
2.	Study of biogas plant – floating dome type	1
3.	Study of cross draft, updraft and down draft gasifiers	1
4.	Study of production process of bio diesel	1
5.	Study of production process of bio fuel	1
6.	To study briquetting machine	1
7.	Study of box type solar cooker	1
8.	Study of solar water heating system	1
9.	Study of solar distillation system	1
10.	Study of solar cookers	1
11.	Study of solar dryer	2
12.	Study of solar photovoltaic water pumping system and visit to nearby solar photovoltaic water pumping system	2
13.	Study of solar photovoltaic sprayer	1
14.	To study solar distillation and solar pond	1

Suggested Readings:

1. Khandelwal, K. C. and Mandi, S. S. 1990. Pratcial Hand Book "Biogass Technology".
2. Kumar, S., Kumar, V. and Sahu, R. K. 2016. Fundamentals of Agricultural Engineering. Kalyani Publishers, New Delhi.
3. Mathur, A. N. and Rathore, N. S. 1992. Biogas Production, Management and Utilization. Himanshu Publication. Delhi.
4. Rai, G. D. 2013. Non-Conventional Energy Sources. Khanna Publishers, Delhi.
5. Rathore, N. S., Kurchania, A. K. and Panwar, N. L. 2007. Non Conventional Energy Sources. Himanshu Publications.
6. Rathore, N. S., Kurchania, A. K. and Panwar, N. L. 2007. Renewable Energy, Theory and Practice. Himanshu Publications.

SSAC-221 Problematic Soils and their Management 2(1+1)

Theory

Soil quality and health, Distribution of Waste land and problem soils in India; Their categorization based on properties; Reclamation and management of saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils; Irrigation water – quality and standards, utilization of saline water in agriculture; Remote

sensing and GIS in diagnosis and management of problem soils; Multipurpose tree species (MPTs), bio remediation through MPTs of soils, land capability and classification, land suitability classification; Problematic soils under different Agro-ecosystems.

Practical

Visual diagnosis of problem soils, determination of cations (Na^+, K^+, Ca^{++} and Mg^{++}) in ground water and soil samples, determination of anions (Cl^-, SO_4^{--}, CO_3^{--} and HCO_3^-) in ground waters and soil samples, determination of $CaCO_3$ in calcareous soils, lime requirements of acid soil and gypsum requirements of sodic soil, computation of SAR and RSC of irrigation water.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Soil quality- indicators and major factors affecting the soil quality, soil health	2
2.	Distribution of problem soils in different agro-ecosystem of India	1
3.	Categorization of problem soils based on properties	1
4.	Reclamation and management of salt affected soils	3
5.	Reclamation and management of acid soils	1
6.	High and low permeable soils and their management	1
7.	Bio remediation of soils through multipurpose trees (MPTs)	1
8.	Land capability classification	1
9.	Land suitability classification	1
10.	Irrigation water – quality, classification and standards	3
11.	Utilization of poor quality water in agriculture	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Visual diagnosis of problem soils	2
2.	Determination of Ca^{++} and Mg^{++} in soil	1
3.	Determination of Ca^{++} and Mg^{++} in ground water	1
4.	Determination of potassium in ground water and soil	1
5.	Determination of sodium in ground water and soil	1
6.	Determination of $CaCO_3$ in calcareous soil	1
7.	Determination of CO_3^{--} and HCO_3^- in ground water	1
8.	Determination of CO_3^{--} and HCO_3^- in soil	1
9.	Determination of chloride in ground water and soil	2
10.	Determination of sulphate (SO_4^{--}) in ground water	1
11.	Determination of sulphate (SO_4^{--}) in soil	1
12.	Determination of gypsum requirement of sodic soil	1
13.	Determination of lime requirement of acid soil	1
14.	Computation of SAR and RSC of irrigation water	1

Suggested Readings:

1. Abrol, I. P. and Dhurva Narayana, V. V. 1998. Technologies for wasteland development. ICAR, New Delhi-110012.
2. Agarwal, R. R., Yadav, J. S. P. and Gupta, R. N. 1982. Saline Alkali soils of India, ICAR, New Delhi.
3. Cirsan Paul, J. 1985. Principles of remote sensing. Longman, New York.
4. ISSS, 2015. Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi.
5. Richards, L. A. 1954. Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
6. Somani, L. L. and Totawat, K. L. 1993. Management of salt affected soils and waters. Agrotech Publishing Academy, Udaipur.
7. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.

HORT-222 Production Technology for Fruit and Plantation Crops 2(1+1)

Theory

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 and; minor fruits- datepalm, ber, kair, lasora, aonla, bael, pineapple, pomegranate, jackfruit, strawberry; plantation crops-coconut, arecanut, cashew, tea, coffee and rubber.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks	1
2.	Production technologies for the cultivation of major fruits - Mango	1
3.	Banana	1
4.	Citrus	1
5.	Grape	1
6.	Guava and Litchi	1
7.	Papaya and Sapota	1
8.	Apple	1
9.	Pear and Peach	1
10.	Walnut and Almond	1
11.	Production technologies for the cultivation of minor fruits- Date palm, Ber, kair, lasora	1
12.	Production technologies for the cultivation of minor fruits- Aonla, Bael, Jackfruit and Strawberry, Pineapple and Pomegranate	2

13.	Production technologies for the cultivation of plantation crops-Coconut and Cashew nut	1
14.	Areca nut & Rubber	1
15.	Tea and Coffee	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Description and identification of fruit and plantation crops	1
2.	Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops	3
3.	Layout and planting of fruits and plantation crops	2
4.	Preparation of plant bio regulators and their uses	1
5.	Important pests of fruits and plantation crops	1
6.	Important diseases of fruits and plantation crops	1
7.	Important physiological disorders of fruits and plantation crops	2
8.	Fertilizer application in fruits and plantation crops	1
9.	Irrigation methods in fruits and plantation crops	1
10.	Training and pruning of fruits and plantation crops	1
11.	Weed management in fruits and plantation crops	1
12.	Visit to commercial orchards	1

Suggested Readings:

1. Bal, J. S. 2010. Fruit Growing. Kalyani Publisher, New Delhi.
2. Banday F. A. and Sharma M. K. 2010. Advances in Temperate Fruit Production. Kalyani Publishers
3. Bose, T. K., Kabir J., Das P. and Joy P. P. 2000. Tropical Horticulture. Naya Prokash, Calcutta**.**
4. Chadda, K. L. 2009. Advanced in Horticulture, Malhotra Publishing House, New Delhi.
5. Chandra, A. and Chandra, A. 1997. Production and Post harvest technology of Fruits. NBS Publisher & Distributers, Bikaner.
6. Chundawat, B. S. and Sen, N. L. 2002. Principle of Fruit culture. Agrotech Publication Academy, Udaipur.
7. Mitra, S. K., Bose, T. K. and Rathore, D. S. 1991. Temperate Fruits. Horticulture & Allied Publishers, Calcutta.
8. Parthasvathy, V. A., Chattopadhyay, P. K. and Bose, T. K. 2006. Plantation Crpos. Naya Prokash, Kolkatta.
9. Singh, A. 1986. Fruit Physiology and Production. Kalyani Publishers, New Delhi**.**
10. Singh, S. P. 2004. Commercial Fruits. Kalyani Publishers, New Delhi**.**

GPB-221 Principles of Seed Technology 3(1+2)

Theory

Seed and seed technology: introduction, definition and importance; Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed; Foundation and certified seed production of important cereals (Wheat, Rice, Maize, Sorghum and Bajra), pulses (Urd, Mung, Cowpea, Pigeonpea, Lentil, Gram, Field pea), oilseeds (Soybean, Rapeseed and Mustard, Groundnut, sesame), fodder (Berseem) and vegetables (Potato, cauliflower, tomato and chilli), Seed spices (Cumin, Coriander, Fennel and Fenugreek); Seed certification, phases of certification, procedure for seed certification, field inspection; Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983; Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test; Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

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

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. Seed production in major pulses: Urd, Mung, Cowpea, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard, Groundnut. Seed production in vegetable crops & Seed spices. 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Seed and seed technology: introduction, definition and importance	1
2.	Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production	1
3.	Seed quality; Definition, Characters of good quality seed, different classes of seed	1
4.	Foundation and certified seed production of important cereals & fodder	1
5.	Foundation and certified seed production of important pulses	1
6.	Foundation and certified seed production of important oilseeds	1
7.	Foundation and certified seed production of important vegetables	1
8.	Foundation and certified seed production of important seed spices	1
9.	Seed certification, phases of certification, procedure for seed certification,	1

	field inspection	
10.	Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983	1
11.	Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test	1
12.	Detection of genetically modified crops, Transgene contamination in non-GM crops	1
13.	GM crops and organic seed production	1
14.	Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing	1
15.	Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage	1
16.	Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Seed production in Wheat including seed standards	1
2.	Seed production in Rice including seed standards	1
3.	Seed production in Maize including seed standards	1
4.	Seed production in Sorghum including seed standards	1
5.	Seed production in Bajra including seed standards	1
6.	Seed production in Urd, mung and cowpea including seed standards	1
7.	Seed production in Pigeonpea including seed standards	1
8.	Seed production in Lentil including seed standards	1
9.	Seed production in Gram including seed standards	1
10.	Seed production in Field pea including seed standards	1
11.	Seed production in Soybean including seed standards	1
12.	Seed production in Rapeseed and Mustard including seed standards	1
13.	Seed production in Groundnut and sesame including seed standards	1
14.	Seed production in vegetable (Potato, cauliflower, tomato and chilli) crops including seed standards	1
15.	Seed production in seed spices (fenugreek, fennel, cumin & coriander) including seed standards	1
16.	Seed sampling methods	1
17.	Physical purity test	1
18.	Germination test	1
19.	Viability test	1

20.	Seed and seedling vigour test	1
21.	Genetic purity test: Grow out test	1
22.	Electrophoresis	1
23.	Seed certification: Procedure	1
24.	Field inspection and preparation of field inspection report	2
25.	Visit to seed production farms	3
26.	Visit to seed testing laboratories	2
27.	Visit to seed processing plant	2

Suggested Readings:

1. Agarwal, P. K. 1999. Seed Technology. ICAR, New Delhi.
2. Agarwal, R. L. 2008. Seed Technology. Oxford & IBH Publishing Co. Delhi.
3. Arya, P. S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana.
4. Chhabra, A. K. 2006. Practical Manual of Floral Biology of Crop Plants. Deptt. of Plant Breeding, CCS HAU, Hisar.
5. Copeland, L. O. and McDonald, M. B. 2001. Principles of Seed Science and Technology. (4th Ed.) Chapman & Hall.
6. Joshi, A. K. and Singh, B. D. 2005. Seed Technology. Kalyani Publishers, New Delhi.
7. Khare, D. and Bhale, M. S. 2011. Seed Technology. Scientific Publishers (India), Jodhpur.
8. Maloo, S. R., Intodia, S. K. and Singh, P. 2008. Beej Pradyogiki. Agrotech Publishing Academy.
9. Singh, B. D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
10. Subir Sen and Nabinanda Ghosh, 1999. Seed Science and Technology, Kalyani Publishers, New Delhi.

AGECON-221 Agricultural Marketing, Trade and Prices 3(2+1)

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm

commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing; Introduction to CWC, SWC, FCI, CACP & DMI; Cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage; Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of elasticities**;** Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price 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/assignment to market institutions – NAFED, SWC, CWC, cooperative marketing society etc. to study their organization and functioning.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing	1
2.	Market structure, marketing mix and market segmentation	1
3.	Classification and characteristics of agricultural markets	1
4.	Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products	2
5.	Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities	1
6.	Product life cycle (PLC) meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC	2
7.	Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits	2
8.	Marketing process and functions: exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark)	3
9.	Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing	2
10.	Meaning and definition of marketing channel	1
11.	Marketing channels for different farm products	1
12.	Integration, efficiency, costs and price spread: Meaning, definition and types of market integration	1

13.	Marketing efficiency	1
14.	Marketing costs, margins and price spread, factors affecting cost of marketing	1
15.	Reasons for higher marketing costs of farm commodities; ways of reducing marketing costs	1
16.	Role of Government in agricultural marketing, Introduction to Public sector institutions- CWC, SWC, FCI, CACP & DIMI — their objectives and functions	2
17.	Cooperative marketing in India	1
18.	Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading	2
19.	Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy	1
20.	Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities	2
21.	GATT and WTO	1
22.	Agreement on Agriculture (AoA) and its implications on Indian agriculture	1
23.	IPR concepts and meaning, importance and applications	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Plotting and study of demand and supply curves	1
2.	Analysis of the problems on elasticities	2
3.	Identification of marketing channels for selected commodity	1
4.	Computation of marketable and marketed surplus of important commodities	2
5.	Study of price behaviour over time for some selected commodities, based on secondary data	1
6.	Visit to a local market to study various marketing functions performed by different agencies	1
7.	Study of relationship between market arrivals and prices of some selected commodities	1
8.	Construction of index numbers- simple and weighted using different methods	1
9.	Visit/assignment to market institutions – NAFED, SWC, CWC, cooperative marketing society and evaluation of the functioning	4
10.	To study their organization and functioning	1
11.	Collection of data regarding marketing costs, margins and price spread and presentation of report in the class	1

Suggested Readings:

1. Acharya, S. S. and Aggarwal, N. L. 2011. Agricultural Marketing in India. Oxford and IBH Publishing Co. New Delhi.
2. Bhall, V. K. and Shiva Ramu, S. 1996. International Business-Environment and Management. Anmol Publications (P) Limited, New Delhi.
3. Chandra, P. 1984. Projects: Preparation, Appraisal & Implementation, McGraw Hill Inc.
4. Gupta, R. D. and Lekhi, R. K. 1982. Elementary Economic Theory. Kalyani Publishers.
5. Kahlon, A. S. and Tyagi, D. S. 1983. Agricultural Price Policy in India. Allied Publishers, New Delhi.
6. Moore, J. R., Johl, S. S. and Khusro, A. M. 1973. Indian Food Grain Marketing. Printice Hall, New Delhi.
7. Philip, K. 2004. Marketing Management. Prentice Hall, New Delhi.
8. Philip, K. 2004. Principles of Marketing. Prentice Hall, New Delhi.

EXT-221 Communication skills and Personality Development 2(1+1)

Theory

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; 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.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations. Script writing, writing for print and electronic media, developing script for radio and television. Visit to community radio.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Communication Skills: meaning and process of communication	1
2.	Verbal and nonverbal communication	1
3.	Structural and functional grammar	1
4.	Listening and note taking	1
5.	Writing skills, oral presentation skills	1
6.	Field diary and lab record; indexing	1
7.	Footnote and bibliographic procedures	1
8.	Reading and comprehension of general and technical articles	1

9.	Precise writing, summarizing, abstracting	1
10.	Individual and group presentations, Impromptu presentation, public speaking	1
11.	Group discussion, organizing seminars and conferences	1
12.	Communication: meaning and definition, principles and functions of communication	1
13.	Models and barriers to communication	1
14.	Agriculture journalism	1
15.	Diffusion-Meaning, definition and elements, adoption process-meaning, stages, innovation decision process	1
16.	Adopter categories and their characteristics, factors influencing adoption process	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Listening and note taking	1
2.	Writing skills, oral presentation skills	2
3.	Field diary and lab record; indexing, footnote and bibliographic procedures	3
4.	Reading and comprehension of general and technical articles	2
5.	Precise writing	2
6.	Summarizing, abstracting	1
7.	Individual and group presentations	2
8.	Script writing, writing for print and electronic media, developing script for radio and television.	2
9.	Visit to community radio	1

Suggested Readings:

1. Dahama, O. P. and Bhatnagar, O. P. 1998. Education and Communication for Development. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
2. De, D. and Jirli, B. 2008. Entrepreneurship: Theory and Practice in Agriculture. Ganga Kaveri Publishing House, Varanasi.
3. Goyal, D. P. 1994. Management Information System: Concept and Application. Deep & Deep Publisher, New Delhi.
4. Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension. Concept publishing company, New Delhi.
5. Ray, G. L. 1991. (1st Edition), Extension Communication and Management. Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
6. Reddy, A. A. 2001. Extension Education. Shri Laxmi Press, Baptala.
7. Sandhu, A. S. 1999. Textbook on Agricultural Communication; process and methods. Oxford & IBH Publishing co. Pvt. Ltd. New Delhi.
8. Sharma, O. P. and Somani, L. L. 2012. Dimension of Agricultural Extension. Agroteh Publishing Academy, Udaipur.
9. Supe, S. V. 2013. (2nd Edition), A Text Book of Extension Education. Agrotech Publishing Academy, Udaipur.

AGRON-222 Introductory Agro-meteorology and Climate Change 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Meaning and scope of agricultural meteorology	1
2.	Earth's atmosphere- its composition, extent and structure	1
3.	Atmospheric weather variables; Atmospheric pressure, its variation with height	1
4.	Wind, types of wind, daily and seasonal variation of wind speed	1
5.	Cyclone, anticyclone, land breeze and sea breeze	1
6.	Nature and properties of solar radiation, solar constant, depletion of solar radiation	1
7.	Short wave, long wave and thermal radiation, net radiation, albedo	1
8.	Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth	1

9.	Atmospheric humidity, concept of saturation, vapour pressure	1
10.	Process of condensation, formation of dew, fog, mist, frost, cloud	1
11.	Precipitation- process , types such as rain, snow, sleet, and hail	1
12.	Cloud formation and classification; Artificial rainmaking, Monsoon-mechanism and importance in Indian agriculture	1
13.	Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave	1
14.	Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production	1
15.	Weather forecasting- types of weather forecast and their uses	1
16.	Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Visit of Agro meteorological Observatory, site selection of observatory, exposure of instruments and weather data recording	2
2.	Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law	2
3.	Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS	2
4.	Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis	1
5.	Measurement of soil temperature and computation of soil heat flux	1
6.	Determination of vapor pressure and relative humidity	1
7.	Determination of dew point temperature	1
8.	Measurement of atmospheric pressure and analysis of atmospheric conditions	1
9.	Measurement of wind speed and wind direction, preparation of windrose	1
10.	Measurement, tabulation and analysis of rain	1
11.	Measurement of open pan evaporation and evapotranspiration	1
12.	Computation of PET and AET	2

Suggested Readings:

1. Balasubramaniyan, P. and Palaniappan, S. P. 2016. Principles and Practices of Agronomy. Agrobios (India), Jodhpur.
2. Lal, D. S. 2005. Climatology. Sharda Pustak Bhawan, Allahabad.
3. Murithy, K. and Radha, V. 1995. Practical Manual on Agricultural Meteorology. Kalyani Publishers, New Delhi.
4. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
5. Sahu, D. D. 2007. Agrometeorology and Remote Sensing: Principles and Practices. Agrobios (India), Jodhpur.
6. Varshneya, M. C. and Balakrishna, Pillai, P. 2003. Text book of Agricultural Meteorology. ICAR, New Delhi.

NSS	National Service Scheme IV	2(0+2)**

Youth and crime: Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice. **Civil/self defence:** Civil defence services, aims and objectives of civil defence; needs and training of self-defence. **Resource mobilization:** Writing a project proposal of self fund units (SFUs) and its establishment. **Additional life skills:** Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

ELECTIVE COURSES

HORT-223 Hi-tech Horticulture (Elective course) 3(2+1)

Theory

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.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction of Hi-tech Horticulture and importance	1
2.	Nursery management and mechanization	2
3.	Micro propagation of horticultural crops	2
4.	Modern field preparation and planting methods	3
5.	Protected cultivation: advantages, controlled conditions, method and techniques	2
6.	Micro irrigation systems and its components	2
7.	EC, pH based fertilizer scheduling	1
8.	Canopy management, high density orcharding	2
9.	Components of precision farming	2
10.	Remote sensing	2
11.	Geographical Information System (GIS)	2
12.	Differential Geo-positioning System (DGPS)	2
13.	Variable Rate applicator (VRA)	2
14.	Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops)	4
15.	Mechanized harvesting of produce	3

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Types of polyhouses and shade net houses	2
2.	Intercultural operations	1

3.	Tools and equipments identification and application	2
4.	Micro propagation	2
5.	Nursery-protrays	2
6.	Micro-irrigation	2
7.	EC, pH based fertilizer scheduling	1
8.	Canopy management	2
9.	Visit to hi-tech orchard/nursery	2

Suggested Readings:

1. Arora, S. K., Bhatia, A. K., Mangal, J. L. and Kumar, P. 2004. Practical Manual, Green House Technology for Vegetable Production. Deptt. of Vegetable Science, CCSHAU, Hisar (Haryana).
2. Bose, T. K., Mitra, S. K. and Sandhu, M. K. 1986. Propagation of Tropical & Sub-tropical Horticultural crops, Naya Prakash, Calcutta.
3. Chadha, K. L. 2010. Handbook of Horticulture (New eds). Indian Council of Agricultural Research, New Delhi.
4. Gill, S. S., Bal, J. S. and Sadhu, A. S. 1985. Raising Fruit Nursery, Kalyani Publishers, New Delhi.
5. Hartman, H. T. and Kester, D. E. 2001. Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay.
6. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crop. Kalyani Publishers, Ludhiana.

ENTO-221# Bio-pesticides and Bio-fertilizers (Elective course) 3(2+1)

Theory

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 entomopathogenic pathogens and nematodes; Methods of application of biopesticides; Methods of quality control and Techniques of biopesticides; Impediments and limitation in production and use of biopesticide.

Biofertilizers - Introduction, status and scope; Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM : endomycorrhiza and ectomycorhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation; Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers; 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.

Practical

Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyzium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides.

Isolation and purification of *Azospirillum, Azotobacter, Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.
Course to be shared with Soil Science.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	History and concept of biopesticides	1
2.	Importance, scope and potential of biopesticide	1
3.	Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides and biorationales	2
4.	Botanicals and their uses	1
5.	Mass production technology of bio-pesticides	4
6.	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes	2
7.	Methods of application of biopesticides	1
8.	Methods of quality control and techniques of biopesticides	2
9.	Impediments and limitations in production and use of biopesticide	1
10.	Biofertilizers: introduction, status and scope	1
11.	Structure and characteristic features of bacterial biofertilizers: *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*	2
12.	Structure and characteristic features of cynobacterialbiofertilizers- *Anabaena*, *Nostoc*	1
13.	Structure and characteristic features of Hapalosiphon and fungal biofertilizers: AM : endomycorrhiza and ectomycorhiza	2
14.	Nitrogen fixation: Free living and symbiotic nitrogen fixation	2
15.	Mechanism of phosphate solubilization and phosphate mobilization, K solubilization	2
16.	Production technology: strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers	3
17.	FCO specifications and quality control of biofertilizers	1
18.	Application technology for seeds, seedlings, tubers, sets etc.	1
19.	Biofertilizers: storage, shelf life, quality control and marketing	1
20.	Factors influencing the efficacy of biofertilizers	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	To study about mass production technology of important biopesticides: NPV, *Metarhyzium, Beauveria, Bt.* etc.	2
2.	Identification of important botanicals. Preparation of plant extract: neem, karanj etc.	2

3.	Visit to biopesticide laboratory in nearby area	1
4.	Field visit to explore naturally infected cadavers	1
5.	Identification of entomopathogenic entities in field condition	1
6.	Quality control of biopesticides	1
7.	Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus* and its production	3
8.	Isolation and purification of *Azospirillum, Azotobacter, Rhizobium* and P-solubilizersand cyanobacteria	2
9.	Mass multiplication and inoculum production of biofertilizers	1
10.	Isolation of AM fungi: wet sieving method and sucrose gradient method	1
11.	Mass production of AM inoculants	1

Suggested Readings:

1. Biswas, T. D. and Mukherjee, S. K. 1990. Text Book of Soil Science. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Campbell, R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
3. Cook, R. J. and Baker, K. F. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.
4. Dhaliwal, G. S. and Koul, O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
5. Mukerji, K. G., Tewari, J. P., Arora, D. K. and Saxena, G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.
6. Mukherjee, N. and Ghosh, T. 1998. Agricultural Microbiology. Kalyani Publishers, New Delhi.
7. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
8. Srivastava, K. P. 2004. A Text Book of Entomology. Vol. I, Kalyani Publishers, New Delhi.
9. Vishunavat, K. and Kolte, S. J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi.

GPB-222 Commercial Plant Breeding (Elective course) 3(1+2)

Theory

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.

Practical

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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Types of crops and modes of plant reproduction	1
2.	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	2
3.	Genetic purity test of commercial hybrids	1
4.	Advances in hybrid seed production of maize and rice	1
5.	Advances in hybrid seed production of sorghum, pearl millet	1
6.	Advances in hybrid seed production of castor, sunflower, cotton	1
7.	Advances in hybrid seed production of pigeon pea, Brassica etc.	1
8.	Quality seed production of vegetable crops under open and protected environment	1
9.	Alternative strategies for the development of the line and cultivars	1
10.	Haploid inducer, tissue culture techniques and biotechnological tools	2
11.	IPR issues in commercial plant breeding	1
12.	DUS testing and registration of varieties under PPV & FR Act	1
13.	Variety testing, release and notification systems in India	1
14.	Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Floral biology in self and cross pollinated species, selfing and crossing techniques	2
2.	Techniques of seed production in self and cross pollinated crops using A/B/R and two line system	3
3.	Learning techniques in hybrid seed production using male-sterility in field crops	2
4.	Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production	2

5.	Concept of rouging in seed production plot	1
6.	Concept of line its multiplication and purification in hybrid seed production	2
7.	Role of pollinators in hybrid seed production	2
8.	Hybrid seed production techniques in sorghum and pearl millet	2
9.	Hybrid seed production techniques in maize and rice	2
10.	Hybrid seed production techniques in rapeseed-mustard and sunflower	2
11.	Hybrid seed production techniques in castor and pigeon pea	2
12.	Hybrid seed production techniques in cotton and vegetable crops	4
13.	Sampling and analytical procedures for purity testing and detection of spurious seed	1
14.	Seed drying and storage structure in quality seed management	2
15.	Screening techniques during seed processing viz., grading and packaging	1
16.	Visit to public private seed production and processing plants	2

Suggested Readings:

1. Agarwal, R. L. 1991. Seed Technology. Oxford & IBH Publishing Co. Delhi.
2. Arya, P. S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana.
3. Chopra, V. L. 2000. Breeding of Field Crops (Edt). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Joshi, A. K. and Singh, B. D. 2005. Seed Technology. Kalyani Publishers, New Delhi.
5. Khare, D. and Mohan, S. Bhale. 2000. Seed Technology. Scientific Publishers, Jodhpur (India).
6. Maloo, S. R., Intodia, S. K. and Singh, P. 2008. Beej Pradyogiki. Agrotech Publishing Academy.
7. Mandal, A. K., Ganguli, P. K. and Banerjee, S. P. 1991. Advances in Plant Breeding. Vol. I and II. CBS Publishers and Distributors, New Delhi.
8. Manjit S. Kang. 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.
9. Poehlman, J. M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Connecticut, USA.
10. Ram, H. H. and Singh, H. G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
11. Ram. H. H. 2005. Vegetable Breeding - Principles and Practices. Kalyani Publishers, New Delhi.
12. Sharma, A. K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
13. Singh, B. D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
14. Singh, P. 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.

B. Sc. (Hons.) Agriculture

Part- III, Semester-I

PPATH-311 Principles of Integrated Pest and Disease Management 3(2+1)

Theory

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.

Practical

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 biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma, Pseudomona*s, *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 farmer's fields.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Categories of insect pests and diseases	2
2.	IPM: Introduction, history, importance, concepts, principles and tools of IPM	2
3.	Economic importance of insect pests, diseases and pest risk analysis	1
4.	Methods of detection and diagnosis of insect pest and diseases	2
5.	Calculation and dynamics of economic injury level and importance of economic threshold level	2
6.	Methods of control: cultural, physical, legislative, biological and chemical control	5
7.	Plant disease resistance – types of resistance – vertical and horizontal – defense mechanism in plants – Structural and biochemical (pre and post- infection) cross-protection	2
8.	Ecological management of crop environment	1
9.	Introduction to conventional pesticides for the insect pests and disease management	1
10.	Survey surveillance and forecasting of Insect pest and diseases	2

11.	Development and validation of IPM module	1
12.	Implementation and impact of IPM (IPM module for Insect pest and disease)	2
13.	Safety issues in pesticide uses	1
14.	Political, social and legal implication of IPM	2
15.	Case histories of important IPM programmes	3
16.	Case histories of important IPM programmes	3

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Methods of diagnosis and detection of various insect pests and plant diseases	1
2.	Methods of insect pests and plant disease measurement	1
3.	Assessment of crop yield losses	1
4.	Calculations based on economics of IPM	1
5.	Identification of bio-control agents	1
6.	Mass multiplication of *Trichoderma* and *Pseudomonas*	2
7.	Mass multiplication of *Trichogramma* and NPV	2
8.	Identification and nature of damage of important insect pests and diseases and their management	1
9.	Crop (agro-ecosystem) dynamics of a selected insect pest and diseases	2
10.	Plan and assess preventive strategies (IPM module) and decision making	1
11.	Crop monitoring attacked by insect, pest and diseases	2
12.	Awareness campaign at farmer's fields	1

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. (5th Ed). Academic Press, New York.
2. Dhaliwal, G. S. and Arora, R. 2002. Integrated Pest Management: Concept and Approaches. Kalyani Publishers, New Delhi, 297 p.
3. Dube, H. C. 2012, Modern Plant Pathology, (2nd Ed). Agrobios (India), Jodhpur.
4. Gupta, V. K. and Sharma, R. C. 1995.IntegratedDiseaseManagement and Plant Health. Scientific Publ., Jodhpur.
5. Mehrotra, R. S. and Agrawal, A. 2013. Plant Pathology. (2nd Ed). Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Metcalf, R. L. and Luckmann, W. H. 1982. Introduction of Insect Pest Management. A Wiley – Interscience Publication, 561 p.
7. Nene Y. L. and Thapliyal, P. N. 2011. Fungicides in Plant Diseases Control. (3rd Ed). Oxford & IBH published Co. Pvt. Ltd., New Delhi.
8. Sharma, R. C. and Sharma, J. N. 1995. Integrated Plant Disease Management. Scientific Publ., Jodhpur.
9. Singh, R. S. 2001. Plant disease management. Oxford & IBH publishing Co., Pvt. Ltd, New Delhi.
10. Singh, R. S. 2011. Introduction to Principles of Plant Pathology. (4th Ed). Oxford & IBH Publishing Company, New Delhi.

SSAC-311 Manures, Fertilizers and Soil Fertility Management 3(2+1)

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures; Green/leaf manuring; Soil organic matter, composition, properties and influences of soil fertility, humic substances – nature and properties; Chemical fertilizers: classification, specification 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; Forms of nutrients in soil, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants; Soil fertility evaluation, Soil testing; Critical levels of different nutrients in soil. Indicator plants; Methods of fertilizer recommendations to crops; Factor influencing nutrient use efficiency (NUE), Integrated nutrient management.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of available 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction and importance of organic manures	1
2.	Classification of organic manures	1
3.	Properties and methods of preparation of bulky manures	2
4.	Properties and methods of preparation of concentrated manures	2
5.	Green/leaf manuring	1
6.	Soil organic matter , composition, properties and influences of on soil fertility	2
7.	Humic substances – nature and properties	1
8.	Chemical fertilizers: classification	1
9.	Major Nitrogenous fertilizers (Urea, Ammonium sulphate, CAN) - Chemistry of manufacturing and fate in soil	2
10.	Major Phosphatic fertilizers(SSP, TSP and DAP)- Chemistry of manufacturing and fate in soil	2
11.	Major Potassic fertilizers (MOP and Potassium sulphate) - Chemistry of manufacturing and fate in soil	1
12.	Secondary & micronutrient fertilizers sources and application	1
13.	Complex fertilizers, nano fertilizers sources and application	1
14.	Soil amendments, Fertilizer storage, fertilizer control order	2

15.	History of soil fertility and plant nutrition	1
16.	Criteria of essentiality. Forms of nutrients in soil	1
17.	Role, deficiency and toxicity symptoms of essential plant nutrients	2
18.	Mechanisms of nutrient transport to plants	1
19.	Factors affecting nutrient availability to plants	1
20.	Soil fertility evaluation	2
21.	Soil testing. Critical levels of different nutrients in soil	1
22.	Indicator plants. Methods of fertilizer recommendations to crops	1
23.	Factor influencing nutrient use efficiency (NUE)	1
24.	Integrated nutrient management	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Introduction of analytical instruments, their principles, calibration and applications, colorimetry and flame photometry	2
2.	Determination of organic carbon in soil	1
3.	Determination of available nitrogen in soil	1
4.	Determination of soil extractable phosphorus	2
5.	Determination of exchangeable potassium in soil	1
6.	Determination of Ca, Mg in soil	1
7.	Determination of soil extractable sulphur in soil	2
8.	Determination of available DTPA extractable -zinc in soil	1
9.	Rapid plant tissue test- N, P and K	2
10.	Estimation of N, P, K and S in plant	3

Suggested Readings:

1. Chopra, S. L., Kanwar, J. S. and Rakshit, A. 2013. Analytical Agricultural Chemistry, Kalyani Publishers Ludhiana.
2. Das, D. K. 2002. Introductory Soil Science, Kalyani publisher, New Delhi.
3. FAI. 1999. Fertilizer (Control) Order, 1985 and the Essential Commodities Act, 1995. FAI, New Delhi, pp. 203.
4. ISSS. 2002. Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi.
5. Jackson, M. L. 1973. Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi.
6. Kanwar, J. S. 1976. Soil Fertility: Theory and Practice. (ed.) ICAR, New Delhi pp. 583.
7. Rakshit, A., Raha, P. and De, N. 2015. Manures, Fertilizers and Agrochemicals-Theory and Application. CBS Publishers, New Delhi.
8. Singh, D., Chhonkar, P. K. and Dwivedi V. S. 2005. Manul on Soil Plant and water analysis. Westville Publishing House, New Delhi.
9. Tisdale, S. L. and Nelson, W. L. 1990. Soil Fertility and fertilizers, McMillan Pub. Co. New York. pp.754.
10. Yawalkar, K. S. and Agarwal. J. P. 1992. Manure and fertilizers. Agriculture-Horticulture Publishing House, Nagpur.

ENTO-311 Pests of Crops and Stored Grain and their Management 3(2+1)

Theory

Scientific name, order, family, distribution, identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests; **Polyphagous insect pests:** Locust, grasshopper, whitegrub, termite and red hairy caterpillar.

Pests of field crops: Cereals and millets- Rice: Brown plant hopper, yellow stem borer, rice hispa. Sorghum: Shootfly; Maize: Stem borer; Sugarcane: Pyrilla, whitefly, shoot borer. Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar. Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer. Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug. **Pests of vegetables** Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Chilli: Thrips; Onion and garlic: Thrips. Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco). Pea: Stem fly. Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite. **Pests of fruit crops** Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly. Citrus: Citrus psylla, citrus caterpillar, bark-eating caterpillar. Citrus: Citrus psylla, citrus caterpillar, bark-eating caterpillar. Pomegranate: Anar butterfly; Ber: Fruit fly. Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid. **Pests of ornamental crops:** Rose aphid, hollyhock tinged bug, jasmine budworm. **Pests of spices and condiments:** Aphid, seed midge. **Pests of stored grains:** Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite, storage fungi. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect, pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage. Identification 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 nearest FCI godowns.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops -		
1.	Polyphagous insect pests: Locust, grasshopper, whitegrub, termite and red hairy caterpillar	3

2.	Rice: Brown plant hopper, yellow stem borer, rice hispa	1
3.	Sorghum: Shootfly; Maize: Stem borer	1
4.	Sugarcane: Pyrilla, whitefly, shoot borer	1
5.	Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar	2
6.	Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer	2
7.	Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug	2
8.	Pests of vegetables crops: Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Pea: Stem fly	2
9.	Chilli: Thrips; Onion and garlic: Thrips; Drum stick green caterpillar	1
10.	Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco)	3
11.	Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite	2
12.	Pests of fruit crops: Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly	2
13.	Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar	1
14.	Pomegranate: Anar butterfly; Ber: Fruit fly, mite	1
15.	Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid	1
16.	Ornamental Crops: Rose aphid, hollyhock tinged bug, jasmine budworm	1
17.	Spices and condiments: Aphid, seed midge	1
18.	Pests of stored grains: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite, storage fungi	2
19.	Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain	1
20.	Insect, pests, mites, rodents, birds and microorganisms associated with stored grain and their management	1
21.	Storage structure and methods of grain storage and fundamental principles of grain store management	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification, biology, damage symptoms and management of pests of field crops	2
2.	Identification, biology, damage symptoms and management of pests of	1

	pulse crops	
3.	Identification, biology, damage symptoms and management of pests of vegetable crops	2
4.	Identification, biology, damage symptoms and management of pests of fruit crops	1
5.	Identification, biology, damage symptoms and management of stored grain pests	2
6.	Identification of insect pests and mites associated with stored grains	1
7.	Determination of insect infestation by different methods	1
8.	Calculations on the doses of insecticides application technique	1
9.	Fumigation of grain stores and godowns	1
10.	Identification of rodents and birds and their control operations	1
11.	Determination of moisture content of grain	1
12.	Methods of grain sampling under storage condition	1
13.	Visit to nearest FCI godowns	1

Suggested Readings:

1. Atwal, A. S. and Dhaliwal, G. S. 2002. Agricultural Pests of South Asia and their management. Kalyani Publishers, New Delhi.
2. David, B. V. and Ramamurthy, V. V. 2016. Elements of Economic Entomology, (8th Ed). Popular Book Depot, Chennai.
3. Khare, B. P. 1994. Stored Grain Pests and their Management. Kalyani Publishers, New Delhi.
4. Mathur, Y. K. and Upadhyay, K. D. 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
5. Nayar, M. R. G. K. 1986. Insects and Mites of Crops in India. ICAR, New Delhi.
6. Reddy, P. Parvatha, 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur.
7. Srivastava, K. P. 2004. A Text Book of Entomology, Vol. II. Kalyani Publishers, New Delhi.

PPATH-312 Diseases of Field and Horticultural Crops and their Management–I 3(2+1)

Theory

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

FIELD CROPS: Rice: Blast, brown spot, bacterial blight, sheath blight, khaira and tungro. **Maize:** Stalk rots, leaf blights and downy mildews. **Sorghum:** Grain smut and anthracnose. **Bajra:** Downy mildew, ergot and blast. **Groundnut:** Tikka, collar rot and peanut clump virus. **Soybean:** Rhizoctonia blight and bacterial pustule. **Pigeon pea**: Sterility mosaic. **Moong, urd and moth beans:** Web blight and yellow mosaic. **Castor:** Phytophthora blight, bacterial blight and wilt. **Guar:** Bacterial blight and Alternaria blight. **Sesamum:** Stem & root rot and phyllody. **Cotton:** Wilt, root rot, bacterial blight and leaf curl.

HORTICULTURAL CROPS: **Guava**: Wilt and zinc deficiency. **Banana:** Panama wilt, Sigatoka and bunchy top. **Papaya:** Foot rot, leaf curl, ring spot and root knot. **Pomegranate:** leaf spots,

bacterial blight and root knot nematode. **Cabbage**: Alternaria leaf spot and black rot. **Brinjal:** Phomopsis blight and little leaf. **Tomato:** Damping off, bacterial wilt, early blight, leaf curl and root knot. **Okra:** Yellow vein mosaic. **Ginger:** Rhizome rot. **Date palm**: Graphiola leaf spot. **Coconut:** Root wilt, cadang cadang and bud rot. **Tea:** Blister blight and red rust. **Coffee:** Rust.

Practical

Identification and histopathological studies of following selected diseases of field and horticultural crops. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. **Maize:** Stalk rots, leaf blights and downy mildews. **Sorghum:** Grain smut and anthracnose. **Bajra:** Downy mildew and ergot. **Groundnut:** Tikka, collar rot and peanut clump virus. **Soybean:** Rhizoctonia blight and bacterial pustule. **Pigeon pea**: Sterility mosaic. **Moong, urd and moth beans:** Web blight and yellow mosaic. **Castor:** Bacterial blight. **Guar:** Bacterial blight and Alternaria blight. **Sesamum:** Phyllody. **Cotton:** Wilt, root rot, bacterial blight and leaf curl. **Guava**: Wilt and zinc deficiency. **Banana:** Sigatoka and bunchy top. **Papaya:** Leaf curl, ring spot and root knot. **Pomegranate:** leaf spots and Bacterial blight. **Cabbage**: Alternaria leaf spot and black rot. **Brinjal:** Little leaf. **Tomato:** Damping off, bacterial wilt, early blight, leaf curl and root knot. **Okra:** Yellow vein mosaic. **Ginger:** rhizome rot. **Date palm**: Graphiola leaf spot.

Note: Students should submit 30 pressed and well-mounted specimens.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
	Symptoms, etiology, disease cycle and management of major diseases of following crops:	-
1.	**Rice:** Blast, brown spot, bacterial blight, sheath blight, khaira and tungro	3
2.	**Maize:** Stalk rots, leaf blights and downy mildews	2
3.	**Sorghum:** Grain smut and anthracnose	1
4.	**Bajra:** Downy mildew, ergot and blast	1
5.	**Groundnut:** Tikka, collar rot and peanut clump virus	2
6.	**Soybean:** Rhizoctonia blight and bacterial pustule	1
7.	**Moong, urd and moth beans:** Web blight and yellow mosaic **Pigeon pea**: Sterility mosaic. **Okra:** Yellow vein mosaic	2
8.	**Castor:** Phytophthora blight, bacterial blight and wilt	1
9.	**Guar:** Bacterial blight and Alternaria blight	1
10.	**Sesamum:** Stem & root rot and phyllody	1
11.	**Cotton:** Wilt, root rot, bacterial blight and leaf curl	2
12.	**Guava**: Wilt and zinc deficiency	1
13.	**Banana:** Panama wilt, Sigatoka and bunchy top	2
14.	**Papaya:** Foot rot, leaf curl, ring spot and root knot	2
15.	**Pomegranate:** leaf spots, bacterial blight and root knot nematode	1
16.	**Cabbage**: Alternaria leaf spot and black rot	1
17.	**Brinjal:** Phomopsis blight and little leaf	1
18.	**Tomato:** Damping off, bacterial wilt, early blight, leaf curl and root	3

	knot	
19.	**Ginger:** Rhizome rot. **Date palm**: Graphiola leaf spot	1
20.	**Coconut:** Root wilt, cadang cadang and bud rot	2
21.	**Tea:** Blister blight and red rust. **Coffee:** Rust	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
Identification and histopathological studies of selected diseases of field and horticultural crops-		
1.	**Maize:** Stalk rots, leaf blights and downy mildews	1
2.	**Sorghum:** Grain smut and anthracnose	1
3.	**Bajra:** Downy mildew and ergot	1
4.	**Groundnut:** Tikka, collar rot and peanut clump virus	1
5.	**Soybean:** Rhizoctonia blight and bacterial pustule. **Pigeon pea**: Sterility mosaic. **Moong, urd and moth beans:** Web blight and yellow mosaic	2
6.	**Castor:** Bacterial blight, **Guar:** Bacterial blight and Alternaria blight, **Cabbage**: Alternaria leaf spot and black rot	1
7.	**Sesamum:** Phyllody. **Brinjal:** Little leaf	1
8.	**Cotton:** Wilt, root rot, bacterial blight and leaf curl	1
9.	**Guava**: Wilt and zinc deficiency. **Banana:** Sigatoka and bunchy top	1
10.	**Papaya:** Leaf curl, ring spot and root knot	1
11.	**Pomegranate:** leaf spots and Bacterial blight	1
12.	**Tomato:** Damping off, bacterial wilt, early blight, leaf curl and root knot	1
13.	**Okra:** Yellow vein mosaic. **Ginger:** rhizome rot. **Date palm**: Graphiola leaf spot	1
14.	Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium	2
15.	**Note:** Students should submit 30 pressed and well-mounted specimens	-

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. (5th Ed). Academic Press, New York.
2. Cook, A. A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
3. Gupta, S. K. and Thind, T. S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
4. Gupta, V. K. and Paul, Y. S. 2002. Diseases of Field Crops. Indus Publishing Co. Delhi.
5. Mehrotra, R. S. and Agrawal, A. 2013. Plant Pathology. (2nd Ed). Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
6. Rangaswamy, G. and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd., New Delhi.

7. Singh, R. S. 1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Singh, R. S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
9. Singh, R. S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

GPB-311 Crop Improvement-I *(Kharif Crops)* 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; 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.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Castor, 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Crop improvement aspects in **Rice** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc & hybrid seed production	1
2.	Crop improvement aspects in **Maize** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc & hybrid seed production	1
3.	Crop improvement aspects in **Sorghum** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc. & hybrid seed production	1
4.	Crop improvement aspects in **Bajra** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc. & hybrid seed production	1

5.	Crop improvement aspects in **Urd, Mung and Cowpea** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
6.	Crop improvement aspects in **Pigeonpea** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc. & hybrid seed production	1
7.	Crop improvement aspects in **Soybean** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
8.	Crop improvement aspects in S**essame** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
9.	Crop improvement aspects in **Groundnut** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
10.	Crop improvement aspects in **Cotton** and **castor** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
11.	Crop improvement aspects in **Chilli** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
12.	Crop improvement aspects in **tomato** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
13.	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)	1
14.	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops	1
15.	Ideotype concept	1
16.	Climate resilient crop varieties for future	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Emasculation and hybridization techniques in Rice, Maize	1
2.	Emasculation and hybridization techniques in Sorghum and Bajra	1
3.	Emasculation and hybridization techniques in Urd, Mung, Cowpea, Pigeonpea	1
4.	Emasculation and hybridization techniques in Soybean and sessame	1
5.	Emasculation and hybridization techniques in Groundnut and cotton	1
6.	Maintenance breeding of different kharif crops	1

7.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods	1
8.	Study of field techniques for seed production and hybrid seeds production in *Kharif* crops	1
9.	Estimation of heterosis, inbreeding depression and heritability	1
10.	Layout of field experiments	1
11.	Study of quality characters	1
12.	Donor parents for different characters	1
13.	Visit to seed production plots	2
14.	Visit to AICRP plots of different field crops	2

Suggested Readings:

1. Chaddha, K. L. and Gupta, R. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
2. Chopra, V. L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Mandal, A. K., Ganguli, P. K. and Banerjee, S. P. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit, S. Kang. 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J. M. 1987. Breeding of Field Crops. AVI Publishing Co.. INC, East Port, Conneacticut, USA.
6. Ram, H. H. and Singh, H. G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Ram. H. H. 2005. Vegetable Breeding - Principles and Practices. Kalyani Publishers, New Delhi.
8. Sharma, A. K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.

EXT-311 Entrepreneurship Development and Business Communication 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Concept of entrepreneur, entrepreneurship development, characteristics of entrepreneurs	1
2.	SWOT analysis & achievement motivation	1
3.	Government policy and programs and institutions for entrepreneurship development	2
4.	Impact of economic reforms on agribusiness / agrienterprises	1
5.	Entrepreneurial development process	1
6.	Business leadership skills	1
7.	Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)	2
8.	Developing managerial skills, business leadership skills (communication, direction and motivation Skills)	2
9.	Problem solving skill, supply chain management and total quality management	2
10.	Project planning, formulation and report preparation	2
11.	Financing of enterprise, opportunities for agri-entrepreneurship and rural enterprise	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Assessing entrepreneurial traits	1
2.	Assessing problem solving skills	1
3.	Assessing managerial skills	1
4.	Assessing achievement motivation	1
5.	Practical exercise in creativity	2
6.	Time audit through planning, monitoring and supervision	2
7.	Identification and selection of business idea	2
8.	Preparation of business plan and proposal writing	2
9.	Visit to entrepreneurship development institute	2
10.	Visit to successful entrepreneurs	2

Suggested Readings:

1. Akhouri, M. M. P., Mishra, S. P. and Sen Gupta, R. 1989. Trainers Manual on Developing Entrepreneurial Motivation. NIESBUD, New Delhi.
2. Balasubrmanyam, M. 1985. Business Communication. Vani Educational Books, Delhi.

3. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut, New Delhi.
4. Chole, R. R., Kapse, P. S. and Deshmukh, P. R. 2012. Entrepreneurship Development and Communication Skills. Scientific Publisher (India), Jodhpur.
5. De, D. and Rao, M. S. 2001. Entrepreneurial behaviour of farmers: An Axiomatic Theory. Ganga Kaveri Publishing House, Varanasi.
6. De, D. and Jirli, B. 2008. Entrepreneurship: Theory and practice in agriculture, Ganga Kaveri Publishing House, Varanasi.
7. Goyal, D. P. 1994. Management Information System: Concept and Application. Deep & Deep Publisher, New Delhi.
8. Khanka, S. S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
9. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192). Artech House, Inc., USA.
10. Mohanty, S. K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., Delhi.
11. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall Inc., New Jersey
12. Rao, T. V. 1974. Development of an Entrepreneur, Indian Institute of Management. Ahmadabad.

AGRON-311 Geoinformatics and Nano-technology and Precision Farming 2(1+1)

Theory

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture; Crop 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.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture	2
2.	Geo-informatics- definition, concepts, tool and techniques; their	1

	use in Precision Agriculture	
3.	Crop discrimination and yield monitoring, soil mapping	1
4.	Fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS	2
5.	Remote sensing concepts and application in agriculture	1
6.	Image processing and interpretation	1
7.	Global positioning system (GPS), components and its functions	1
8.	Introduction to crop simulation models and their uses for optimization of agricultural inputs	1
9.	STCR approach for precision agriculture	1
10.	Nanotechnology, definition, concepts and techniques	1
11.	Brief introduction about nanoscale effects	1
12.	Nano-particles, nano-pesticides, nano-fertilizers, nano-sensors	1
13.	Use of nanotechnology in seed and water for scaling-up farm productivity	1
14.	Use of nanotechnology in fertilizer and plant protection for scaling-up farm productivity	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Introduction to GIS software, spatial data creation and editing	2
2.	Introduction to image processing software. Visual and digital interpretation of remote sensing images	2
3.	Generation of spectral profiles of different objects	2
4.	Supervised and unsupervised classification and acreage estimation	2
5.	Multispectral remote sensing for soil mapping	1
6.	Creation of thematic layers of soil fertility based on GIS	1
7.	Creation of productivity and management zones	1
8.	Fertilizers recommendations based of VRT and STCR technique	1
9.	Crop stress (biotic/abiotic) monitoring using geospatial technology	1
10.	Use of GPS for agricultural survey	1
11.	Formulation, characterization and applications of nanoparticles in agriculture	1
12.	Projects formulation and execution related to precision farming	1

Suggested Readings:

1. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
2. Gupta, R. K. and Chander, S. 2008. Principles of Geoinformatics. Jain Brothers, Delhi.
3. Krishna, K. K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press.

4. Sekhon, B. S. 2014. Nanotechnology in agri-food production: an overview. Nanotechnology, Science and Applications **7**:31-532.

5. Srivastava, G. S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd., New Delhi.

AGRON-312 Practical Crop Production – I (*Kharif* crops) 2(0+2)

Practical

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.

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Introduction of the course, crop planning and allotment of field	1
2.	Raising field crops in multiple cropping systems	2
3.	Field preparation	1
4.	Selection of crop and varieties, Seed treatment	2
5.	Sowing of crops	1
6.	Observations on germination	1
7.	Thinning and gap filling	1
8.	Intercultural operations-hoeing and weeding	2
9.	Water management- application of irrigation water and demonstrating methods of irrigation	2
10.	Top dressing of fertilizer (urea)	1
11.	Insect and pest management (control)- application of insecticides	1
12.	Disease management (control)- application of fungicides	1
13.	Harvesting	1
14.	Threshing, winnowing and storage	1
15.	Marketing of produce	2
16.	The emphasis will be given to seed production, mechanization	3
17.	Resource conservation and integrated nutrient	3
18.	Insect-pest and disease management technologies	3
19.	Preparation of balance sheet including estimating cost of cultivation and net return per student as well as per team of a group of student	3

Suggested Readings:

1. Balasubramaniyan, P. and Palaniappan, S. P. 2016. Principles and Practices of Agronomy. Agrobios (India), Jodhpur.
2. Reddy, S. R. 2016. Principles of Agronomy (5th edition). Kalyani Publishers, Ludhiana.
3. Singh, S. S. and Singh, R. 2015. Principles and Practices of Agronomy (5th Re-set). Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

GPB-312	Intellectual Property Rights	1(1+0)

Theory

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction and meaning of intellectual property	1
2.	Introduction to GATT, WTO, TRIPs and WIPO	2
3.	Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.	1
4.	Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets	2
5.	Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims	1
6.	Patent opposition and revocation, infringement	1
7.	Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database	1
8.	Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India	2
9.	Registration of plant varieties under PPV&FR Act 2001	1
10.	Plant breeders rights, breeders, researcher and farmers rights	1
11.	Traditional knowledge-meaning and rights of TK holders	1
12.	Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA)	1
13.	Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing	1

Suggested Readings:

1. Acharya, N. K. 2014. Text Book of Intellectual Property Rights. Asia Law House, Hyderabad.

2. Adukia, R. S. 2013. Handbook on Intellectual Property Rights in India. Jain Book Depot. New Delhi.
3. Catherine, J. 2007**.** Intellectual property: patents, trademarks, copyrights, trade secrets. Entrepreneur Press, Holland.
4. Elsy, C. R., Joseph, J. and Thomas, J. K. 2014. Protection and Management of IPR in Agriculture. Kerala Agricultural University, Vellanikkara.
5. GOI. 2001. The Protection of Plant varieties and Farmers Rights. The Gazette of India 2(1) Ministry of Law, Justice and Company Affairs, GOI, New Delhi.
6. GOI. 2003. The Biological Diversity Act, 2002. The Gazette of India II (1) Ministry of Law, GOI, New Delhi.
7. IPR & Plant Breeder's Rights At a glance - Phundan Singh & Rajeev Singh
8. IPR & Plant Breeder's Rights- Phundan Singh
9. IPR & Plant Breeder's Rights- Phundan Singh, Rajeev Singh, S. K. Chandel & S. K. Chauhan
10. Karki, M. M. S. 2009. Intellectual Property Rights: Basic Concepts. Atlantic Publishers, Mumbai.
11. Rosedar, S. R. A. 2014. Intellectual Property Rights (1stEd.) LexisNexis.

Important Websites

www.patentoffice.nic.in – Patent office, India,
http://copyright.gov.in/ - Copyright Office, India
www.plantauthority.gov.in – Plant Varieties and Farmers' Rights Authority, India
http://nbaindia.org/ - National Biodiversity Authority,
www.nipo.in – The Indian IPR Foundation
www.wipo.int – World Intellectual Property Organisation, http://www.wto.org – World Trade Organisation

ELECTIVE COURSES

HORT-311 Protected Cultivation (Elective course) 3(2+1)

Theory

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, lilium, tulip, tomato, bell pepper, cucumber, strawberry, turmeric, ginger; Off-season production of flowers and vegetables; Insect pest and disease management.

Practical

Raising of seedlings and saplings under protected conditions, use of protrays 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 ad misting.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Protected cultivation- importance and scope	1
2.	Status of protected cultivation in India and World, types of protected structure based on site and climate	2
3.	Cladding material involved in greenhouse/ poly house	1
4.	Greenhouse design, environment control, artificial lights, automation	2
5.	Soil preparation and management, substrate management	1
6.	Types of benches and containers	1
7.	Irrigation and fertigation management	1
8.	Propagation and production of quality planting material of horticultural crops	3
	Green house cultivation of important horticultural crops	
9.	Greenhouse cultivation of rose	2
10.	Greenhouse cultivation of important horticultural crops – carnation	1
11.	Greenhouse cultivation of important horticultural crops – chrysanthemum	1
12.	Greenhouse cultivation of important horticultural crops – gerbera	1
13.	Greenhouse cultivation of important horticultural crops – orchid	1
14.	Greenhouse cultivation of important horticultural crops – anthurium	1
15.	Greenhouse cultivation of important horticultural crops – lilium	1
16.	Greenhouse cultivation of important horticultural crops – tulip	1

17.	Greenhouse cultivation of important horticultural crops – tomato	1
18.	Greenhouse cultivation of important horticultural crops – bell pepper	1
19.	Greenhouse cultivation of important horticultural crops – cucumber	1
20.	Greenhouse cultivation of important horticultural crops – strawberry	1
21.	Greenhouse cultivation of important horticultural crops – turmeric	2
22.	Greenhouse cultivation of important horticultural crops – ginger	2
23.	Off-season production of flowers and vegetables	2
24.	Insect pest and disease management	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Raising of seedlings and saplings under protected conditions	2
2.	Use of protrays in quality planting material production	2
3.	Bed preparation and planting of crop for production	5
4.	Inter cultural operations	2
5.	Soil EC and pH measurement	2
6.	Regulation of irrigation and fertilizers through drip, fogging ad misting	3

Suggested Readings:

1. Anonymous 2003. Proc. All India Seminar on Potential and Prospects for Protective Cultivation. Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
2. Arora, S. K., Bhatia, A. K., Mangal, J. L. and Kumar, P. 2004. Practical Manual Green House Technology for Vegetable Production. Deptt. of Vegetable Science, CCSHAU, Hisar (Haryana).
3. Chandra, S. and Som, V. 2000. Cultivating Vegetables in Green House. Indian Horticulture, 45: 17-18.
4. More, T. A., Jagtap, K. B. and Ranpsie, 1988. Green House Technology. Continental Publishers, Pune.
5. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crop. Kalyani Publishers, Ludhiana.

AGRON-313 Weed Management (Elective course) 3(2+1)

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem; Classification, reproduction and dissemination of weeds; Weed prevention, control and eradication; Methods of weed control: physical, chemical and biological. Integrated weed management; 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.

Practical

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem	2
2.	Classification, reproduction and dissemination of weeds	2
3.	Weed prevention, control and eradication	2
4.	Methods of weed control: physical, chemical and biological	3
5.	Integrated weed management	2
6.	Introduction to herbicides, advantages and limitations of herbicides usages	1
7.	Herbicide classification	2
8.	Concept of adjuvant, surfactant, herbicide formulation and their use	2
9.	Introduction to mode of action of herbicides and selectivity	2
10.	Allelopathy and its application for weed management	2
11.	Bio-herbicides and their application in agriculture	2
12.	Concept of herbicide mixture and utility in agriculture	3
13.	Herbicide compatibility with agro-chemicals and their application	2
14.	Integration of herbicides with non chemical methods of weed management	3
15.	Herbicide resistance and its management	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of common weeds and their characteristics	2
2.	Techniques of weed preservation	2
3.	Biology of important weeds	2
4.	Study of herbicide formulations and mixture of herbicide	2
5.	Herbicide and agro-chemicals study	2
6.	Shift of weed flora study in long term experiments	1
7.	Study of methods of herbicide application	1
8.	Familiar with herbicide spray equipments	1
9.	Calculations of herbicide doses and weed control efficiency and weed index	3

Suggested Readings:

1. Das, T.K.2019. Weed Science: Basics and Applications, Jain Brothers, New Delhi (India)
2. Gupta, O. P. 2015. Weed Management: Principles and Practices (3rd edition), Agrobios (India), Jodhpur.
3. Gupta, O. P. 2016. Modern Weed Management (3rd edition), Agrobios (India), Jodhpur.
4. Rao, V. S. 2000. Principals of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.
5. Saraswat, V. N., Bhan, V. M. and Yaduraju, N. T. 2003. Weed Management, ICAR, Delhi.
6. Shukla, U.N. 2016. A Practical Manual on Weed Management (Fourth Dean Committee), Department of Agronomy, College of Agriculture, Jodhpur (Publication No.: CoA/MND/02/2016)
7. Shukla, U.N. and Mishra, M.L. 2020. A Practical Manual on Weed Management (Fifth Dean Committee), Department of Agronomy, College of Agriculture, Jodhpur (Publication No.: CoA/JODH/27/2020)

GPB -313 Micro propagation Technologies (Elective course) 3(1+2)

Theory

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation.

Practical

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction, history, advantages and limitations of Micro propagation technologies	1
2.	Types of cultures (seed, embryo, organ, callus, cell)	3
3.	Stages of micropropagation	2
4.	Axillary bud proliferation (Shoot tip and meristem culture, bud culture)	2
5.	Organogenesis (callus and direct organ formation)	2
6.	Somatic embryogenesis	1
7.	Cell suspension cultures	1
8.	Production of secondary metabolites	2
9.	Somaclonal variation	1
10.	Cryopreservation	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification and use of equipments in tissue culture Laboratory	2
2.	Nutrition media composition	3
3.	Sterilization techniques for media	2
4.	Sterilization techniques for containers and small instruments	3
5.	Sterilization techniques for explants	2
6.	Preparation of stocks and working solution	4
7.	Preparation of working medium	3
8.	Culturing of explants	2
9.	Seeds, shoot tip and single node	5
10.	Callus induction	2
11.	Induction of somatic embryos regeneration of whole plants from different explants	2
12.	Hardening procedures	2

Suggested Readings:

1. Bhojwani, S. S. 1983. Plant Tissue Culture. Theory and Practice, Elsevier.
2. Christou, P. and Klee, H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons.
3. Dixon, R. A. 2003. Plant Cell Culture. IRL Press.
4. George, E. F., Hall, M. A. and De Klerk, G. J. 2008. Plant Propagation by Tissue Culture. Agritech Publishing.
5. Herman, E. B. 2005-08. Media and Techniques for Growth, Regeneration and Storage. Agritech Publishing.
6. Pierik, R. L. M. 1997. In vitro Culture of Higher Plants. Kluwer.
7. Singh, B. D. 2007. Biotechnology: Expanding Horiozon. Kalyani Publishers.

B. Sc. (Hons.) Agriculture
Part- III, Semester-II

AGRON-321 Rainfed Agriculture and Watershed Management 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Rainfed agriculture- definition, history and its importance in India with particular to references Rajasthan	1
2.	Problems of dryland agriculture related to climate, soil, technological and socio economic conditions	1
3.	Soil and climatic conditions prevalent in rainfed areas, soil and water conservation techniques	2
4.	Drought: types, effect of water deficit on physio- morphological characteristics of the plants	1
5.	Use of antitranspirants-their kind, mode of action and effect on crop yield	1
6.	Crop adaptation and mitigation to drought	1
7.	Water harvesting: importance, its techniques	1
8.	Efficient utilization of water through soil and crop management practices	1
9.	Water harvesting techniques in dry farming areas	1
10.	Watershed management- concept, definition, objectives and principles	1

11.	Integrated watershed management for drylands	1
12.	A study of model watershed area	1
13.	Management of crops in rainfed areas	1
14.	Contingent crop planning for aberrant weather conditions	1
15.	Alternate cropping and land use strategies for dryland agriculture	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Studies on climate classification	1
2.	Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons	1
3.	Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India	1
4.	Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops	1
5.	Critical analysis of rainfall and estimation of moisture index and aridity index and possible drought period in the country	1
6.	Field demonstration on construction of water harvesting structures	1
7.	Effective rainfall and its calculation	1
8.	Studies on cultural practices for mitigating moisture stress	1
9.	Spray of antitranspirants on dryland crops and their effect on crops	1
10.	Characterization and delineation of model watershed	1
11.	Field demonstration on soil & moisture conservation measures	1
12.	Crops and cropping systems for drylands	1
13.	Acquiring skill in tillage methods for *in-situ* moisture conservation	1
14.	Mulching and its effects on soil moistures conservation	1
15.	Seed soaking, seed treatment with chemicals for sowing in dryland areas	1
16.	Visit to rainfed research station/watershed	1

Suggested Readings:

1. Dhruva Narayan, V. V., Singh, P. P., Bhardwaj, S. P., Sharma, U., Sikha, A. K., Vital, K. P. R. and Das, S. K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
2. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Reddy, S. R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
5. Singh, P. K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.
6. Singh, R. P. 1995. Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.

7. Singh, R. P., Sharma, S., Padmnabhan, N. V., Das, S. K. and Mishra, P. K. 1990. A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.
8. Singh, S. S. 1993. Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.

AGENGG-321 Protected Cultivation and Secondary Agriculture 2(1+1)

Theory

Green house technology: Introduction, Types of Green Houses; climate control in Green house, 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 naturally ventilated solar green house, high tech green house, use of green house in drying; Concept and construction of low tunnels. Use of shade net house in protected cultivation; Important Engineering properties such as physical, thermal and aero & hydrodynamic of cereals, pulses and oilseed; Concepts of cleaning and grading; Drying and dehydration: Moisture measurement, EMC, drying theory, various drying methods, commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer); Material handling equipment: conveyer and elevators, their principle, working and selection.

Practical

Study of different types of greenhouses based on shape. Measurement of solar radiation, CO_2 level, humidity and temperature inside and outside green house. Determination of drying rate of agricultural products inside green house. Study of greenhouse equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying method. Study of spiral, centrifugal and disc separator. Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant and agro processing plant.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Introduction to Greenhouse technology, types of green houses and climate control inside green house	1
2.	Planning and design of greenhouses	1
3.	Design criteria of green house for cooling and heating purposes and greenhouse equipments	1
4.	Materials of construction for traditional and low cost green houses	1
5.	Irrigation systems used in greenhouses	1
6.	Naturally ventilated solar green house, high tech green house	1
7.	Use of green house in drying	1
8.	Concept and construction of low tunnels. Use of shade net house in protected cultivation	2
9.	Important engineering properties such as physical, thermal and aero & hydrodynamic of cereals, pulses and oilseed	1
10.	Concepts of cleaning and grading vibratory and rotary type air	1

	cleaner	
11.	Drying and dehydration: Moisture measurement, EMC, drying theory, various drying methods	1
12.	Commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer)	2
13.	Material handling equipment: conveyers and elevators, their principle, working and selection	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of various shapes of green houses	1
2.	Measurement of climatic factors inside and outside green houses and study of greenhouse equipments	1
3.	Construct of low tunnel in vegetable crops	2
4.	Study of shade net house and visit to nearby shade net house	2
5.	Drying of agriculture produce in green house	1
6.	Determination of moisture content by oven drying methods	1
7.	Study of spiral, centrifugal and disc separator	1
8.	Determination of moisture content of various grains by moisture meter	2
9.	Study of mechanical grain dryer- bin dryer, tray dryer, and re-circulatory dryer	2
10.	Visit to seed processing plant	1
11.	Visit to agro processing plants	2

Suggested Readings:

1. Chakraverty, A. 2008. Post Harvest Technology of Cereals, Pulses and Oil Seeds. Oxford and IBH Pub. New Delhi.
2. Henderson, S. M. and Perry, R. L. 1955. Agricultural Process Engineering. John Willy and Sons, New York.
3. Michael, A. M. and Ojha, T. P. 2012. Principles of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
4. Sharma, A. and Salokhe, V. M. 2006. Green House Technology- Application and Practice. Agro Tech. publication, Udaipur
5. Shay K. M. and Singh, K. K. 2004. Unit operation of Agriculture Processing. Vikas Publication House, New Delhi.
6. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crops. Kalyani Publishers, New Delhi.

PPATH-321	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)

Theory

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

FIELD CROPS: Wheat: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu. **Barley:** Stripe, covered smut and molya disease. **Sugarcane:** Red rot, whip smut, grassy shoot, ratoon stunting and Pokkahboeng. **Sunflower**: Alternaria blight. **Lentil:** Wilt. **Mustard:** Alternaria blight, white rust and Sclerotinia rot. **Gram:** Root rot, wilt and Ascochyta blight. **Isabgol:** Downy mildew. **Coriander:** Stem gall. **Cumin**: Wilt, powdery mildew and Alternaria blight. **Fenugreek:** Powdery mildew.

HORTICULTURAL CROPS: Mango: Malformation and black tip. **Citrus:** Canker, dieback and gummosis. **Grape vine:** Downy mildew and anthracnose. **Apple:** Scab. **Ber:** Powdery mildew. **Aonla:** Rust. **Potato:** Late blight, black heart, golden nematode and leaf roll. **Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot. **Onion**: Purple blotch. **Chillies:** Anthracnose and leaf curl. **Pea:** Root rot and powdery mildew. **Carrot:** Alternaria blight. **Rose:** Dieback and powdery mildew. **Marigold:** Blight.

Practical

Identification and histopathological studies of following selected diseases of field and horticultural. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. **Wheat**: Rusts, loose smut, karnal bunt and ear cockle. **Barley:** Stripe, covered smut and molya disease. **Sugarcane:** Red rot, whip smut and grassy shoot. **Sunflower**: Alternaria blight. **Lentil:** Wilt. **Mustard:** Alternaria blight, white rust and Sclerotinia stem rot. **Gram:** Root rot, wilt and Ascochyta blight. **Isabgol:** Downy mildew. **Coriander:** Stem gall. **Cumin**: Wilt, powdery mildew and Alternaria blight. **Fenugreek:** Powdery mildew. **Mango**: Malformation and black tip. **Citrus:** Canker, dieback and gummosis. **Grape vine:** Downy mildew and anthracnose. **Ber:** Powdery mildew. **Aonla:** Rust. **Potato:** Late blight, black heart, golden nematode and leaf roll. **Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot. **Onion**: Purple blotch. **Chillies:** Anthracnose and leaf curl. **Pea:** Root rot and powdery mildew. **Carrot:** Alternaria blight. **Rose:** Dieback and powdery mildew. **Marigold:** Blight.

Note: Students should submit 30 pressed and well-mounted specimens.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	**Wheat**: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu	4
2.	**Barley:** Stripe, covered smut and molya disease	2
3.	**Sugarcane:** Red rot, whip smut, grassy shoot, ratoon stunting and Pokkahboeng	3
4.	**Mustard:** Alternaria blight, white rust and Sclerotinia rot **Sunflower**: Alternaria blight	2
5.	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt	2

6.	**Coriander:** Stem gall. **Fenugreek:** Powdery mildew; **Cumin**: Wilt, powdery mildew and Alternaria blight	3
7.	**Mango**: Malformation and black tip	2
8.	**Citrus:** Canker, dieback and gummosis	1
9.	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew	1
10.	**Apple:** Scab. **Aonla:** Rust	1
11.	**Potato:** Late blight, black heart, golden nematode and leaf roll	3
12.	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot	2
13.	**Onion**: Purple blotch. **Carrot:** Alternaria blight	1
14.	**Chillies:** Anthracnose and leaf curl	1
15.	**Pea:** Root rot and powdery mildew. **Ber:** Powdery mildew	2
16.	**Rose:** Dieback and powdery mildew	1
17.	**Marigold:** Blight	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
	Identification and histopathological studies of following selected diseases of field and horticultural crops	-
1.	**Wheat**: Rusts, loose smut, karnal bunt and ear cockle	1
2.	**Barley:** Stripe, covered smut and molya disease	1
3.	**Sugarcane:** Red rot, whip smut and grassy shoot	1
4.	**Mustard:** Alternaria blight, white rust and Sclerotinia stem rot	1
5.	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt	1
6.	**Coriander:** Stem gall. **Cumin**: Wilt, powdery mildew and Alternaria blight **Fenugreek:** Powdery mildew. **Ber:** Powdery mildew	2
7.	**Mango**: Malformation and black tip.**Aonla:** Rust	1
8.	**Citrus:** Canker, dieback and gummosis	1
9.	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew	1
10.	**Potato:** Late blight, black heart, golden nematode and leaf roll	1
11.	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot	1
12.	**Chillies:** Anthracnose and leaf curl. **Pea:** Root rot and powdery mildew. **Rose:** Dieback and powdery mildew. **Marigold:** Blight	1
13.	**Sunflower**: Alternaria blight. **Onion**: Purple blotch. **Carrot:** Alternaria blight	1
14.	Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium	2
Note: Students should submit 30 pressed and well-mounted specimens		-

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. (5th Ed). Academic Press, New York.
2. Cook, A. A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
3. Gupta, S. K. and Thind, T. S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
4. Gupta, V. K. and Paul, Y. S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
5. Mehrotra, R. S. and Agrawal, A. 2013. Plant Pathology. (2nd Ed). Tata McGraw-Hill Publishing Co. Ltd. New Delhi.
6. Rangaswamy, G. and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd., New Delhi.
7. Singh, R. S. 1998. Diseases of Vegetable Crops. (3rd Ed). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Singh, R. S. 2009. Plant Diseases. (9th Ed). Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
9. Singh, R. S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

HORT-321 Post-harvest Management and Value Addition of Fruits and Vegetables 2(1+1)

Theory

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; 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.

Practical

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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance of post-harvest processing of fruits and vegetables	1
2.	Extent and possible causes of post-harvest losses	1
3.	Pre-harvest factors affecting postharvest quality, maturity, ripening	1

	and changes occurring during ripening	
4.	Respiration and factors affecting respiration rate	1
5.	Maturity indices, harvesting and field handling	1
6.	Storage (ZECC, cold storage, CA, MA, and hypobaric)	1
7.	Value addition concept; Principles and methods of preservation	2
8.	Intermediate moisture food- Jam, jelly, marmalade	1
9.	Preserve, candy – Concepts and standards	1
10.	Fermented and non-fermented beverages	2
11.	Tomato products- Concepts and standards	1
12.	Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying	1
13.	Canning – Concepts and standards, packaging of products	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification and applications of different types of packaging, containers for shelf life extension	1
2.	Identification of important tools/equipments/ machines and chemicals required for PHT laboratory	1
3.	Demonstration of Zero energy cool chamber	1
4.	Effect of temperature on shelf life and quality of produce (drying and dehydration)	1
5.	Demonstration of chilling and freezing injury in vegetables and fruits	1
6.	Extraction and preservation of pulps and juices	1
7.	Preparation of Jam and Jelly	1
8.	Pickles	1
9.	RTS, nectar and squash	1
10.	Osmotically dried products	1
11.	Fruit bar and Candy	1
12.	Tomato products (sauce and ketchup)	1
13.	Canned products	1
14.	Quality evaluation of products - physico-chemical (Moisture, TSS, acidity and ascorbic acid) and sensory	2
15.	Visit to processing unit/ industry	1

Suggested Readings:

1. Battacharjee, S. K. and De, L. C. 2005. Post Harvest Technology of Flowers and Ornamentals Plants. Pointer Publisher.
2. Chadha, K. L. and Pareek, O. P. 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House. New Delhi.
3. Haid, N. F. and Salunkhe, S. K. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ.

4. John, P. J. 2008. A Handbook on Post Harvest management of Fruits and Vegetables. Daya Publishing House. Delhi.
5. Kader, A. A. 2002. Postharvest Technology of Horticultural Crops. UCUCANR Publications. 535p.
6. Mitra, S. K. 1997. Postharvest Physiology and Storage of Tropical Fruits. CAB International, UK.
7. NIIR Board. 2012. Food Packaging Technology Handbook (2nd Rev.Ed). NIIR Project Consultancy Services. 749 p.
8. Rajarathnam, S. and Ramteke, R. S. 2011. Advances in preservation and processing technologies of fruits and vegetables. New India Publishing Agency, New Delhi.
9. Ranganna, S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata Mc. Graw Hill Publishing Company, New Delhi, 1112p.
10. Saraswathy, S., Preeti, J. L., Balasubramanyan, S., Suresh, J., Revathy, N. and Natarajan, S. 2008. Postharvest management of horticultural crops. AGRIBIOS (India).
11. Sharma, S. K. 2010. Post-harvest management and processing of fruits and vegetables-Instant Notes. New India Publishing Agency. New Delhi.
12. Srivastava, R. P. and Kumar, S. 2007. Fruits and vegetable Preservation: Principles and Practice. International Book Distributing Company, Lucknow.
13. Sudheer, K. P. and Indira, V. 2007. Post Harvest Technology of Horticultural Crops. New India. Publ. Agency.
14. Verma, L. R. and Joshi, V. K. 2000. Postharvest technology of fruits and vegetables-General concepts and principles. Vol I & II. Indus Publishing Co., New Delhi.
15. Vijay, K. 2001. Text Book of Food Sciences and Technology, ICAR.

ENTO-321	Management of Beneficial Insects	2(1+1)

Theory

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; 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.

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Beekeeping and pollinators, Importance, bee species and biology	1
2.	Commercial methods of rearing, equipment used, seasonal management	1
3.	Bee enemies and disease	1
4.	Bee pasturage, bee foraging and communication	1
5.	Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants	1
6.	Importance, species and types of silkworm, voltinism and biology	1
7.	Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves	1
8.	Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm	1
9.	Management, rearing appliances of mulberry silkworm and methods of disinfection	1
10.	Species of lac insect, importance, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products	1
11.	Identification of major parasitoids and predators commonly being used in biological control	1
12.	Insect orders bearing predators and parasitoids used in pest control	1
13.	Mass multiplication techniques of parasitoids	2
14.	Important species of pollinator	1
15.	Weed killers and scavengers with their importance	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Honey bee species, castes of bees	1
2.	Beekeeping appliances and seasonal management, bee enemies and disease	1
3.	Bee pasturage, bee foraging and communication	1
4.	Types of silkworm, voltinism of silkworm	1
5.	Knowledge of mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves	1
6.	Species of lac insect, host plant identification	1
7.	Identification of important parasitoids, predators, pollinators, weed killers and scavengers	2
8.	Collection of important parasitoids, predators, pollinators, weed killers and scavengers	2
9.	Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies	3
10.	Identification and techniques for mass multiplication of natural enemies	3

Suggested Readings:

1. Abrol, D. P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping. Scientific Publishers, Jodhpur.
2. Aruga, H. 1994. Principles of Sericulture. Oxford & IBH, New Delhi.
3. Atwal, A. S. 2006. The World of the Honey Bee. Kalyani Publ., New Delhi.
4. De Bach, P. 1974. Biological control by Natural enemies. Cambridge University Press.
5. Dhaliwal, G. S. and Arora, R. 2001. Integrated Pest Management: Concepts and approaches. Kalyani Publ., New Delhi.
6. Dhaliwal, G. S. and Koul, O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
7. Gautam, R. D. 2008. Biological Pest Suppression. Westville Publising House, New Delhi.
8. Manfred Mackaur, Laster E. Ehler and Jens Roland. 1990. Critical Issues in Biological control- Intercept Ltd. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. Technical Bulletin-4.
9. Srivastava, K. P. 2004. A Text Book of Entomology. Vol. I, Kalyani Publishers, New Delhi.

GPB-321 Crop Improvement-II *(Rabi crops)* 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals (Wheat, Oat and Barley); pulses (Chickpea, Lentil and Field pea); oilseeds (Rapeseed Mustard and Sunflower); fodder crops (Berseem) and cash crops (Sugarcane); vegetable and horticultural crops (Potato); Plant genetic resources, its utilization and conservation; Floral biology, 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); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops; Hybrid seed production technology of rabi crops; Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; 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.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Crop improvement aspects in **Wheat** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1

2.	Crop improvement aspects in **Oat** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
3.	Crop improvement aspects in **Barley**as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
4.	Crop improvement aspects in **Chickpea** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
5.	Crop improvement aspects in **Lentil** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
6.	Crop improvement aspects in **Pigeonpea** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc & hybrid seed production	1
7.	Crop improvement aspects in **Field pea** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
8.	Crop improvement aspects in **Rapeseed Mustard** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology breeding objectives and procedures etc.	1
9.	Crop improvement aspects in **Rapeseed Mustard** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc & hybrid seed production	1
10.	Crop improvement aspects in **Sunflower** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
11.	Crop improvement aspects in **Berseem** and **potato** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc & hybrid seed production	1
12.	Crop improvement aspects in **Sugarcane** as mentioned in the syllabus such as Centers of origin, distribution of species. Floral biology, breeding objectives and procedures etc.	1
13.	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)	1
14.	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops	1
15.	Ideotype concept	1
16.	Climate resilient crop varieties for future	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Emasculation and hybridization techniques in Wheat, Oat, Barley	1
2.	Emasculation and hybridization techniques in Chickpea, Lentil, Field pea	1
3.	Emasculation and hybridization techniques in Rapeseed Mustard	1
4.	Emasculation and hybridization techniques in Sunflower, Potato	1
5.	Emasculation and hybridization techniques in Berseem, Sugarcane	1
6.	Maintenance breeding of different rabi crops	1
7.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods	1
8.	Study of field techniques for seed production and hybrid seeds production in rabi crops	1
9.	Estimation of heterosis, inbreeding depression and heritability	1
10.	Layout of field experiments	1
11.	Study of quality characters	1
12.	Donor parents for different characters	1
13.	Visit to seed production plots	2
14.	Visit to AICRP plots of different field crops	2

Suggested Readings:

1. Bahl, P. N. and Salimath, P. M. 1996. Genetics, Cytogenetics and Breeding of Crop Plants Vol I. Pulses and Oilseeds. Oxford & IBH Publsihing Co Pvt Ltd., New Delhi.
2. Chaddha. K. L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Chopra, V. L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Kumar, N. 2006. Breeding of Horticultural Crops – Principles and Practices.New India Publishing Agency, New Delhi.
5. Mandal, A. K., Ganguli, P. K. and Banerjee, S. P. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
6. Manjit, S. Kang, 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
7. Poehlman, J. M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Conneacticut, USA.
8. Ram, H. H. and Singh, H. G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
9. Ram. H. H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.
10. Sharma, A. K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.

AGRON-322 Practical Crop Production –II (*Rabi* crops) 2(0+2)

Practical

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.

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Allotment of land and field preparation	1
2.	Raising field crops in multiple cropping systems	2
3.	Field preparation	1
4.	Selection of crop and varieties, Seed treatment	2
5.	Sowing of crops	1
6.	Observation of germination	1
7.	Thinning and gap filling	1
8.	Intercultural operations-hoeing and weeding	2
9.	Water management- application of irrigation water and demonstrating methods of irrigation	2
10.	Top dressing of fertilizer (urea)	1
11.	Insect and pest management (control)- application of insecticides	1
12.	Disease management (control)- application of fungicides	1
13.	Harvesting	1
14.	Threshing, winnowing and storage	1
15.	Marketing of produce	2
16.	The emphasis will be given to seed production, mechanization	3
17.	Resource conservation and integrated nutrient management	3
18.	Integrated insect-pest and disease management techniques	3
19.	Preparation of balance sheet including estimating cost of cultivation and net return per student as well as per team of a group of student	3

Suggested Readings:

1. Balasubramaniyan, P. and Pallaniappan, S. P. 2001. Principles and Practices of Agronomy. Agrobios (India), Jodhpur.
2. Reddy, S. R. 2002. Principles of Agronomy. Kalyani Publishers, New-Delhi.
3. Singh, S. S. 1993. Principles and Practices of Agronomy. Kalyani Publishers, New-Delhi.
4. Yawalkar, K. S., Agarwal, J. P. and Bokde, S. 1992. Manures and Fertilizers. Agri-Horticultural Pub. House, Nagpur- India.

AGRON-323	Principles of Organic Farming	2(1+1)

Theory

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.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Organic farming, principles and its scope in India	2
2.	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture	1
3.	Organic ecosystem and their concepts	1
4.	Organic nutrient resources and its fortification	1
5.	Restrictions to nutrient use in organic farming	1
6.	Choice of crops and varieties in organic farming	1
7.	Fundamentals of insect, pest, disease management	2
8.	Weed management under organic mode of production	1
9.	Operational structure of NPOP	2
10.	Certification process and standards of organic farming	2
11.	Processing, leveling, economic considerations and viability	1
12.	Marketing and export potential of organic products	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Visit of organic farms to study the various components and their utilization	2
2.	Preparation of enrich compost	2
3.	Vermicompost	2
4.	Bio-fertilizers/bio-inoculants and their quality analysis	2
5.	Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management	2
6.	Cost of organic production system	2
7.	Post harvest management	2
8.	Quality aspect, grading, packaging and handling	2

Suggested Readings:

1. Dhama, A. K. 2014. Organic Farming for Sustainable Agriculture. (2nd Ed.), Agrobios (India), Jodhpur.
2. Palaniappan, S. P. and Anandurai, K. 1999. Organic Farming – Theory and Practice. Scientific Pub. Jodhpur
3. Sharma, A. K. 2013. A Handbook of Organic Farming. Agrobios (India), Jodhpur
4. Thapa, U. and Tripathy, P. 2006. Organic Farming in India, Problems and prospects. Agrotech, Publising Academy, Udaipur.

AGECON-321 Farm Management, Production and Resource Economics 2(1+1)

Theory

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

Practical

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Meaning and concept of farm management, objectives and relationship with other sciences	1
2.	Meaning and definition of farms, its types and characteristics, factor determining types and size of farms	1

3.	Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship	1
4.	Law of equi-marginal/or principles of opportunity cost and law of comparative advantage	1
5.	Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income	2
6.	Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises	2
7.	Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts	2
8.	Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting. Introduction to linear programming	1
9.	Concept of risk and uncertainty in agriculture production, nature and sources of risks Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation	2
10.	Concepts of resource economics, types of natural resources, differences between NRE and agricultural economics, unique properties of natural resources	1
11.	Positive and negative externalities in agriculture, solutions	1
12.	Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.	1

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Preparation of farm layout	1
2.	Determination of cost of fencing of a farm	1
3.	Computation of depreciation cost of farm assets	2
4.	Application of equi-marginal returns/opportunity cost principle in allocation of farm resources	2
5.	Determination of most profitable level of inputs use in a farm production process	1
6.	Determination of least cost combination of inputs	1
7.	Selection of most profitable enterprise combination	1
8.	Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises	2
9.	Preparation of farm plan and budget, farm records and accounts and profit & loss accounts	2
10	Collection and analysis of data on various resources in Rajasthan	3

Suggested Readings:

1. Dhondyal, S. P. 1987. Farm management: An Economic Analysis. Friends Publications, Meerut.
2. Gittinger, J. P. 1973. Economic Analysis of Agricultural Projects. The Johns Hopkins University Press, Baltimore.
3. Johl, S. S. and Kapur, T. R. 2000. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.
4. Kahlon, A. S. and Singh. K. 1992. Economics of Farm Management in India. Theory and Practice, Allied Publishers.
5. Raju, V. T. and Rao, D. V. S. 2002. Economics of Farm Production and Management. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Reddy, S. S., Ram, P. R. and Dev, J. B. 2004. Agricultural Economics. Oxford & IBH Publishing Co. Private Limited, New Delhi.
7. Sankhayan, P. L. 1988. Introduction to the Economics and Agricultural Production, Prentice Hall of India Private Limited, New Delhi.
8. Singh, I. J. 1977. Elements of Farm Management Economics. Affiliated East-West Press Pvt. Ltd., New Delhi.

FSN-321 Principles of Food Science and Nutrition 2(2+0)

Theory

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

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.)	2
2.	Food- Definition, classification and importance – functions – food groups - major food constituents and their physico-chemical properties	2
3.	Recommended dietary allowances of nutrients for different age groups and sex	1
4.	Water – Functions, Regulation of water balance, disturbances in water balance	1
5.	Carbohydrates – Composition, classification, functions, sources, deficiency	1
6.	Proteins - Composition, classification, functions, sources, deficiency	1
7.	Fats - Composition, classification, functions, sources, deficiency	1
8.	Vitamins – water soluble and fat soluble- functions, sources, deficiency	1

9.	Minerals – Macro minerals – Calcium, Phosphorus, Magnesium, Sodium, Potassium - functions, sources, deficiency	1
10.	Minerals – Micro minerals – Iron, Zinc, Copper, Selenium, Chromium, Manganese, Iodine, Cobalt, , functions, sources, deficiency	1
11.	Organic compounds in food – Flavours, pigments and other bioactive compounds	1
12.	Food spoilage - Common Food borne Bacteria, Moulds and yeasts. Role of microorganisms in food spoilage. Spoilage of milk, fruits and vegetables, grains and oilseeds, fish, meat and poultry	2
13.	Food borne diseases – types – definition – examples, causative organism, symptoms and prevention	1
14.	Principles and methods of food preservation – drying - dehydration – low temperature – freezing – use of chemicals – irradiation - canning, Importance of food preservation	3
15.	Food and nutrition	2
16.	Malnutrition (over and under nutrition)	2
17.	Nutritional disorders	3
18.	Energy metabolism (carbohydrate, fat, proteins)	2
19.	Balanced/ modified diets	1
20.	Menu planning	1
21.	New trends in food science and nutrition	2

Suggested Readings:

1. Baniji, S. M., Krishnaswamy, K. and Brahmam, G. N. V. 2013. Text book of Human Nutrition. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Dietary Guidelines for Indians- A Manual. 2010. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India.
3. Lal, G., Siddappa, G. S. and Tandon, G. L. 1998. Preservation of Fruits and Vegetables. Published by ICAR, New Delhi.
4. Manay, S. and Shadaksharaswamy, M. 2001. Foods: Facts and Principles, II Edition. Published by New Age International P (Ltd.) Publishers. Reprint 2003.
5. Nutrient Requirement and Recommended Dietary Allowances for Indians. 2010. National Institute of Nutrition, Indian Council of Medical Research, New Delhi.
6. Sharma, A. 2010. Text book of Food Science and Technology. 2nd Revised and Enlarged Edition. Ibdc Publishers.
7. Srilakshmi, B. 2009. Nutrition Science. New Age International (P) Limited, Publishers, New Delhi.
8. Srilakshmi, B. 2010. Food Science. New Age International (P) Limited, Publishers, New Delhi.
9. Swaminathan, M. 1998. Advanced Text-Book on Food & Nutrition, Vol.I, Revised and Enlarged Edition Published by The Bangalore Printing And Publishing Co.Ltd.
10. Swaminathan, M. 2011. Hand Book of Food and Nutrition. The Bangalore Printing and Publishing Company Ltd, Bangalore.

ELECTIVE COURSES

HORT-322 Landscaping (Elective course) 3(2+1)

Theory

Importance and scope of landscaping; Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes; Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture; Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents; Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions; Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/ parks/ institutes.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Importance and scope of landscaping	1
2.	Principles of landscaping	2
3.	Garden styles and types	3
4.	Terrace gardening	1
5.	Vertical gardening	1
6.	Garden components	1
7.	Garden adornments	1
8.	Rockery	1
9.	Water garden	1
10.	Walk-paths, bridges, other constructed features etc. gardens for special purposes	1
11.	Trees: selection, propagation, planting schemes, canopy management	1
12.	Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture	1
13.	Climber and creepers: importance, selection, propagation, planting	1

14.	Annuals: selection, propagation, planting scheme	1
15.	Other garden plants: palms, ferns, grasses, cacti succulents and shade loving plants	2
16.	Pot plants: selection, arrangement, management	1
17.	Bio-aesthetic planning: definition, need, planning	2
18.	Landscaping of urban and rural areas	1
19.	Peri-urban landscaping (roof garden)	1
20.	Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions	2
21.	Bonsai: principles and management	2
22.	Lawn: establishment and maintenance	2
23.	CAD application	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Identification of trees, shrubs, annuals, pot plants	2
2.	Identification of tools and implements used in landscape design	1
3.	Propagation of trees, shrubs and annuals	2
4.	Care and maintenance of plants, shrubs and trees	1
5.	Potting and repotting	1
6.	Training and pruning of plants for special effects	1
7.	Lawn establishment and maintenance	1
8.	Layout of formal gardens	1
9.	Layout of informal gardens	1
10.	Layout of special type of gardens (sunken garden, terrace garden, rock garden)	2
11.	Designing of conservatory and lath house	1
12.	Use of computer software	1
13.	Visit to important gardens/ parks/ institutes	1

Suggested Readings:

1. Bose, T. K. and Mukherjee, D. 1972. Gardening in India. Oxford and IBH Publishing Company, Calcutta.
2. Bose, T. K., Maiti, R. G., Dhua, R. S. and Das, P. 1999. Floriculture and Landscaping. Naya Prakash, Calcutta, India.
3. Lauria, A. and Victor, H. R. 2001. Floriculture – Fundamentals and Practices Agrobios. Jodhpur.
4. Nambisan, K. M. P. 1992. Design Elements of Landscape Gardening. Oxford & IBH.
5. Randhawa, G. S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.

FSN-322 Food Safety and Standards (Elective course) 3(2+1)

Theory

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety; Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards; Management of hazards - Need. Control of parameters; Temperature control; Food storage; Product design; Hygiene and Sanitation in Food Service Establishments- Introduction; Sources of contamination and their control; Waste Disposal; Pest and Rodent Control; Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series; TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis; Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene; Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens; Packaging, Product labeling and Nutritional labelling; Genetically modified foods\ transgenics; Organic foods; Newer approaches to food safety; Recent Outbreaks; Indian and International Standards for food products.

Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Food Safety – Definition, importance, scope and factors affecting food safety	2
2.	Hazards and risks, Types of hazards - Biological, chemical, physical hazards	3
3.	Management of hazards - Need	1
4.	Control of parameters	1
5.	Temperature control	1
6.	Food storage	1
7.	Product design	1
8.	Hygiene and Sanitation in Food Service Establishments- Introduction	1
9.	Sources of contamination and their control. Waste Disposal	2
10.	Pest and rodent control. personnel hygiene	1
11.	Food Safety Measures. Food Safety Management Tools- Basic concepts	2
12.	PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series	3
13.	TQM - concept and need for quality, components of TQM, Kaizen.	1

	Risk Analysis	
14.	Accreditation and auditing, water analysis, surface sanitation and personal hygiene	2
15.	Food laws and Standards- Indian Food Regulatory Regime, FSSA	2
16.	Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens	2
17.	Packaging, product labeling and nutritional labeling	1
18.	Genetically modified foods/transgenics. Organic foods	2
19.	Newer approaches to food safety	1
20.	Recent Outbreaks. Indian and International standards for food products	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Water quality analysis physico-chemical and microbiological	2
2.	Preparation of different types of media	2
3.	Microbiological examination of different food samples	3
4.	Assessment of surface sanitation by swab/rinse method	2
5.	Assessment of personal hygiene	1
6.	Biochemical tests for identification of bacteria	2
7.	Scheme for the detection of food borne pathogens	1
8.	Preparation of plans for implementation of FSMS - HACCP, ISO: 22000	3

Suggested Readings:

1. Hester, R. E. and Harrison, R. M. 2001. Food Safety and Food Quality. Royal Society of Chemistry, Cambridge, UK.
2. Inteaz, Alli. 2004. Food Quality Assurance: Principles and Practices. CRC Press, Boca Raton, FL, USA.
3. Ronald, H. S. and Gary, E. R. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.

ENTO-322* Agrochemicals (Elective course) 3(2+1)

Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture; Herbicides-Major classes, properties and important herbicides; Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride; Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb; Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use; Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine,

Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant; IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers; Phosphatic fertilizers: feedstock and manufacturing of single superphosphate; Preparation of bone meal and basic slag; Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate; Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures; Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes; Fertilizer control order; Fertilizer logistics and marketing; Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.
*Course to be shared with Soil Science

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	An introduction to agrochemicals, their type and role in agriculture	1
2.	Effect of agrochemicals on environment, soil, human and animal health, merits and demerits of their uses in agriculture	1
3.	Management of agrochemicals for sustainable agriculture	1
4.	Herbicides-Major classes, properties and important herbicides, Fate of herbicides	1
5.	Fungicides - Classification – Inorganic fungicides - characteristics	1
6.	Preparation and use of sulfur and copper	1
7.	Mode of action-Bordeaux mixture and copper oxychloride	1
8.	Organic fungicides- Mode of action- Dithiocarbamates-characteristics	1
9.	Preparation and use of Zineb and maneb	1
10.	Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use	1
11.	Introduction and classification of insecticides: inorganic and organic insecticides	1
12.	Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals	1

13.	Insecticide Act and rules, Insecticides banned, withdrawn and restricted use	1
14.	Fate of insecticides in soil & plant	1
15.	IGRs Biopesticides, Reduced risk insecticides	1
16.	Botanicals, plant and animal systemic insecticides their characteristics and uses	1
17.	Fertilizers and their importance	1
18.	Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers	3
19.	Phosphatic fertilizers: feedstock and manufacturing of single superphosphate	1
20.	Preparation of bone meal and basic slag	1
21.	Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate	2
22.	Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures	2
23.	Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes	2
24.	Fertilizer control order	1
25.	Fertilizer logistics and marketing	1
26.	Plant bio-pesticides for ecological agriculture, Bio-insect repellent	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Sampling of fertilizers and pesticides	1
2.	Pesticides application technology to study about various pesticides appliances	1
3.	Quick tests for identification of common fertilizers	2
4.	Identification of anion and cation in fertilizer	1
5.	Calculation of doses of insecticides to be used	2
6.	To study and identify various formulations of insecticide available in market	1
7.	Estimation of nitrogen in Urea	1
8.	Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate	2
9.	Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer	1
10.	Determination of copper content in copper oxychloride	1
11.	Determination of sulphur content in sulphur fungicide	1
12.	Determination of thiram	1
13.	Determination of ziram content	1

Suggested Readings:

1. Nene, Y. L. and Thapliyal, P. N. 1991. Fungicides in Plant Disease Control. Oxford & IBHPublishing Co. Pvt. Ltd., New Delhi.
2. Panda, H. 2003. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides with Formulae & Processes. National Institute of Industrial Research publisher.
3. Rao, V. S. 1992. Principles of Weed Science. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
4. Seetharaman, S., Biswas, B. C., Maheswari, S. and Yadav, D. S. 1996. Hand Book on Fertilizers Usage. The Fertilizer Association of India, New Delhi.
5. Sreeramalu, U. S. 1991. Chemistry of Insecticides and Fungicides. Oxford & IBH Publishing Co, New Delhi.
6. Yawalkar, K. S., Agarwal, J. P. and Bokde, S. 1992. Manures and Fertilizers. Agri-Horticultural Publishing House, Nagpur.
7. Basak, R. K. 2007. Fertilizers: A Text Book. Kalyani Publishers, Ludhiana.

AGRON-324 System Simulation and Agro-advisory (Elective course) 3(2+1)

Theory

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams; Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis; Potential and achievable crop production-concept and modelling techniques for their estimation; Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance; Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast; Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential and achievable production; yield forecasting, insect and disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agroadvisory.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	System Approach for representing soil-plant-atmospheric continuum	2
2.	System boundaries, crop models, concepts & techniques	2
3.	Types of crop models, data requirements, relational diagrams	3
4.	Evaluation of crop responses to weather elements	2
5.	Elementary crop growth models; calibration, validation, verification	3

	and sensitivity analysis	
6.	Potential and achievable crop production- concept and modelling techniques for their estimation	2
7.	Crop production in moisture and nutrients limited conditions	2
8.	Components of soil water and nutrients balance	1
9.	Weather forecasting, types, methods, tools & techniques	3
10.	Forecast verification; Value added weather forecast	2
11.	ITK for weather forecast and its validity	2
12.	Crop-Weather calendars	2
13.	Preparation of agro-advisory bulletin based on weather forecast	3
14.	Use of crop simulation model for preparation of agro-advisory and its effective dissemination	3

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Preparation of crop weather calendars	1
2.	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts	2
3.	Working with statistical and simulation models for crop growth	2
4.	Potential & achievable production; yield forecasting, insect & disease forecasting models	3
5.	Simulation with limitations of water and nutrient management options	1
6.	Sensitivity analysis of varying weather and crop management practices	1
7.	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast	4
8.	Feedback from farmers about the agro-advisory	2

Suggested Readings:

1. Gordan, G. 1992. System Simulation. 2nd Ed. Prentice Hall.
2. Kropff, M. J. and Vann Laar H. H. 1993. Modelling Crop Weed Interactions. (Ed.). ISBN.
3. Murithy, K. and Radha, V. 1995. Practical Manual on Agricultural Meteorology. Kalyani Publishers, New Delhi.
4. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
5. Ritchie, J. T. and Hanks, J. 1991. Modelling Plant and Soil Systems. American Society of Agronomy, Madison.
6. Sahu, D. D. 2007. Agrometeorology and Remote Sensing: Principles and Practices. Agrobios (India), Jodhpur.
7. Varshneya, M. C. and Balakrishna, Pillai, P. 2003. Text book of Agricultural Meteorology. ICAR, New Delhi.
8. Weixing, C., Jeffrey, W. W. and Wang, E. 2009. Crop Modeling and Decision Support (Ed). Springer, Heidelberg, Germany.

AGECON-322 Agribusiness Management (Elective course) 3(2+1)

Theory

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 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, polices 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; 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.

Practical

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. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Appraisal/evaluation techniques of identifying viable project- discounted and non-discounting techniques.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems	2
2.	Importance of agribusiness in the Indian economy and New Agricultural Policy	2
3.	Distinctive features of Agribusiness Management: Importance and needs of agro-based industries	2
4.	Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries	2
5.	Constraints in establishing agro-based industries	1
6.	Agri-value chain: Understanding primary and support activities and their linkages	2
7.	Business environment: PEST and SWOT analysis	2
8.	Management functions: Roles and activities	1
9.	Organization culture. Planning, meaning, definition, types of plans	1

10.	Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan	3
11.	Steps in planning and implementation	1
12.	Organization, staffing, directing and motivation. Ordering, leading, supervision, communications, control	3
13.	Capital management and financial management of Agribusiness	2
14.	Financial statements and their importance	1
15.	Sales and distribution management	1
16.	Pricing policy, various pricing methods	2
17.	Project management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation	2
18.	Project Appraisal and evaluation techniques	2

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Study of agri-input markets: Seed, fertilizers, pesticides	2
2.	Study of output markets: grains, fruits, vegetables, flowers	1
3.	Study of product markets, retails trade commodity trading and value added products	1
4.	Study of financing institutions- Cooperative, commercial banks	2
5.	Study of financing institution- RRBs	1
6.	Study of financing institution- Agribusiness Finance Limited	1
7.	Study of financing institution- NABARD	1
8.	Preparations of projects and Feasibility reports for agribusiness entrepreneur	2
9.	Case study of agro-based industries	1
10.	Trend and growth rate of prices of agricultural commodities	1
11.	Appraisal/evaluation techniques of identifying viable project- discounted and non-discounting techniques	3

Suggested Readings:

1. Gittinger, J. P. 1984, Economic Analysis of Agricultural Projects. John Hopkins University Press.
2. Kotler, Philip. 1999. Marketing Management. Prentice Hall of India, New Delhi,
3. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005. Principles and Practices of Marketing in India. Kitab Mahal, Allahabad.
4. Meena, G. L., Burark, S. S., Pant, D. C. and Sharma, R. 2017. Fundamentals of Agribusiness Management. Agrotech Publishing Academy, Udaipur.
5. Somani, L. L. and Meena, G. L. 2017. Agribusiness & Farm Management at a Glance. Vol- 1 & 2, Agrotech Publishing Academy, Udaipur.
6. Sudha, G. S. 2000. Business Management. RBSA Publishers, Jaipur.
7. Tripathi, P. C. and Reddy, P. N. 2008. Principles of Management. Tata McGraw Hill Education Private Limited, New Delhi.

EXT-321 Agricultural Journalism (Elective course) 3(2+1)

Theory

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism; Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers; Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines; The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story; Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources; Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures; Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions; Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

Lecture schedule: Theory

S.No.	Name of Topic	No. of lectures
1.	Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist	3
2.	How agricultural journalism is similar to and different from other types of journalism	1
3.	Newspapers and magazines as communication media	2
4.	Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers	3
5.	Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines	3
6.	The agricultural story: Types of agricultural stories	3
7.	Subject matter of the agricultural story, structure of the agricultural story	2
8.	Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources	6
9.	Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures	3
10.	Illustrating agricultural stories: Use of photographs, use of artwork	3

	(graphs, charts, maps, etc.), writing the captions	
11.	Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing	3

Lecturer schedule: Practical

S.No.	Name of Topic	No. of lectures
1.	Practice in interviewing. Covering agricultural events	2
2.	Abstracting stories from research and scientific materials and from wire services	3
3.	Writing different types of agricultural stories	2
4.	Selecting pictures and art work for the agricultural story	2
5.	Practice in editing, copy reading, headline and title writing	1
6.	Proof reading, layouting	2
7.	Testing copy with a readability formula	2
8.	Visit to a publishing office	2

Suggested Readings:

1. Bhaskaran, C. 2008. Farm Journalism and Media Management. Agrotech Publishing Company.
2. Bhatnagar, R. 2001. Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi.
3. Bhatt, S. C. 1993. Broadcast Journalism: Basic Principles, Har Anand Publications, Delhi.
4. Katyal, V. P. 2007. Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.
5. Kumar, Arvind. 1999. The Electronic Media. Anmol Publications, New Delhi.
6. Narayanaswamy, V. R. 1979. Strengthen your writing. Orient Longman, New Delhi.
7. Ray, G. L. and Mondal, S. 2005. Journalism including communication, Farm and Rural Journalism, Public Relations, Kalyani Publication, Ludhiana.
8. Singh, A. K. 2014. Agricultural Extension and Farm Journalism. Agrobios, Jodhpur.

ET-321 Educational Tours 2(0+2)**

Student study and educational tours to well-known institutions and organizations and interactions with their faculty help students broaden their knowledge and skills.

Note: Education tour will only be permitted after getting financial support from ICAR

B. Sc. (Hons.) Agriculture
Semester-VII
(STUDENT READY)

Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA)			
S.No.	**Activities**	**No. of weeks**	**Credit Hours**
1.	General orientation & On campus training by different faculties	1	14
2.	Village attachment	8	
3.	Unit attachment in University/ College/ KVK/ Research Station Attachment	5	
4.	Plant clinic	2	2
5.	Agro-Industrial Attachment	3	4
6.	Project Report Preparation, Presentation and Evaluation	1	-
	Total weeks for RAWE & AIA	**20**	**20**

Agro- Industrial Attachment: The students will be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working

Component-I RAWE (Village Attachment Training Programme)

S.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	1 week
7	Animal production interventions	1 week
8	Extension and transfer of technology activities	1 week

Component–II RAWE (Agro Industrial Attachment)

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

Activities and Tasks during Agro-Industrial Attachment Programme:

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

B. Sc. (Hons.) Agriculture
Semester-VIII
(STUDENT READY)

Module-I	GPB-421	Seed Production and Technology	0+10

Germination test purity percent and quality parameters, generation system of seed multification, identification of suitable area/location for seed production; Ear to row method and nucleus seed production - major characteristics of released and notified, verities, hybrid seed production technology of importance crops.

Module-II	PPATH-421	Mushroom Cultivation Technology	0+10

Construction cultivation room/structure and Disinfection; Compost preparation and pasteurization; Procurement of mother culture and spawn preparation; Procurement of casing soil and preparation for production; Mushroom seeding, Casing with soil and maintenance, Harvesting, processing, grading, packing, marketing and cost economics of mushroom culture.

Module-III	PPATH-422*	Production Technology for Bioagents and Biofertilizer	0+10

Isolation and pure culture establishment of bio-fertilizers and bio-pesticides; Culture methods and substrates; Scale of methods for bio-fertilizers and bio-agents; Substrate preparation and mixing techniques; Quality analysis of bio-fertilizers and bio-pesticides. Testing the final product in small scale level. Storage, marketing and cost analysis of bio-fertilizers and bio-pesticides.

#Course shall be shared with Soil Science

Module-IV	SSAC-421	Soil, Plant and Water Testing	0+10

Collection and soil water and plant sample for analyses, soil profile study, bulk density, particle density, porosity, water holding capacity, soil texture, estimation of soil moisture by gravimetric and volumetric methods, lime requirement, soil pH, EC, organic carbon and available major and micronutrient in soil and plant sample, leaf area by leaf area meter, relative water content of leaf, specific leaf weight, chlorophyll content of leaf, irrigation water quality analysis, measurement of soil water potential, water flood measurement.

Module-V	ENTO-421	Commercial Beekeeping	0+10

Beneficial insect, scope of apiculture, honey bee colony, different bee hives and apiculture equipment, summer and winter management of colony, Honey extraction and bottling; Study of pests and disease of honey bees; Specifies of honey bees, Bee pasturage, Honey composition and value, bee crop and tissue.

Module-VI	LPM-421	Poultry Production Technology	0+10

Important Indian and foreign breeds of poultry; Breeding management of Chick, Grower and Layer birds; Incubation and hatching, management of incubator during incubation; care and management of chicks — grown up birds, equipment, feeders, drinker systems, housing programs — Farm knout, house design, orientation of shed, cross ventilation, lighting systems — floor space requirements, brooder space, water space and feeding space at different age of broilers — random weighting of chicks, commonly used major feed in gradients identification — Feed manufacturing — preparation of feed for different age groups of broilers different methods of injection and procedure; structure of poultry eggs, selection and care of hatching egg; disease of poultry, vaccination schedule.

Module-VII	HORT-421	Commercial Horticulture	0+10

Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control; Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing; Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.

Module-VIII	HORT-422	Floriculture and Landscaping	0+10

Preparation of project report, soil and water analysis, preparation of land and layout; Production and Management of commercial flowers; Harvesting and postharvest handling of produce; Marketing of produce, Cost Analysis, Institutional Management, Visit to Flower growing areas and Export House, Attachment with private landscape agencies; Planning and designing, site analysis, selection and use of plant material for landscaping; Formal and informal garden, features, styles, principles and elements of landscaping; Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues; Making of lawns, use of software in landscape; Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces; Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques).

Module-IX	FP-421	Food Processing	0+10

Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labeling, pricing and marketing of product.

Module-X	SSAC-422#	Agriculture Waste Management	0+10

Analysis and design of systems for vermicomposting and compost; Collection, storage, treatment, transport and utilization of disposable organic water and west waters, operating system and laboratory evaluation of materials and processes, mass and energy balance for process systems, water and water analysis; Physical, chemical and biological basis for waste treatment and recycling; waste treatment systems, management of dead animals rendering plants, incineration, disposal pits; gaseous waste treatment.

#Course shall be shared with Agronomy

Module-XI	AGRON-421	Organic Production Technology	0+10

Organic production requirement, Crop management in organic farming, organic seed production, organic manures, composting, vermin composting, Green manuring, biofertilizers, organic liquid fertilizers, organic management protection for controlling insects, disease and weeds, organic certification, processing and marketing, Quality standards; Important herbs, shrubs and trees their identification, uses and characteristics; habitat management is rainfed and integrated farm, integrated farming system.

Module-XII	ENTO-422	Commercial Sericulture	0+10

Importance and history of sericulture, silk worms kinds and their hosts, systemic position, distribution, life cycle; establishment of mulberry garden, preparation of mulberry cutting, planting methods under integrated and rainfed condition; maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest; mulberry pests and disease and their management and nutritional disorders; study of different kinds of silk worms and mulberry, silk worm morphology, silk glands; sericulture equipment; Reading of silk worms — chalky reading; reading of silk worms late age silk worm reading and study of montages; study of silk worm pests and their management; study of silk worm disease and its management.

NOTES

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