FIFTH DEANS' COMMITTEE REPORT

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

VTH DEANS' COMMITTEE

Discipline-wise Courses

S.No	Course Code	Course Title	Credit Hours
Agronomy			
1.	**AGRON-111**	Fundamentals of Agronomy	4(3+1)
2.	**AGRON-112**	Agricultural Heritage	1(1+0)**
3.	**AGRON-211**	Crop Production Technology – I (*Kharif* crops)	2(1+1)
4.	**AGRON-221**	Introductory Agro-meteorology & Climate Change	2(1+1)
5.	**AGRON-222**	Crop Production Technology – II (*Rabi* crops)	2(1+1)
6.	**AGRON-223**	Farming System & Sustainable Agriculture	1(1+0)
7.	**AGRON-311**	Practical Crop Production - I *(Kharif* crops*)*	2(0+2)
8.	**AGRON-312**	Geoinformatics and Nanotechnology and Precision Farming	2(1+1)
9.	**AGRO-313**	Weed Management	3(2+1)*
10.	**AGRON-321**	Practical Crop Production - II *(Rabi* crops*)*	2(0+2)
11.	**AGRON-322**	Principles of Organic Farming	2(1+1)
12.	**AGRON-323**	Rainfed Agriculture & Watershed Management	2(1+1)
13.	**AGRO-324**	System Simulation and Agro-advisory	3(2+1)*
Plant Breeding & Genetics			
14.	**GPB-121**	Fundamentals of Genetics	3(2+1)
15.	**GPB-211**	Fundamentals of Plant Breeding	3(2+1)
16.	**GPB-221**	Principles of Seed Technology	3(1+2)
17.	**GPB-222**	Commercial Plant Breeding	3(1+2)*
18.	**GPB-311**	Crop Improvement-I (*Kharif* crops)	2(1+1)
19.	**GPB-321**	Crop Improvement-II (*Rabi* crops)	2(1+1)
20.	**GPB-322**	Micro propagation Technologies	3(1+2)*
Soil Science & Agricultural Chemistry			
21.	**SSAC-111**	Fundamentals of Soil Science	3(2+1)
22.	**SSAC-221**	Problematic soils and their Management	2(1+1)
23.	**SSAC-311**	Manures, Fertilizers and Soil Fertility Management	3(2+1)
Entomology			
24.	**ENTO-121**	Fundamentals of Entomology	3(2+1)
25.	**ENTO-211**	Insect Ecology and Principles of Integrated Pest Management	3(2+1)
26.	**ENTO-221**	Biopesticides & Biofertilizers	3(2+1)*
27.	**ENTO-311**	Pests of Crops and Stored Grain and their Management	3(2+1)
28.	**ENTO-321**	Management of Beneficial Insects	2(1+1)
Agricultural Economics			
29.	**AECON-121**	Fundamentals of Agricultural Economics	2(2+0)
30.	**AECON-211**	Agricultural Finance and Co-Operation	3(2+1)
31.	**AECON-221**	Agricultural Marketing Trade & Prices	3(2+1)

32.	**AECON 311**	Agribusiness Management	3(2+1)*
33.	**AECON-321**	Farm Management, Production & Resource Economics	2(1+1)
Agricultural Engineering			
34.	**AENGG-121**	Soil and Water Conservation Engineering	2(1+1)
35.	**AENGG-211**	Farm Machinery and Power	2(1+1)
36.	**AENGG-311**	Renewable Energy and Green Technology	2(1+1)
37.	**AENGG-321**	Protected Cultivation and Secondary Agriculture	2(1+1)
Plant Pathology			
38.	**PPATH-121**	Fundamentals of Plant Pathology	3(2+1)
39.	**PPATH-211**	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)
40.	**PPATH-221**	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)
41.	**PPATH-311**	Epidemiology and Principles of Integrated Disease Management	2(1+1)
Horticulture			
42.	**HORT-111**	Fundamentals of Horticulture	2(1+1)
43.	**HORT-211**	Production Technology for Vegetables and Spices	2(1+1)
44.	**HORT-221**	Production Technology for Fruit and Plantation Crops	2(1+1)
45.	**HORT-222**	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
46.	**HORT-223**	Hi-tech. Horticulture	3(2+1)*
47.	**HORT- 311**	Landscaping	3(2+1)*
48.	**HORT-321**	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
Food Science & Technology			
49.	**FSN-321**	Principles of Food Science & Nutrition	2(2+0)
Agricultural Extension and Communication			
50.	**AGEXT-111**	Rural Sociology & Educational Psychology	2(2+0)
51.	**AGEXT-121**	Fundamentals of Agricultural Extension Education	3(2+1)
52.	**AGEXT-122**	Communication Skills and Personality Development	2(1+1)
53.	**AGEXT-311**	Entrepreneurship Development and Business Communication	2(1+1)
54.	**AGEXT- 321**	Agricultural Journalism	3(2+1)*
Biochemistry / Physiology / Microbiology/ Environmental Sciences (Basic Science)			
55.	**PPHYS-121**	Fundamentals of Crop Physiology	2(1+1)
56.	**MICROB-121**	Agricultural Microbiology	2(1+1)
57.	**ESDM-211**	Environmental Studies & Disaster Management	3(2+1)
58.	**BIOCH-311**	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
Statistics, Computer Application and I.P.R.			
59.	**STAT-211**	Statistical Methods	2(1+1)
60.	**AGINFO-111**	Agri-Informatics	2 (1+1)
61.	**IPR-311**	Intellectual Property Rights	1(1+0)

Animal Production			
62.	**LPM-211**	Ruminant Production & Management	2(1+1)
63.	**LPM-321**	Non- Ruminant Production & Management	2(1+1)
Language			
64.	**ENG-111**	Comprehension & Communication Skills in English	2(1+1)
Remedial Courses			
65.	**BIO-111/ MATH-111**	Introductory Biology/ Elementary Mathematics	2(1+1)**/ 2(2+0)**
Non-Gradial Courses			
66.	**NSS I-IV/ NCC I-IV/ PHED I-IV**	NSS/NCC/Physical Education & Yoga Practices	2(0+2)
67.	**HVE-111**	Human Values & Ethics	1(1+0)
68.	**ET-321**	Educational Tour	2(0+2)

***Elective course ** Remedial Course**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S.No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

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**.**

Educational tour will be conducted in break between VI & VII Semester

RAWE Component-I

Village Attachment Training Programme

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

RAWE Component-II

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.

S.No.	Activities and Tasks during Agro-Industrial Attachment Programme
1.	Acquaintance with industry and staff
2.	Study of structure, functioning, objective and mandates of the industry
3.	Study of various processing units and hands-on trainings under supervision of industry staff
4.	Ethics of industry
5.	Employment generated by the industry
6.	Contribution of the industry promoting environment
7.	Learning business network including outlets of the industry Skill development in all crucial tasks of the industry
8.	Documentation of the activities and task performed by the students
9.	Performance evaluation, appraisal and ranking of students

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

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-421**	Production Technology for Bioagents and Biofertilizer	0+10	Plant Pathology + Microbiology
2.	**READY-422**	Seed Production and Technology	0+10	Plant Breeding & Genetics
3.	**READY-423**	Mushroom Cultivation Technology	0+10	Plant Pathology
4.	**READY-424**	Soil, Plant, Water and Seed Testing	0+10	SSAC + Plant Breeding & Genetics
5.	**READY-425**	Commercial Beekeeping	0+10	Entomology
6.	**READY-426**	Poultry Production Technology	0+10	LPM
7.	**READY-427**	Commercial Horticulture	0+10	Horticulture
8.	**READY-428**	Floriculture and Landscaping	0+10	Horticulture
9.	**READY-429**	Food Processing	0+10	Horticulture
10.	**READY-4210**	Agriculture Waste Management	0+10	Soil Science
11.	**READY-4211**	Organic Production Technology	0+10	Agronomy
12.	**READY-4212**	Commercial Sericulture	0+10	Entomology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

Evaluation of Experiential Learning Programme/ HOT		
S.N.	**Parameters**	**Max. Marks**
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

Total Credit (Subject wise)

S.N.	Group	Credits
1	Agronomy	21(10+11)
2	Genetics & Plant Breeding	13(7+6)
3	Soil Science & Agricultural Chemistry	8(5+3)
4	Entomology	11(7+4)
5	Agricultural Economics	10(7+3)
6	Agricultural Engineering	8(4+4)
7	Plant Pathology	11(7+4)
8	Horticulture	10(5+5)
9	Food Science	2(2+0)
10	Agricultural Extension	9(6+3)
11	Biochemistry / Physiology / Microbiology/ Environmental Sciences	10(6+4)
12	Statistics, Computer Application and I.P.R.	5(3+2)
13	Animal Production	4(2+2)
14	Comprehension & Communication Skills in English	2(1+1)
15	Remedial Courses (BIO/MATH+ AGINFO)	3
16	NSS/NCC/Physical Education & Yoga Practices	2
17	Human Values and Ethics	1
18	Educational Tour	2
TOTAL	**124(72+52) + 2 (for Bio / Math)+1(Agri Info) + 5 NC+ 9 Elective course=124+2+1+5+ 9 = 144 credits]**	
RAWE + ELP Modules		**20+20 Credits**
Grand Total		**144+20+20=181**

* Remedial courses ** Non-gradial courses

SEMESTER-WISE DISTRIBUTION OF COURSES

I Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**HORT-111**	Fundamentals of Horticulture	2 (1+1)
2.	**SSAC-111**	Fundamentals of Soil Science	3(2+1)
3.	**AGINFO-111**	Agri-Informatics	2 (1+1)
4.	**ENG-111**	Comprehension & Communication Skills in English	2 (1+1)
5.	**AGRON-111**	Fundamentals of Agronomy	4(3+1)
6.	**BIO/MATH-111**	Introductory Biology*/Elementary Mathematics*	2 (1+1)/ 2(2+0)*
7.	**AGRON-112**	Agricultural Heritage*	1(1+0)*
8.	**AGEXT-111**	Rural Sociology & Educational Psychology	2 (2+0)
9.	**HVE-111**	Human Values & Ethics (non gradial)	1(1+0)**
10.	**NCC-I / NSS-I /PHED-I**	NSS/NCC/Physical Education & Yoga Practices**	-
TOTAL			**15(10+5)+3*+ 1****
***R: Remedial course; **NC: Non-gradial courses**			

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

II Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**GPB-121**	Fundamentals of Genetics	3(2+1)
2.	**MICROB-121**	Agricultural Microbiology	2(1+1)
3.	**AENGG-121**	Soil and Water Conservation Engineering	2(1+1)
4.	**PPHYS-121**	Fundamentals of Crop Physiology	2(1+1)
5.	**AECON-121**	Fundamentals of Agricultural Economics	2(2+0)
6.	**PPATH-121**	Fundamentals of Plant Pathology	3(2+1)
7.	**ENTO-121**	Fundamentals of Entomology	3(2+1)
8.	**AGEXT-121**	Fundamentals of Agricultural Extension Education	3(2+1)
9.	**AGEXT-122**	Communication Skills and Personality Development	2(1+1)
10.	**NCC-II / NSS-II /PHED-II**	NSS/NCC/Physical Education & Yoga Practices**	-
Total			**22 (14+8)**

III Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**AGRON-211**	Crop Production Technology – I *(Kharif Crops)*	2 (1+1)
2.	**GPB-211**	Fundamentals of Plant Breeding	3 (2+1)
3.	**AECON-211**	Agricultural Finance and Cooperation	3 (2+1)
4.	**AENGG-211**	Farm Machinery and Power	2 (1+1)
5.	**HORT-211**	Production Technology for Vegetables and Spices	2 (1+1)
6.	**ESDM-211**	Environmental Studies and Disaster Management	3(2+1)
7.	**STAT-211**	Statistical Methods	2(1+1)
8.	**LPM-211**	Ruminant Production & Management	2 (1+1)
9.	**ENTO-211**	Insect Ecology & Principles of Integrated Pest Management	3(2+1)
10.	**PPATH-211**	Diseases of Field & Horticultural Crops & their Management-I	3(2+1)
11.	**NCC-III / NSS-III /PHED-III**	NSS/NCC/Physical Education & Yoga Practices**	-
Total			**25(15+10)**

IV Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**AGRON-221**	Introductory Agro-meteorology & Climate Change	2(1+1)
2.	**AGRON-222**	Crop Production Technology –II *(Rabi Crops)*	2(1+1)
3.	**AGRON-223**	Farming System & Sustainable Agriculture	1(1+0)
4.	**HORT-221**	Production Technology for Fruit and Plantation Crops	2(1+1)
5.	**HORT-222**	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
6.	**SSAC-221**	Problematic Soils and their Management	2(1+1)
7.	**GPB-221**	Principles of Seed Technology	3(1+2)
8.	**AECON-221**	Agricultural Marketing Trade & Prices	3(2+1)
9.	**PPATH-221**	Diseases of Field & Horticultural Crops & their Management-II	3(2+1)
10.	**NCC-IV/ NSS-IV PHED-IV**	NSS/NCC/Physical Education & Yoga Practices**	2(0+2)**
11.	**HORT-223 / ENTO-221 / GPB-222**	Hi-Tech Horticulture* / Biopesticides & Biofertilziers* / Commercial Plant Breeding*	3(2+1)* 3(2+1)* 3(1+2)*
Total			**20(11+9)+3* +2****

***Elective course **Non-gradial course**

V Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**PPATH-311**	Epidemiology & Principles of Integrated Disease Management	2(1+1)
2.	**SSAC-311**	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
3.	**ENTO-311**	Pests of Crops and Stored Grain and their Management	3 (2+1)
4.	**GPB-311**	Crop Improvement-I *(Kharif Crops)*	2 (1+1)
5.	**AGEXT-311**	Entrepreneurship Development and Business Communication	2 (1+1)
6.	**AGRON-311**	Practical Crop Production – I (*Kharif* crops)	2 (0+2)
7.	**AGRON-312**	Geoinformatics and Nano-technology and Precision Farming	2 (1+1)
8.	**IPR-311**	Intellectual Property Rights	1(1+0)
9.	**BIOCH-311**	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
10.	**AENGG-311**	Renewable Energy and Green Technology	2(1+1)
11.	**AECON-311 / AGRON-313 / HORT-311**	Agribusiness Management* / Weed Management * / Landscaping*	3(2+1)* 3(2+1)* 3(2+1)*
Total			**22(12+10)+3***

***Elective course**

VI Semester			
S.No	**Course Code**	**Course Title**	**Credit Hours**
1.	**AGRON-321**	Practical Crop Production –II (*Rabi* crops)	2 (0+2)
2.	**AGRON-322**	Principles of Organic Farming	2 (1+1)
3.	**AGRON-323**	Rainfed Agriculture & Watershed Management	2 (1+1)
4.	**AENGG-321**	Protected Cultivation and Secondary Agriculture	2 (1+1)
5.	**LPM-321**	Non-ruminant Production & Management	2(1+1)
6.	**HORT-321**	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
7.	**ENTO-321**	Management of Beneficial Insects	2 (1+1)
8.	**GPB-321**	Crop Improvement-II *(Rabi crops)*	2 (1+1)
9.	**AECON-321**	Farm Management, Production & Resource Economics	2 (1+1)
10.	**FSN-321**	Principles of Food Science and Nutrition	2(2+0)
11.	**AGEXT-321/ GPB-322 / AGRON-324**	Agricultural Journalism* / Micro propagation Technologies* / System Simulation and Agro-advisory*	3(2+1)* 3(1+2)* 3(2+1)*
12.	**ET-321**	Educational Tour	2(0+2)**
Total			**20(10+10)+3* +2****

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

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S.No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

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**.**

Educational tour will be conducted in break between VI & VII Semester

RAWE Component-I

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

RAWE Component-II

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.

S.No.	Activities and Tasks during Agro-Industrial Attachment Programme
10.	Acquaintance with industry and staff
11.	Study of structure, functioning, objective and mandates of the industry
12.	Study of various processing units and hands-on trainings under supervision of industry staff
13.	Ethics of industry
14.	Employment generated by the industry
15.	Contribution of the industry promoting environment
16.	Learning business network including outlets of the industry Skill development in all crucial tasks of the industry
17.	Documentation of the activities and task performed by the students
18.	Performance evaluation, appraisal and ranking of students

VIII Semester

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

SN	Course code	Title of the module (ELP)	Credits	Department
1.	**READY-421**	Production Technology for Bioagents and Biofertilizer	0+10	Plant Pathology + Microbiology
2.	**READY-422**	Seed Production and Technology	0+10	Plant Breeding & Genetics
3.	**READY-423**	Mushroom Cultivation Technology	0+10	Plant Pathology
4.	**READY-424**	Soil, Plant, Water and Seed Testing	0+10	SSAC + Plant Breeding & Genetics
5.	**READY-425**	Commercial Beekeeping	0+10	Entomology
6.	**READY-426**	Poultry Production Technology	0+10	LPM
7.	**READY-427**	Commercial Horticulture	0+10	Horticulture
8.	**READY-428**	Floriculture and Landscaping	0+10	Horticulture
9.	**READY-429**	Food Processing	0+10	Horticulture
10.	**READY-4210**	Agriculture Waste Management	0+10	SSAC
11.	**READY-4211**	Organic Production Technology	0+10	Agronomy
12.	**READY-4212**	Commercial Sericulture	0+10	Entomology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

DEPARTMENT OF AGRONOMY

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF AGRONOMY

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	AGRON-111	Fundamentals of Agronomy	4(3+1)
	AGRON-112	Agricultural Heritage	1(1+0)**
	II Semester- NIL		
Part-II	**III Semester**		
	AGRON-211	Crop Production Technology – I (*Kharif* crops)	2(1+1)
	IV Semester		
	AGRON-221	Introductory Agro-meteorology & Climate Change	2(1+1)
	AGRON-222	Crop Production Technology – II (*Rabi* crops)	2(1+1)
	AGRON-223	Farming System & Sustainable Agriculture	1(1+0)
Part-III	**V Semester**		
	AGRON-311	Practical Crop Production - I *(Kharif* crops*)*	2(0+2)
	AGRON-312	Geoinformatics and Nanotechnology and Precision Farming	2(1+1)
	AGRO-313	Weed Management	3(2+1)*
	VI Semester		
	AGRON-321	Practical Crop Production - II *(Rabi* crops*)*	2(0+2)
	AGRON-322	Principles of Organic Farming	2(1+1)
	AGRON-323	Rainfed Agriculture & Watershed Management	2(1+1)
	AGRO-324	System Simulation and Agro-advisory	3(2+1)*

***Elective courses ** Remedial courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-4211**	Organic Production Technology	0+10	Agronomy
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

AGRON-111 Fundamentals of Agronomy 4(3+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, Effect of sowing depth on germination and seedling vigour, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, 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.N.	Topic	No. of lectures
1.	Agriculture-definition and importance of agriculture	1
2.	Agronomy-meaning and scope of Agronomy	1
3.	Types of seeds, dormancy of seeds	1
4.	Viability of seeds, seed treatment	1
5.	Sowing-methods, depth, plant density	1
6.	Nursery bed and transplanting	1
7.	Crop density and geometry	1
8.	Optimum plant population	1
9.	Tillage-definition and types of tillage including minimum and no tillage.	1
10.	Tilth-definition and characteristics of good tilth.	1
11.	Crop nutrition-essential nutrients-classification	1
12.	Nutrient mobility in plants, Factors affecting nutrient availability	1
13.	Functions and deficiency symptoms of primary nutrients	1
14.	Manures –types, nutrient content ,	1
15.	Green manures, compost	1
16.	Fertilizers , INM	1
17.	Nutrient use efficiency	1
18.	Irrigation : definition and objectives	1
19.	Water resources and irrigation development in India and Rajasthan.	1

20.	Soil moisture constants and theories of soil water availability	1
21.	Crop water requirement and factors affecting it	1
22.	Scheduling of irrigation: meaning and different approaches for scheduling irrigation in field crops.	1
23.	Surface methods of irrigation ; border , furrow , check basin and basin methods	1
24.	Sprinkler and drip methods; their layout, adaptability , advantages and limitations.	1
25.	Irrigation efficiency ; different terms used and their importance.	1
26.	Water use efficiency -factors affecting and agronomic techniques to boost WUE	1
27.	Irrigation water quality- different criteria and limits used, effect of poor quality water on plant growth .	1
28.	Management practices for efficient use of poor quality waters including conjunctive use of water.	1
29.	Agricultural drainage- definition, benefits and different methods of drainage.	1
30.	Growth and development of crops,	1
31.	factors affecting growth and development,	1
32.	Plant ideotypes,	1
33	Crop rotation and its principles,	1
34	Adaptation and distribution of crops,.	1
35	Crop management technologies in problematic areas,	1
36	Harvesting and threshing of crops	1
37	Weeds – definition , harmful and beneficial effects and classification	1
38	Ecology of weeds	1
39	Weed - reproduction and seed dissemination	1
40	Crop-weed competition-concept and allelopathy	1
41	Concepts of weed prevention, eradication and weed control	1
42	Physical and cultural methods of weed control	1
43	Chemical and biological methods of weed control	1
44	Integrated weed management - An introduction	1
45	Introduction to herbicides, advantages and limitations of herbicides usages	1
46	Classification of herbicides	1
47	Herbicidal selectivity and resistance	1
48	Allelopathy	1

Lecturer schedule: Practical

S.No	Topic	No. of lectures
1	Identification of crops, seeds, fertilizers,	1
2	Common Pesticides in agriculture	1
3	Study of agro-climatic zones of India and Rajasthan	1
4	Identification of weeds in crops	1
5	Methods of herbicide and fertilizer application,	1
6	Study of yield contributing characters and yield estimation,	1
7	Seed germination and viability test	1
8	Numerical exercises on fertilizer requirement of crops	1
9	Plant geometry and plant population of various crops	1

. 10	Herbicides requirement calculations and water requirement	1
. 11	Use of tillage implements-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	Determination of bulk density	1
. 15	Determination of infiltration rate	1
. 16	Measurement of irrigation water	1

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AGRON-112 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

S.No.	Topic	No. of lectures
1.	Introduction of 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;	1
9.	Crop significance and classifications;	1
10	Classification of crops-botanical, agronomic, seasonal.	1
11.	Classification of crops based on life span, special purposes i.e. cover, green manure, catch, trap, cash, soiling.	1
12.	National agriculture setup in India;	1
13.	Current scenario of Indian agriculture;	1
14.	Indian agricultural concerns and future prospects.	1

References:

1. ICAR 1989 Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
2. Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri-Histroy Foundation, Secunderabad, Andhra Pradesh.
3. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. 2009. A Textbook on Ancient History of Indian Agriculture, Munshiram Manoharial Publishers Pvt. Ltd,
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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 –pearl millet, maize, sorghum and rice; oilseeds- groundnut, and soybean; pulses-pigeonpea, fibre crops- cotton; forage crops-sorghum,. Package of Practices of mungbean,urdbean, cowpea, cluster bean, sesame ,castor, sunhemp, miner millet and napier & acquaintance about *Panicum* , *Lasiuras and Cenchrus* and Jute

Practical

Sowing of kharif crops and their identification, effect of seed size on germination and seedling vigour of *kharif* season crops, effect of sowing depth on germination of kharif crops, identification of weeds in *kharif* season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Pearl millet- Origin, geographical distribution, economic importance, soil and climatic requirements,	1
2.	Pearl millet-, varieties, cultural practices and yield	1
3.	Maize-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
4.	Sorghum-Origin, geographical distribution, economic importance, soil and climatic requirements,	1
5.	Sorghum- varieties, cultural practices and yield(Seed and forage)	1
6.	Rice-Origin, geographical distribution, economic importance, soil and climatic requirements,	1
7.	Rice- varieties, cultural practices and yield	1
8.	Groundnut-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
9.	Soybean-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
10.	Pigeonpea-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
11.	Cotton-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
12.	Clusterbean,Mothbean, Cowpea, package of practices	1
13.	Sesame, Castor, package of practices	1
14.	Urdbean, Sunhemp, package of practices	1
15.	Napier, minor millets, package of practices	1
16.	Acquaintance about *Panicum* , *Lasiuras and Cenchrus* and Jute	1

Lecturer schedule: Practical

S.No.	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.	Seed bed preparation of *kharif* crops including rice nursery and transplanting	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

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1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
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AGRON-221 Introductory Agro meteorology & Climate Change 2(1+1)

Theory

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

Practical

Visit of Agro meteorological 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 wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET

Lecture schedule: Theory

S.N.	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,	1
9.	Energy balance of earth; Atmospheric humidity, concept of saturation, vapor 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

Lecture schedule: Practical

S.N.	Topic	No. of lectures
1	Visit of Agrometeorological 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 wind rose.	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

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AGRON-222 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 ;oilseeds-rapeseed, mustard and sunflower; pulses-chickpea, lentil, peas, sugar crops-sugarcane; Forage crops-lucerne and oat; package of practices of berseem ,safflower sugarbeet, opium poppy taramira, linseed; medicinal and aromatic crops-mentha, lemon grass and citronella,.

Practical

Sowing of rabi crops and their identification , 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.N.	Topic	No. of lectures
1.	Wheat- Origin, geographical distribution, economic importance, soil and climatic requirements	1
2.	Wheat- varieties, cultural practices and yield	1
3.	Barley- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
4.	Rapeseed and mustard- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
5.	Sunflower- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	
6.	Chickpea-Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
7.	Lentil- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
8.	Peas- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
9.	Sugarcane- Origin, geographical distribution, economic importance, soil and climatic requirements	1
10.	Sugarcane- varieties, cultural practices and yield	1
11.	Lucerne – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
12.	Oat – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield	1
13.	Berseem ,Safflower,- package of practices	
14.	Sugarbeet, Opium poppy- package of practices	1
15.	Taramira, Linseed- - package of practices	1
16.	Medicinal and aromatic crops-mentha, lemon grass and citronella	1

Lecture schedule: Practical

S.N.	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.	Judging physiological maturity of various crops	1
7.	Fertilizer application in crops and related numerical	1
8.	Morphological difference in wheat, barley and oat, rapeseed and mustard, berseem and lucerne.	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

References:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir.2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
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AGRON-223 Farming System and Sustainable Agriculture 1(1+0)

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system 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.

Lecture schedule: Theory

S.N.	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,	1
15.	farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.	1

References:

1. Panda, S.C.2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur

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Agron-311 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.

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Introduction of the course, crop planning and allotment of field	2
2.	Field preparation, application of manures and fertilizers	2
3.	Selection of crop and varieties, seed treatment and sowing	2
4.	Sowing of crops.	2
5.	Observation of germination	2
6.	Thinning and gap filling	2
7.	Intercultural operations-hoeing and weeding	2
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).	2
11.	Insect and pest management (control)- application of insecticides	2
12.	Disease management (control)- application of fungicides	2
13.	Harvesting	2
14.	Threshing, winnowing and storage	2
15.	Marketing of produce	2
16.	Preparation of balance sheet including estimating cost of cultivation and net return per student as well as per team of a group of student	2

References:

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of AgronomyAgrobios (India), Jodhpur.
3. Reddy, S. R., 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Agron-312 Geoinformatics, 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.N.	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 use in Precision Agriculture	1
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

Lecture schedule: Practical

S.N.	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 techniques.	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

References:

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press
2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd. , New Delhi
3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.
4. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
5. Sekhon, B.S. 2014. Nanotechnology in agri-food production: an overview. Nanotechnology, Science and Applications **7**:31-532.

Agron-313 Weed Management 3(2+1)**

Theory

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

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.N.	Topic	No. of lectures
1.	Introduction to weeds	1
2.	Characteristics of weeds	1
3.	Harmful and beneficial effects of weeds on ecosystem	1
4.	Classification of weeds	2
5.	Reproduction and dissemination of weeds	1
6.	Dormancy in weeds and its types	1
7.	Crop-weed competition	1
8.	Principles of weed management- an introduction	1
9.	Physical and cultural methods of weed control	1
10.	Chemical and biological methods of weed control	2
11.	Herbicide classification	1
12.	Herbicide active ingradient and formulations	1
13.	Herbicide application- types and techniques	2
14.	Introduction to mode of action of herbicides	2
15.	Herbicidal selectivity to plants	2
16.	Fate of herbicides	1
17.	Concept of adjuvant- surfactant, stabilizing agents, stickers, activators and compatibility agents and solvents	2
18.	Bio-herbicides and their application in agriculture.	1
19.	Concept of herbicide mixture and utility in agriculture.	1
20.	Herbicide compatibility with agro-chemicals and their application.	1
21.	Allelopathy and its application for weed management.	1
22.	Integrated weed management - An introduction	1
23.	Integration of herbicides with non chemical methods of weed management.	1
24.	Weed management in rice, wheat, barley, maize, sorghum and bajra	1

25.	Weed management in oil seeds and pulses – groundnut , soybean, mustard, gram , lentil,, mungbean and urdbean	1
26.	Aquatic weeds and their management	1

Lecture schedule: Practical

S.N.	Topic	No. of lectures
1.	Identification of weeds and techniques of weed preservation	1
2.	Collection of common *kharif/rabi* weeds and their preservation	1
3.	Collection of common perennial weeds and their preservation	1
4.	Biology of important weeds.	2
5.	Study of herbicide formulations and mixture of herbicide.	1
6.	Herbicide and agro-chemicals study.	2
7.	Shift of weed flora study in long term experiments.	1
8.	Study of methods of herbicide application,	1
9.	To become familiar with herbicide spray equipments.	1
10.	Calibration of herbicide spray equipments	1
11.	Calculation on herbicidal requirement for field crops and aquatic situations	1
12.	Application of pre plant , pre-emergence and post emergence herbicides in the field	1
13.	Calculations of weed control efficiency and weed index.	1
14.	Farm visit to problem areas of weeds	1

Reference:

1. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management , ICAR, New-Delhi.
2. Gupta, O.P. 2015. Weed Management: Principles and Practices (2nd Ed.), Agribios (India), Jodhpur.
3. Gupta, O.P. 2016. Modern Weed Management , Agribios (India), Jodhpur
4. Das, T.K. 2008. Weed Science : Basics and Applications , Jain Brothers, New-Delhi.
5. Rao, V.S. 2000. Principals of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.
6. तिवारी, जे. पी. 2007 नींदा (खरपतवार) नियंत्रण विज्ञान, साइंटिफिक पब्लिशर्स, जोधपुर.

Agron-321 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.

Lecture schedule

S.N.	Topic	No. of lectures
1.	Allotment of land and field preparation	2
2.	Sowing methods	2
3.	Selection of crops and varieties	2
4.	Seed treatment	2
5.	Preparation of seed bed and sowing of crops	2
6.	Thinning and gap filling	2
7.	Fertilizer application including top dressing of fertilizers	2
8.	Intercultural operations- hoeing and weeding	2
9.	Intercultural operations- hoeing and weeding	2
10.	Application of moisture conservation practices	2
11.	Insect and pest management /control –application of insecticides.	2
12.	Disease management/control –application of fungicides	2
13.	Harvesting of the crops	2
14.	Threshing, winnowing and storage	2
15.	Marketing of produce	2
16.	Preparation of balance sheet including cost of cultivation and net return per student as well as team of a group of student	2

References:

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
3. Reddy, S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Agron-322 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.N.	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 mgt	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

Lecture Schedule--Practical

S.N.	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

References:

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture (2nd edition), Agrobios (India), Jodhpur.
2. Sharma, Arun K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur
3. Palaniappan, S.P. and Anandurai, K.1999. Organic Farming – Theory and Practice. Scientific Pub. Jodhpur
4. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agrtech, Publising Academy, Udaipur.
5. शर्मा, अरूण के. 2015. जैविक खेती – नई दिशाए, एग्रोबायोस (इण्डिया), जोधपुर

Agron-323 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.N.	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 water conservation techniques,	1
4.	Drought: types,	1
5.	effect of water deficit on physio- morphological characteristics of the plants,	1
6.	Use of antitranspirants-their kind, mode of action and effect on crop yield.	1
7.	Crop adaptation and mitigation to drought;	1
8.	Water harvesting: importance, its techniques,	1
9.	Efficient utilization of water through soil and crop management practices,	1
10.	Water harvesting techniques in dry farming areas	1
11.	Watershed management- concept, definition, objectives and principles	1
12.	Integrated watershed management for drylands	1
13.	A study of model watershed area	1
14.	Management of crops in rainfed areas,	1
15.	Contingent crop planning for aberrant weather conditions,	1
16.	Alternate cropping and land use strategies for dryland agriculture	1

Lecture schedule: Practical

S.N.	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 c onservation	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

References:

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
5. 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.
6. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.
7. Singh, R.P. 1995, Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
8. Singh, S.S., 1993, Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.

Agron-324 System Simulation and Agroadvisory 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 & achievable production; yield forecasting, insect & 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.N.	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 and sensitivity analysis.	3
6.	Potential and achievable crop production- concept and modelling techniques for their estimation.	2
7.	Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	3
8.	Weather forecasting, types, methods, tools & techniques,	3
9.	forecast verification; Value added weather forecast,	2
10	ITK for weather forecast and its validity;	2
11.	Crop-Weather Calendars;	2
12.	Preparation of agro-advisory bulletin based on weather forecast.	3
13	Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.	3

Lecture schedule: Practical

S.N.	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,	2
5.	insect & disease forecasting models.	1
6.	Simulation with limitations of water and nutrient management options.	2
7.	Sensitivity analysis of varying weather and crop management practices.	1
8.	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.	3
9.	Feedback from farmers about the agroadvisory.	2

DEPARTMENT OF PLANT BREEDING & GENETICS

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF PLANT BREEDING & GENETICS

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	GPB-121	Fundamentals of Genetics	3(2+1)
Part-II	**III Semester**		
	GPB-211	Fundamentals of Plant Breeding	3(2+1)
	IV Semester		
	GPB-221	Principles of Seed Technology	3(1+2)
	GPB-222	Commercial Plant Breeding	3(1+2)*
Part-III	**V Semester**		
	GPB-311	Crop Improvement-I (*Kharif* crops)	2(1+1)
	VI Semester		
	GPB-321	Crop Improvement-II (*Rabi* crops)	2(1+1)
	GPB-322	Micro propagation Technologies	3(1+2)*

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-422**	Seed Production and Technology	0+10	Plant Breeding & Genetics
2.	**READY-424**	Soil, Plant, Water and Seed Testing	0+10	SSAC + Plant Breeding & Genetics
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

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

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, 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 changes in chromosome, numerical changes in chromosome, introduction to mutation, classification, Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples. Cytoplasmic inheritance. Genetic disorders.

Nature, structure & replication of genetic material. proof for DNA as genetic material and genetic code, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. stains and fixatives, Study of cell structure. 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 structure.

Lecture Schedule:Theory

S.N.	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	Pleiotropism, pseudoalleles, Multiple 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 & mechanisms	1
15	Chromosome mapping	1
16	Structural changes in chromosome	1
17	Numerical changes in chromosome	1
18	Mutation: introduction, characteristics & classification	1
19	Mutagenic agents: physical and chemical mutagens	1
20	Induction of mutation, Methods of inducing mutation & CIB technique	1
21	Qualitative & Quantitative traits, Polygenes and continuous variations	1
22	Multiple factor hypothesis	1
23	Cytoplasmic inheritance	1
24	Genetic disorders	1
25	Nature, structure and types of genetic material	1
26	Proof for DNA as genetic material	1
27	Replication of genetic material	1
28	Genetic code & Protein synthesis	1
29	Transcription mechanism of genetic material	1
30	Translational mechanism of genetic material	1
31	Gene concept: Gene structure and function	1
32	Gene regulation, operon concept, Lac and Trp operons	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1	Study of microscope: parts and types	1
2	Study of cell structure	1
3	Experiments on monohybrid, test cross and back cross	1
4	Experiments on dihybrid, test cross and back cross	1
5	Experiments on trihybrid, test cross and back cross	1
6	Experiments on epistatic interactions including test cross and back cross	1
7	Experiments on epistatic interactions including test cross and back cross	1

8	Stains and their preparation	1
9	Fixatives and their preparation	1
10	Practice on mitotic cell division	1
11	Practice on meiotic cell division	1
12	Experiments on probability	1
13	Experiments on Chi-square test	1
14	Determination of linkage and cross over analysis (through two point test cross and three point test cross data)	1
15	Study on sex linked inheritance in Drosophila	1
16	Study of models on DNA and RNA structure	1

References:

1. Gupta P.K.2004. *Cytology, Genetics and Evolution*. Rastogi Publications, Meerut. (Hindi Edition)
2. Klug, W.W. and Cummings, M.R.2005.*Concepts of Genetics.* Pearson Education (Singapore) pvt. Ltd., Indian Branch, Pratap Ganj, New Delhi.
3. Singh, B.D. 2001.*Genetics.* Kalyani Publishing House, New Delhi.
4. Strickberger, M.W.2001.*Genetics.* Prentice Hall of india. Pvt. Ltd., New Delhi.
5. Sharma, A. K. and Sharma, R. A. 2013. *Crop Improvement and Mutagenesis.* Scientific Publishers, Jodhpur.

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, pollination and 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, pedigree, bullk, SSD and backcross methods, 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; 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; Development and release of varieties.

Practical:

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregating populations. Methods of calculating mean, range, variance, standard deviation, heritability.

Designs used in plant breeding experiment, analysis of Randomized Block Design 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

Lecture Schedule: Practical

S.N.	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

References:

1. Alard, R.W. 2000.Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G.S. and S.S. Ghosal.2002.Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
4. Singh, P. 2001.Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.
5. Jain,H.K. and M.C. Kharkwal.2004. Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
6. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
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GPB-221 Principles of Seed Technology Credit hours: 3(1+2)

Theory

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.

Cereals: Wheat, rice, maize, sorghum and bajra

Pulses: Moth bean, mung, cowpea, pigeonpea, urd, gram, field pea

Oilseeds: Soybean, rapeseed and mustard, groundnut, sesame

Fodder: Berseem, lucerne and oats

Vegetables: Potato, cauliflower, tomato and chilli

Seed spices and medicinal plants: Cumin, coriander, fennel, fenugreek, isabgol

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. 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.N.	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, field inspection	1
10	Seed Act and Seed Act enforcement. Duty and powers of seed inspector,	1

	offences and penalties. Seeds Control Order 1983	
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

Lecture Schedule: Practical

S.N.	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 crops (Potato, cauliflower, tomato and chilli) 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	
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

References:

1. Agarwal, R.L.1991.*Seed Technology.* Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. *Seed Technology*. ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh.1999. *Seed Science and Technology*. Kalyani Publishers. New Delhi.
4. Dhirenra Khare and Mohan S. Bhale.2000. *Seed Technology*. Scientific Publishers (India), Jodhpur.
5. Maloo,S.R., Intodia, S.K. and Pratap Singh.2008. *Beej Pradyogiki*. Agrotech Publishing Academy.
6. A.K. Joshi and B.D. Singh.2005.*Seed Technology*. Kalyani Publishers, New Delhi.
7. Arya, P.S. 2001. *Vegetable Breeding and Seed Production*. Kalyani Pub., Ludhiana
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9. Singh, B.D. 2005. *Plant Breeding.* Kalyani Publishing House, New Delhi.
10. Shekhawat, S. S. and S. Gangopadhyay (eds.) (2013). *Quality Fodder Seed Production*. Centre for Forage Management, ARS, SKRAU, Bikaner.

GPB-222 Commercial Plant Breeding 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, 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. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, 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.N.	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	1
3	Genetic purity test of commercial hybrids	1
4	Advances in hybrid seed production of maize, rice, sorghum, pearl millet	1
5	Advances in hybrid seed production of castor, sunflower	1
6	Advances in hybrid seed production of cotton, pigeon pea, brassica	1
7	Quality seed production of vegetable crops under open and protected environment	1
8	Alternative strategies for the development of the line and cultivars: haploid inducer	1
9	Tissue culture techniques	1
10	Biotechnological tools	1
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	1

15	Types of seeds	1
16	Quality testing in self and cross pollinated crops	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1	Floral biology in self pollinated species	1
2	Floral biology in cross pollinated species	1
3	Selfing and crossing techniques	1
4	Selfing and crossing techniques	1
5	Techniques of seed production in self and cross pollinated crops using A/B/R and two line system	1
6	Learning techniques in hybrid seed production using male-sterility in field crops	1
7	Understanding the difficulties in hybrid seed production	1
8	Tools and techniques for optimizing hybrid seed production	1
9	Concept of line its multiplication and purification in hybrid seed production	1
10	Role of pollinators in hybrid seed production	1
11	Hybrid seed production techniques in sorghum	1
12	Hybrid seed production techniques in pearl millet	1
13	Hybrid seed production techniques in maize	1
14	Hybrid seed production techniques in rice	1
15	Hybrid seed production techniques in rapeseed-mustard	1
16	Hybrid seed production techniques in sunflower	1
17	Hybrid seed production techniques in castor	1
18	Hybrid seed production techniques in pigeon pea	1
19	Hybrid seed production techniques in cotton	1
20	Hybrid seed production techniques in vegetable crops	1
21	Sampling and analytical procedures for purity testing and detection of spurious seed	1
22	Seed drying	1
23	Seed storage structure in quality seed management	1
24	Screening techniques during seed processing viz., grading and packaging	1
25	Visit to public private seed production units	4
26	Visit to public private seed processing plants	4

References:

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. *Advances in Plant Breeding*. Vol. I and II. CBS Publishers and Distributors, New Delhi.
3. Manjit S. Kang 2004. *Crop Improvement: Challenges in the Twenty-First Century* (Edt). International Book Distributing Co. Lucknow.
4. Poehlman, J.M. 1987. *Breeding of Field Crops*. AVI Publishing Co.. INC, East Port, Conneacticut, USA.

5. Ram, H.H. and H.G. Singh. 1994. *Crop Breeding and Genetics.* Kalyani Publishers, New Delhi.
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GPB-311 Crop Improvement – I (*Kharif*) 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 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.

Cereals: Rice, maize, sorghum and bajra
Pulses: Urd, mung, cowpea, pigeonpea and moth bean
Oilseeds: Soybean, sesame and groundnut
Fibre crops: Cotton
Fodder: Bajra, sorghum, maize
Vegetables: Chilli and tomato
Cash/ other crops: Castor

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame , Castor, Cotton, Cowpea and Pearl millet. 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.N.	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	1

	Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production	
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 sesame 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 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

Lecture Schedule: Practical

S.N.	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, sesame	1
5	Emasculation and hybridization techniques in and groundnut and cotton	1
6	Maintenance breeding of different kharif crops	1
7	Handling of germplasm and segregating populations by different	1

	methods like pedigree, bulk and single seed decent methods	
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

References:

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
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GPB-321 Crop Improvement – II (*Rabi*) 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; 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.

Cereals: Wheat, oats and barley

Pulses: Chickpea, lentil and field pea

Oilseeds: Rapeseed mustard and sunflower

Fodder: Berseem, oats and lucerne

Cash crop: Sugarcane

Seed spices and medicinal plants: Cumin, coriander, fenugreek, fennel and isabgol

Vegetables & Hort. crops: Potato

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; 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.N.	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 field pea as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
7	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
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 & hybrid seed production	1
9	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
10	Crop improvement aspects in berseem as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production	1
11	Crop improvement aspects in lucerne 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

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1	Emasculation and hybridization techniques in wheat, oats, 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	1

	production in *rabi* crops	
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

References:

1. Chopra, V.L. 2000. *Breeding of Field Crops* (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. *Advances in Horticulture* Vol. II *Medicinal and Aromatic Plants*. Malhotra Publishing House, New Delhi.
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GPB-322 Micro propagation Technologies 3(1+2)*

Theory

Meaning and concept of *in vitro* culture and micro-propagation; Historical milestones, advancement and future prospects of micro-propagation; totipotency, dedifferentiation; Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration; Plant regeneration pathways - Organogenesis and Somatic embryogenesis;

Micro-propagation- Definition, methods, stages of micro-propagation and its significance; Axillary bud proliferation approach- Shoot tip and meristem culture; Organogenesis- Purpose, methods and requirements for organogenesis, indirect and direct organogenesis; Somatic embryogenesis- Procedures and requirements for organogenesis, indirect and direct embryogenesis; Differences between somatic and gametic embryogenesis, Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds. Agencies working on micro propagation.

Practical

Laboratory organization, sterilization techniques for explants, glassware, plastic wares, lab wares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators. Preparation of working medium and experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues. Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
1	Meaning and concept of *in vitro* culture and micro-propagation	1
2	Historical milestones of *in vitro* culture and micro-propagation	1
3	Advancement and future prospects of micro-propagation	1
4	Totipotency, dedifferentiation	1
5	Tissue culture methodology: Sterilization techniques	1
6	Synthetic and natural media components	1
7	Growth regulators used in tissue culture media	1
8	Environmental requirement	1
9	Genetic control of regeneration	1
10	Plant regeneration pathways - Organogenesis and Somatic embryogenesis	1
11	Micro-propagation- Definition, methods, stages of micro-propagation and its significance	1

12	Axillary bud proliferation approach- Shoot tip and meristem culture	1
13	Organogenesis- Purpose, methods and requirements for organogenesis, indirect and direct organogenesis	1
14	Somatic embryogenesis- Procedures and requirements for organogenesis, indirect and direct embryogenesis	1
15	Differences between somatic and gametic embryogenesis	1
16	Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds	1

Lecture Schedule:Practical

S.N.	Topic	No. of lectures
1	Laboratory organization	1
2	Sterilization techniques for explants	2
3	Sterilization techniques for glassware	2
4	Sterilization techniques for plastic wares	2
5	Sterilization techniques for lab wares	2
6	Sterilization techniques for working platform	2
7	Preparation of stocks and working solution	1
8	Preparation of stocks and working solution	1
9	Preparation and sterilization of growth regulators	1
10	Preparation of working medium	2
11	Experimentation on determining optimum concentration of growth regulators	2
12	Callus induction and regeneration of whole plants from different parts of plants	4
13	Direct regeneration into whole plants using bud	2
14	Direct regeneration into whole plants using node	2
15	Direct regeneration into whole plants using other tissues	2
16	Induction of somatic embryos	1
17	Experiments of synthetic seeds production	1
18	Testing storability of synthetic seed	1
19	Germination efficiency of synthetic seed	1

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5. Mascarenhas, A. F. (2008). *Hand Book of Plant Tissue Culture.* ICAR,New Delhi
6. Singh BD. 2005. *Biotechnology, Expanding Horizons.* Kalyani Publishers, New Delhi.

DEPARTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF SOIL SCIENCE & AGRICULTURAL CHEMISTRY

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	SSAC-111	Fundamentals of Soil Science	3(2+1)
	II Semester- NIL		
Part-II	**III Semester- NIL**		
	IV Semester		
	SSAC-221	Problematic soils and their Management	2(1+1)
Part-III	**V Semester**		
	SSAC-311	Manures, Fertilizers and Soil Fertility Management	3(2+1)
	VI Semester-NIL		

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-424**	Soil, Plant, Water and Seed Testing	0+10	SSAC + Plant Breeding & Genetics
2.	**READY-4210**	Agriculture Waste Management	0+10	SSAC
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

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, consistence and plasticity; soil taxonomical classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange 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;.

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.

Lecture Schedule:Theory

S.N.	Topic	No. of lectures
1.	Soil as a natural body, Pedological and edaphological concepts of soil	1
2.	Soil genesis: soil forming rocks and minerals classification	2
3.	Weathering of rocks - Chemical, Physical and Biological	2
4.	Factors of soil formation, fundamental and specific soil forming processes	2
5.	Soil Profile	1
6.	Definition and components of soil	1
7.	Soil Physical properties- Soil texture, classifications of soil separates, importance of soil texture, particle size analysis. Stoke's law	2
8.	Soil structure and types of soil structure, mechanism of soil structure formation, management of soil structure.	2
9.	Bulk density, particle density and porosity, factors affecting them, agricultural significance and manipulation	1
10.	soil consistence and plasticity and their agricultural significance	1
11.	Soil colour and expression of soil colour with munsell soil colour chart	1
12.	soil taxonomical classification and soils of India	2
13.	Soil water classification, forces of soil water retention	2
14.	Movement of soil water and availability to plants	1
15.	Soil air, composition, gaseous exchange and its composition, importance and	2

	in plant growth	
16.	Soil temperature; source, amount and flow of heat in soil; effect on plant growth,	2
17.	Soil reaction-pH, soil acidity and alkalinity, buffering	1
18.	effect of pH on nutrient availability	1
19.	Soil colloids, types of soil colloids and their significance	2
20.	1:1, 2:1and 2:1:1 types of layer silicates, their structure and characteristics, sources of charges on soil colloids.	2
21.	Cation and anion exchange phenomenon and factors influencing ion exchange, Base saturation	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Study of Soil Profile in field	1
2.	Study of soil sampling tools, Collection of representative 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 by R D bottle methods	1
6.	Determination of particle density of soil by R D bottle and computation of porosity of soil	1
7.	Determination of lower and upper plastic limit of soil	1
8.	Determination of field capacity, permanent wilting point of soil and WHC	2
9.	Determination of soil texture by feel and Bouyoucos Methods.	1
10.	Determination of soil pHand electrical conductivity	1
11.	Determination of cation exchange capacity of soil	2
12.	Determination of soil colour by munsell colour chart	1

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1. Boul S.W., Hole R.D., McCracken and Southard R.J. (1998).Soil genesis and classification Fourth Ed Panima Publishing corporation, New delhi.
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3. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science. Tata McGraw Hill publishing Co. Ltd, New Delhi
4. Brady, N.C. and Weil, R.R. (2002) The nature and properties of soils, prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi
5. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
6. Mehra R.K. (2004) Text book of Soil Science, ICAR, New Delhi
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8. Chopra S.L. and Kanwar, J.S. (1991) Analytical Agricultural Chemistry, Kalyani publisher, Ludhiana

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11. Richards, L.A. (1960) Diagnosis and improvement of saline and alkali soils., USDA agriculture Hand book 60, Washington D.C., USA
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SSAC-221 Problematic Soils and their Management 2(1+1)

Theory

Soil quality and health, distribution of Waste land and problem soils in different agro ecosystem of India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, highly and low permeable soils. Remote sensing and GIS in diagnosis and management of problem soils. Bio remediation of soils through multipurpose trees (MPTs) , land capability and suitability classification. Irrigation water – quality and standards, utilization of saline water in agriculture.

Practical

- Characterization of acid, acid sulfate, salt-affected and calcareous soils.
- Determination of cations (Na^+, K^+, Ca^{++} and Mg^{++}) in irrigation water and soil samples.
- Determination of anions (Cl^-, $SO4^{--}$, $CO3^{--}$ and $HCO3^-$) in irrigation 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.N.	Topic	No. of lectures
1.	Soil quality-Physical, Chemical and Biological indicators and major factors affecting the soil quality. Soil health and Soil health card , its importance to farmer and crop productivity	2
2.	Distribution of Waste land and problem soils in different agro-ecosystem of India.	1
3.	Categorization of Saline and sodic soils based on properties and its reclamation and management	2
4.	Categorization of acid and acid sulphate soils based on properties and its reclamation and management	2
5.	Highly and low permeable soils	1
6.	Remote sensing and GIS in diagnosis and management of problem soils	2
7.	Bio remediation of soils through multipurpose trees (MPTs),	1
8.	Land capability and land suitability classification	1
9.	Irrigation water – quality, criteria and classification and standards	2
10.	Management and Utilization of saline water for irrigation	2

Lecture Schedule :Practical

S.N.	Topic	No. of lectures
1.	Characterization of acid soils	1
2.	Characterization of salt-affected soils	1
3.	Characterization of calcareous soils	1
4.	Determination of Ca^{++} and Mg^{++} in soil	1
5.	Determination of Ca^{++} and Mg^{++} in ground water	1
6.	Determination of Potassium in ground water and Soil	1

7.	Determination of sodium in irrigation water and Soil	1
8.	Determination of $CaCO_3$ in calcareous soil	1
9.	Determination of $CO3^{--}$ and $HCO3^{-}$ in irrigation waters	1
10.	Determination of $CO3^{--}$ and $HCO3^{-}$ in soil	1
11.	Determination of chloride in irrigation waters and in soil	1
12.	Determination of sulphate ($SO4^{--}$) in irrigation waters	1
13.	Determination of sulphate ($SO4^{--}$) in soil	1
14.	Determination of gypsum requirement of sodic soil	1
15.	Determination of lime requirement of acid soil	1
16.	Computation of SAR and RSC of irrigation water	1

References:

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3. USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils*. Oxford & IBH.
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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, 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. N.	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

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Introduction of analytical instruments and their principles	2
2.	Determination of organic matter 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 soil extractable sulphur in soil	2
7.	Determination of available DTPA extractable -zinc in soil	1
8.	Rapid plant tissue test- N, P and K	3
9.	Estimation of N,P, K and S in plant	3

References:-

1. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science.Tata McGraw Hill publishing Co. Ltd, New Delhi
2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
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DEPARTMENT OF ENTOMOLOGY

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF ENTOMOLOGY

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	ENTO-121	Fundamentals of Entomology	3(2+1)
Part-II	**III Semester**		
	ENTO-211	Insect Ecology and Principles of Integrated Pest Management	3(2+1)
	IV Semester		
	ENTO-221	Biopesticides & Biofertilizers	3(2+1)*
Part-III	**V Semester**		
	ENTO-311	Pests of Crops and Stored Grain and their Management	3(2+1)
	VI Semester		
	ENTO-321	Management of Beneficial Insects	2(1+1)

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-425**	Commercial Beekeeping	0+10	Entomology
2.	**READY-4212**	Commercial Sericulture	0+10	Entomology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

ENTO. 121 Fundamentals of Entomology 3(2+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

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; 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/Cockroach; 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.

Lecture Schedule: Theory

S.N.	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.	Structure and functions of insect cuticle and molting.	1
5.	Morphology of grasshopper: Body segmentation- structure of head, thorax and abdomen.	2
6.	Structure and modifications of insect antennae.	1

7.	Structure and modifications of insect mouth parts.	3
8.	Structure and modifications of insect leg.	1
9.	Wing venation, modifications and wing coupling apparatus.	1
10.	Structure of genital organs and sensory organs (simple and compound eyes, chemoreceptor).	2
11.	Metamorphosis in insects, types of larvae and pupae.	1
12.	Structure and functions of digestive system.	1
13.	Structure and functions of circulatory and excretory system.	2
14.	Structure and functions of respiratory system.	1
15.	Structure and functions of nervous system.	1
16.	Structure and functions of secretory (endocrine) system	1
17.	Structure and functions of reproductive system and types of reproduction in insects.	2
18.	**Taxonomy**- importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order.	2
19.	Orthoptera: Acrididae, Gryllidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae. Thysanoptera: Thripidae.	2
20.	Hemiptera: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae.	1
21.	Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Bombycidae.	1
22.	Coleoptera: Coccinellidae, Galerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae.	1
23.	Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae.	1
24.	Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae; Neuroptera: Chrysopidae.	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Methods of collection and preservation of insects including immature stages.	1
2.	External features of Grasshopper/Cockroach.	1
3.	Types of insect antennae, mouthparts and legs.	4
4.	Wing venation, types of wings and wing coupling apparatus.	1
5.	Dissection of digestive system in insects (Grasshopper/ Cockroach)	1
6.	Dissection of male and female reproductive systems in insects (Grasshopper/ Cockroach).	1
7.	Study of characters of orders Orthoptera, Dictyoptera with their families.	1
8.	Study of characters of orders Odonata, Isoptera, Thysanoptera with their families.	1
9.	Study of characters of order Hemiptera with its families.	1

10.	Study of characters of order Lepidoptera with its families.	1
11.	Study of characters of order Coleoptera with its families.	1
12.	Study of characters of order Diptera with its families.	1
13.	Study of characters of orders Hymenoptera and Neuroptera with their families.	1

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ENTO. 211 **Insect Ecology and Principles of Integrated Pest Management** **3(2+1)**

Theory

Part-I

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-II

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.

Practical

Sampling techniques for estimation of insect population and damage. Monitoring of insect population through light and pheromone traps. Insecticides and their formulations. Pesticide appliances and their maintenance. Calculations on the doses of insecticides and application techniques. Safe use of pesticides. Ientification of biocontrol agents. Mass production of NPV and fungi.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
1.	**Insect Ecology:** Introduction, Environment and its components.	2
2.	Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents.	2
3.	Effect of biotic factors – food competition, natural and environmental resistance. Agroecosystem.	2
4.	**IPM:** Categories of pests. Introduction, history, importance, concept, principles and limitations of IPM.	3
5.	Economic decision levels.	2
6.	Survey, surveillance and forecasting of insect pests. Assessment of insect pest population.	3
7.	Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological.	4

8.	Chemical control: Importance, hazards and limitations. Classification, toxicity and formulations of insecticides.	3
9.	Insecticides Act 1968-Important provisions.	3
10.	Application techniques of insecticides, symptoms of poisoning, first aid and antidotes.	4
11.	Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.	4

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Sampling techniques for estimation of insect population and damage.	2
2.	Monitoring of insect population through light and pheromone traps	1
3.	Insecticides and their formulations.	2
4.	Pesticide appliances: Handling and their maintenance of small kitchen garden sprayer, hand compression sprayer, knapsack sprayer, foot sprayer, power sprayer, hand rotary duster, power duster	4
5.	Calculations on the doses of insecticides	1
6.	Application techniques of insecticides.	1
7.	Safe use of pesticides	1
8.	Ientification of biocontrol agents	1
9.	Mass production of NPV and fungi	3

References:

1. Yazdani G.S. and Agarwal M.L. 1979. Elements of Insect Ecology. Naroji publishing house, New Delhi.
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.
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4. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
5. Metcalf, R.L and Luckman W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I, Kalyani Publishers, New Delhi.
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ENTO. 221 Bipesticides & Biofertilizers 3(2+1)

Theory

Part - I

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.

Part - II

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 mycorrhiza 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.

Lecture Schedule:Theory

S.N.	Topic	No. of lectures
1.	History and concept of biopesticides.	3
2.	Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses.	3
3.	Mass production technology of bio-pesticides.	2
4.	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.	2
5.	Methods of application of biopesticides.	2
6.	Methods of quality control and Techniques of biopesticides.	3

	Impediments and limitation in production and use of biopesticide	
7.	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 mycorrhiza and ectomycorhiza.	4
8.	Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization. K	3
9	Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.	3
10	FCO specifications and quality control of biofertilizers	2
11	Application technology for seeds, seedlings, tubers, sets etc.	2
12	Biofertilizers -Storage, shelf life, quality control and marketing.	1
13	Factors influencing the efficacy of biofertilizers	2

Lecture Schedule:Practical

S.N.	Topic	No. of lectures
1.	Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyzium* etc. and its production.	2
2.	Identification of important botanicals.	2
3.	Visit to biopesticide laboratory in nearby area.	2
4.	Field visit to explore naturally infected cadavers.	1
5.	Identification of entomopathogenic entities in field condition. Quality control of biopesticides.	2
6.	Isolation and purification of *Azospirillum , Azotobacter, Rhizobium*, P-solubilizers and cyanobacteria.	2
7.	Mass multiplication and inoculums production of biofertilizers.	1
8.	Isolation of AM fungi -Wet sieving method and sucrose gradient method	2
9.	Mass production of AM inoculants.	2

References:

1. Lakshman, H.C. (2014) Bio-fertilizers and Bio-pesticides. Pointer Publishers
2. Sylvia D.N. 2005; Principles and application of Soil Microbiology.Peason Publisher.
3. Project Directorate of Biological control. 1994. Technology for mass production of natural enemies. Technical Bulletin-4.
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ENTO. 311 Pests of crops and stored grains 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 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.

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. 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 structures and methods of grain storage. Principles of stored grain pest management.

Rodents and their management in fields and godowns.

Birds of agricultural importance and their management.

Practical

Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops, vegetable crops, fruit crops, ornamental crops, spices and condiments including polyphagous insect pests. Identification of insect pests and mites associated with stored grains. Determination of insect infestation by different methods. Fumigation of grain stores and godowns. Identification of rodents and birds and their control operations. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearest FCI godowns.

Lecture Schedule: Theory

S.No.	Topic	No.of lectures
1.	Polyphagous insect pests: Locust, grasshopper, whitegrub, termite and red hairy caterpillar	2
2.	Rice: Brown plant hopper, yellow stem borer, rice hispa.	2
3.	Sorghum: Shootfly; Maize: Stem borer; Sugarcane: Pyrilla, whitefly, shoot borer	2
4.	Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar	2
5.	Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer.	2
6.	Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug.	2
7.	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
8.	Chilli: Thrips; Onion and garlic: Thrips	1
9.	Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco).	2
10.	Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.	2
11.	Pests of fruit crops: Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly.	2
12.	Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar.	1
13.	Pomegranate: Anar butterfly; Ber: Fruit fly.	1
14.	Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid.	1
15.	Ornamental Crops: Rose aphid, hollyhock tinged bug, jasmine budworm.	1
16.	Spices and condiments: Aphid, seed midge	1
17.	Pests of stored grains: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite.	2
19	Rodents and their management in fields and godowns.	1
20.	Birds of agricultural importance and their management.	1
21.	Storage structures and methods of grain storage.	1
22.	Principles of stored grain pest management.	1

Lecture Schedule: Practical

S.No.	Topic	No.of lectures
1.	Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops: Polyphagous pests-Locust, grasshopper, whitegrub, termite and red hairy caterpillar	2

2.	Field crops 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.	4
3.	Vegetable crops: Identification, host range and nature of damage, biology and bionomics, and management of important insect pests: Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer; Okra- Shoot and fruit borer; Potato: Tuber moth; Chilli: Thrips; Onion and garlic: Thrips; Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar; Pea: Stem fly; Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.	3
4.	Pests of fruit crops: Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly; Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar; Pomegranate: Anar butterfly; Ber: Fruit fly.	2
5.	Pests of stored grains: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth.	1
6.	Rodents and their management in fields and godowns.	1
7.	Birds of agricultural importance and their management.	1
8.	Storage structures and methods of grain storage.	1
9.	Management of stored grain pests.	1

References:

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.
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5. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I & II, Kalyani Publishers, New Delhi.
6. Reddy, P. Parvatha 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur.

ENTO. 321 MANAGEMENT OF BENEFICIAL INSECTS 2(1+1)

Theory

Part - I

Beekeeping- Importance, bee species and biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Sericulture- Importance, species 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. Lac culture- Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac-products.

Part - II

Insect orders bearing parasitoids and predators used in pest control and their mass multiplication techniques. Important species of pollinators, 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. Species 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.N.	Topic	No. of lectures
1.	Beekeeping- Importance, bee species and biology.	2
2.	Commercial methods of rearing, equipment used, seasonal management.	1
3.	Bee enemies and diseases.	1
4.	Bee pasturage, bee foraging and communication.	1
5.	Importance, species of silkworm, voltinism and biology.	1
6.	Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.	1
7.	Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm.	1
8.	Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac- products.	2
9.	Insect orders bearing parasitoids and predators used in pest control.	2
10.	Mass multiplication techniques of parasitoids (*Trichogramma chilonis* and *Campoletis chloridae*) and predators (ladybird beetle).	3
11.	Important species of pollinators, weed killers and scavengers with their importance.	1

Lecture Schedule:Practical

S.N.	Topic	No. of lectures
1.	Honey bee species, castes of bees.	1
2.	Beekeeping appliances and seasonal management, bee enemies and disease.	2
3.	Bee pasturage, bee foraging and communication.	1
4.	Types of silkworm, voltinism and biology of silkworm.	1
5.	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.	1
8.	Collection of important parasitoids, predators, pollinators, weed killers and scavengers.	2
9.	Mass multiplication techniques of parasitoids (*Trichogramma chilonis* and *Campoletis chloridae*) and predators (ladybird beetle).	4
10.	Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.	2

References:

1. DeBach, P. 1974. Biological control by Natural enemies. Cambridge University Press.
2. Dhaliwal GS & Arora R. 2001. *Integrated Pest Management: Concepts and approaches.* Kalyani Publ., New Delhi.
3. Dhaliwal, GS & Koul O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.
4. Gautam, R.D. Biological Pest Suppression, Westvill Publising Co., New Delhi.
5. 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.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
7. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping, Scientific Publishers, Jodhpur.

DEPARTMENT OF AGRICULTURAL ECONOMICS

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF AGRICULTURAL ECONOMICS

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	AECON-121	Fundamentals of Agricultural Economics	2(2+0)
Part-II	**III Semester**		
	AECON-211	Agricultural Finance and Co-Operation	3(2+1)
	IV Semester		
	AECON-221	Agricultural Marketing Trade & Prices	3(2+1)
Part-III	**V Semester**		
	AECON 311	Agribusiness Management	3(2+1)*
	VI Semester		
	AECON-321	Farm Management, Production & Resource Economics	2(1+1)

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VII Semester - NIL

AECON- 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, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.

Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. *Cost:* Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Good and services tax (GST) - meaning, definition, advantage and disadvantages and its implication on Indian economy.

Tax*:* meaning, direct and indirect taxes, agricultural taxation.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
	Economics:	
1.	Meaning, scope and subject matter	1
2.	Definitions, activities, Approaches to economic analysis	1
3.	Micro and macro economics, positive and normative analysis	1
4.	Nature of economic theory; rationality assumption	1
5.	Concept of equilibrium	1
6.	Economic laws as generalization of human behavior	1
7.	Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare	1
	Agricultural economics:	
8.	Meaning, definition, characteristics of agriculture	1
9.	Importance and its role in economic development	1
10.	Agricultural planning and development in the country	1
	Demand:	1

11.	Law of demand, demand schedule and demand curve	1
12.	Determinants	1
13.	Utility theory; law of diminishing marginal utility	1
14.	Equi-marginal utility principle	1
15.	Consumer's equilibrium and derivation of demand curve, concept of consumer surplus	1
16.	Elasticity of demand: concept and measurement of price elasticity	1
17.	Income elasticity and cross elasticity	1
	Production:	
18.	Process, creation of utility	1
19.	Factors of production, input output relationship	1
20.	Laws of returns	1
21.	Law of variable proportions and law of returns to scale	1
22.	Cost: Cost concepts, short run and long run cost curves	1
23.	Supply: Stock v/s supply, law of supply, supply schedule, supply curve	1
24.	Determinants of supply, elasticity of supply	1
	Market structure	
25.	Meaning and types of market	1
26.	Basic features of perfectly competitive and imperfect markets	1
27.	Price determination under perfect competition	1
28.	Short run and long run equilibrium of firm and industry	1
29.	Shut down and break even points	1
	Distribution theory	
30.	Meaning, factor market and pricing of factors of production	1
31.	Concepts of rent, wage, interest and profit	1
	National income:	1
32.	Meaning and importance, circular flow	1
33.	Concepts of national income accounting and approaches to measurement, difficulties in measurement	1
34.	Good and services tax (GST) - meaning, definition, advantage and disadvantages and its implication on Indian economy.	1
	Tax*:*	
35.	Meaning, direct and indirect taxes, agricultural taxation	1

References:

1. Dominick Salvatore, 2011, Outline of Microeconomics, Schaum's Outline Series.
2. Bhavani Devi,P. Raghu Ram,S. Subba Reddy,T.V. Neelakanta Sastry, 2009, Agricultural economics, Oxford and IBH Co. Pvt. Ltd., , New Delhi.
3. K. K. Dewett and J. D. Varma, 1986, Elementary Economic Theory, S. Chand & Company, New Delhi.
4. Latika Sharma *et al* (2014) Principles of agricultural economics, Agrotech publishers, Udaipur.
5. M.L. Jhingan, 2004, Micro Economic Theory, Vikas Publishing House Pvt. Ltd., New Delhi.

AECON-211 Agricultural Finance and Co-Operation 3(2+1)

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.

Agricultural credit: meaning, definition, need, classification. Credit analysis- 3 R's, 5 C's and 7 P's, Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Crop insurance and its scope. Credit Guarantee Corporation of India, Pradhan Mantri Fasal Bima Yogana- features, Significant and limitation. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Financial instruments and methods – E banking, Kisan Cards and core banking.

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

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. Preparation of Bankable projects for various agricultural products and its value added products. Different type of repayment plans.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
	Agricultural finance	
1.	Meaning, scope and significance,	2
2.	Credit needs and its role in Indian agriculture.	1
	Agricultural credit:	
3.	Meaning, definition, need, classification.	2
4.	Credit analysis- 3 R's, 5 C's and 7 P's,	2
5.	Sources of agricultural finance: institutional and non-institutional sources	1
6.	Commercial banks, social control and nationalization of commercial banks, micro financing including KCC	2
7.	Lead Bank Scheme, RRBs	1

8.	Scale of finance and unit cost	1
9.	An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank	3
10.	Crop insurance and its scope	2
11.	Credit guarantee corporation of India	1
12.	Pradhan Mantri Fasal Bima Yogana- features, significant and limitation	2
13.	Cost of credit	1
14.	Recent development in agricultural credit	1
15.	Preparation and analysis of financial statements – balance sheet and income statement.	2
16.	Basic guidelines for preparation of project reports- bank norms – SWOT analysis	1
17.	Financial instruments and methods – e banking, Kisan Cards and core banking	1
	Agricultural cooperation	
18.	Meaning, brief history of cooperative development in India	1
19.	Objectives, principles of cooperation, significance of cooperatives in Indian agriculture	1
20.	Agricultural cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies,	2
21.	Cooperative warehousing; role of ICA, NCUI, NCDC, NAFED	2

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Optimum allocation of limited amount of capital among different enterprise	3
2.	Analysis of progress and performance of cooperatives using published data	1
3.	Analysis of progress and performance of commercial banks and RRBs using published data	1
4.	Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures.	2
5.	Estimation of credit requirement of farm business – a case study	1
6.	Preparation and analysis of balance sheet – a case study	1
7.	Preparation and analysis of income statement – a case study.	1
8.	Appraisal of a loan proposal – a case study	2
9.	Techno-economic parameters for preparation of projects	1
10.	Preparation of bankable projects for various agricultural products and its value added products.	2
11.	Different type of repayment plans	1

References:

1. S. Subba Reddy, P. Raghu Ram, 1996, Agricultural finance and management, Oxford & IBH Pub. Co, New Delhi
2. Kamat, G.S., 1978, New Dimensions of Cooperative Management, Himalyan Publishing House, Mumbai.
3. Nelson and Murray, 1988. Agricultural Finance. Kalyani Publishers, New Delhi.
4. Pandey, U.K. 1990. An Introduction to Agricultural Finance, Kalyani Publishers, New Delhi.
5. Singh, J.P., 1988, Agricultural Finance Theory and Practices, Ashish Publishing House, New Delhi.
6. Muniraj, R. 1987, Farm finance for development, Oxford & IBH Pub. Co., New Delhi.

AECON-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) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing;

Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits

Marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;

Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy;

Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

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

Lecture Schedule:Theory

S.N.	Topic	No. of lectures
	Agricultural marketing:	
1.	Concepts and definitions of market, marketing, agricultural marketing,	1
2.	Market structure	1
	Marketing mix and market segmentation	1
3.	Classification and characteristics of agricultural markets	1
	Demand, supply and producer's surplus of agri-commodities:	
4.	Nature and determinants of demand and supply of farm products	1
5.	Producer's surplus – meaning and its types, marketable and marketed surplus	1
6.	Factors affecting marketable surplus of agri-commodities	1
	Product life cycle	
7.	PLC and competitive strategies: Meaning and stages in PLC	1
8.	Characteristics of PLC; strategies in different stages of PLC	1
9.	Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing	1
	Market promotion	
10.	Advertising, personal selling,	1
11.	Sales promotion and publicity – their meaning and merits & demerits	1
	Marketing process and functions:	
12.	Marketing process-concentration, dispersion and equalization;	1
13.	Exchange functions – buying and selling;	1
	Physical functions – storage, transport and processing;	1
14.	Facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK)	1
15.	Market functionaries and marketing channels	1
16.	Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels;	2
17.	Integration, efficiency, costs and price spread: Meaning, definition and types of market integration;	1
18.	Marketing efficiency; marketing costs, margins and price spread;	1
19.	Factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;	1
	Role of Govt. In agricultural marketing:	
20.	Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions	1
21.	Cooperative marketing in India	1
22.	Risk in marketing: Types of risk in marketing	1
23.	Speculation & hedging; an overview of futures trading	1
24.	Agricultural prices and policy: Meaning and functions of price	1

25.	Administered prices; need for agricultural price policy	1
	Trade:	
26.	Concept of International Trade and its need,	1
27.	Theories of absolute and comparative advantage	1
28.	Present status and prospects of international trade in agri-commodities; GATT and WTO	1
29.	Agreement on Agriculture (AoA and its implications on Indian agriculture; IPR	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Plotting and study of demand and supply curves and calculation of elasticities**;**	2
2.	Study of relationship between market arrivals and prices of some selected commodities	2
3.	Computation of marketable and marketed surplus of important commodities	2
4.	Study of price behaviour over time for some selected commodities, Construction of index numbers	2
5.	Price forecasting; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity	2
6.	Collection of data regarding marketing costs, margins and price spread and presentation of report in the class;	2
7.	Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. To study their organization and functioning;	2
8.	Application of principles of comparative advantage of international trade	2

References:

1. Acharya, S.S. and Agarwal, N.L., 1994, Agricultural Price Analysis and Price Policy, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Acharya, S.S. and Agarwal, N.L., 2004, Agricultural Marketing in India, Oxford and IBH Publishing Co. New Delhi.
3. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma, 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-418-6. First edition.
4. Kahlon, A.S. and George, M.V., 1985, Agricultural Marketing and Price Policy, Allied Publication Pvt. Ltd., New Delhi.
5. Kohls, Richard L. and Uhl, Joseph N., 1980, Marketing of Agricultural Products, Macmillan Publishing Co., Inc. New York
6. Mamoria, C.B and Joshi, R.L., 1971, Principles and Practice of Marketing in India, Kitabmahal, Allahabad.

AECON-311 Agri-businessManagement 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.

Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies.

Product Life Cycle (PLC).

Sales & Distribution Management.

Pricing policy, various pricing methods.

Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

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. Appraisal/evaluation techniques of identifying viable project- Net present worth technique for selection of viable project. Internal rate of return. Non-discounting techniques.

Case study of agro-based industries.

Trend and growth rate of prices of agricultural commodities.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
	Transformation of agriculture into agribusiness	
1.	Various stakeholders and components of agribusiness systems	1
2.	Importance of agribusiness in the Indian economy and New Agricultural Policy	2

	Distinctive features of Agribusiness Management:	
3.	Importance and needs of agro-based industries,	1
4.	Classification of industries and types of agro based industries	1
5.	Institutional arrangement, procedures to set up agro based industries.	1
6.	Constraints in establishing agro-based industries	1
	Agri-value chain	
7.	Understanding primary and support activities and their linkages	2
	Business environment	
8.	PEST & SWOT analysis	2
	Management functions:	
9.	Roles & activities, Organization culture.	2
10.	Planning, meaning, definition, types of plans.	2
11.	Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.	2
12.	Components of a business plan, Steps in planning and implementation	1
	Organization setup	
13.	Staffing, directing and motivation	1
14.	Ordering, leading, supervision, communications, control	2
	Capital Management and Financial management	
15.	Capital Management and Financial management of Agribusiness	1
16.	Financial statements and their importance	1
	Marketing management:	
17.	Segmentation, targeting & positioning.	1
18.	Marketing mix and marketing strategies.	1
19.	Product life cycle (plc).	1
20.	Sales & distribution management.	1
21.	Pricing policy, various pricing methods.	1
	Project management	
22.	Definition, project cycle,	1
23.	Identification, formulation, appraisal, implementation,	1
24.	Monitoring and evaluation	1
25.	Project Appraisal and evaluation techniques	1

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Study of agri-input markets: Seed, fertilizers, pesticides	2
2.	Study of output markets: grains, fruits, vegetables, flowers	2
3.	Study of product markets, retails trade commodity trading, and value added products	2
4.	Study of financing institutions- Cooperative, Commercial banks, rrbs, Agribusiness Finance Limited, NABARD	2
5.	Preparations of projects and Feasibility reports for agribusiness entrepreneur	2
6.	Appraisal/evaluation techniques of identifying viable project- Net present worth technique for selection of viable project.	2
7.	Internal rate of return. Non-discounting techniques.	2

8.	Case study of agro-based industries.	2
9.	Trend and growth rate of prices of agricultural commodities.	2

References:

1. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma, 2017. Fundamentals of Agribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-418-6. First edition.
2. Gittinger, J.P, 1984, Economic Analysis of Agricultural Projects, John Hopkins University Press.
3. Kotler, Philip, 1999, Marketing Management, Prentice Hall of India, New Delhi,
4. L.L. Somani and G. L. Meena, 2017. Agribusiness & Farm Management at a Glance, Vol-2, Basic & Applied Fundamentals, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-429-2. Second edition.
5. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad.
6. Sudha, G.S, 2000, Business Management, RBSA Publishers, Jaipur.
7. Tripathi, P. C. and Reddy, P. N, Principles of Management, Tata McGraw Hill Education Private Limited, New Delhi, 2008.

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

Theory

Farm management: Meaning and concept, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income.

Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies**,**

Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

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

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
	Farm management:	
1.	Meaning and concept, 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	1
4.	Use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship,	1

5.	Law of equi-marginal/or principles of opportunity cost and law of comparative advantage	1
6.	Meaning and concept of cost, types of costs and their interrelationship	1
7.	Importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income	1
	Farm business analysis:	
8.	Meaning and concept of farm income and profitability, Technical and economic efficiency measures in crop and livestock enterprises	1
9.	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	1
10.	Meaning and importance of farm planning and budgeting, partial and complete budgeting,	1
11.	Steps in farm planning and budgeting	1
12.	Linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.	1
	Concept of risk and uncertainty	
13.	Concept of risk and uncertainty occurs in agriculture production, Nature and sources of risks and its management strategies	1
	Concepts of resource economics, Differences between NRE and agricultural economics,	
14.	Unique properties of natural resources	1
15.	Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions	1
16.	Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.	1

Lecture Schedule: Practical

S.N.	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	1
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	2
6.	Determination of least cost combination of inputs	2
7.	Selection of most profitable enterprise combination	2
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 India	1

References:

1. Dhondyal, S.P., "Farm Management – An Economic Analysis", Aman Publishing House, Madhu Market, Meerut (U.P.).
2. Bhavani Devi,P. Raghu Ram,S. Subba Reddy,T.V. Neelakanta Sastry, 2009, Agricultural economics, Oxford and IBH Co. Pvt. Ltd., , New Delhi.
3. Johl, S.S. and T.R. Kapur, 1989, Fundamentals of Farm Business Management, Kalyani Publishers, Ludhiyana.
4. Kerr, John M., et al., 1997, Natural Resource Economics: Theory and Applications in India, Oxford & IBH, New Delhi.
5. Raju, V. T. and D. V. S. Rao, 2002, "Economics of Farm Production and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Sankhayan, P. L., 1988, Introduction to the Economics and Agricultural Production, Prentice Hall of India Private Limited, New Delhi.
7. Singh, I. J., 1977, Elements of Farm Management Economics, Affiliated East-West Press Pvt. Ltd., New Delhi.

DEPARTMENT OF AGRICULTURAL ENGINEERING

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF AGRICULTURAL ENGINEERING

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	AENGG-121	Soil and Water Conservation Engineering	2(1+1)
Part-II	**III Semester**		
	AENGG-211	Farm Machinery and Power	2(1+1)
	IV Semester- NIL		
Part-III	**V Semester**		
	AENGG-311	Renewable Energy and Green Technology	2(1+1)
	VI Semester		
	AENGG-321	Protected Cultivation and Secondary Agriculture	2(1+1)

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)
VIII semester- NIL				

AENGG-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 Soil Loss Equation. Introduction to contouring, strip cropping. contour bund. graded bund and bench terracing. Grass water ways. Water harvesting and its techniques. Wind erosion - principle of wind erosion control and its control measures. Familiarization with centrifugal pumps, measurement of irrigation water, water conveyance system and familiarization with pressurized irrigation methods.

Practical

General status of soil conservation in India and Rajasthan. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of contour bunds. Design of graded bunds. 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.N.	Topic	No. of lectures
1.	Introduction to Soil and Water Conservation and causes of soil erosion	1
2.	Definition and agents of soil erosion and water erosion	1
3.	Forms of soil erosion-rain drop, sheet, rill and gully erosion: factor affecting soil erosion.	1
4.	Gully classification and control measures.	1
5.	Soil loss estimation by universal Soil Loss Equation.	1
6.	Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways.	2
7.	Water harvesting and its techniques.	1
8.	Wind erosion- principle of wind erosion and its control measures	1
9.	Centrifugal pumps- volute and diffuser types; Principle of operation of centrifugal pumps.	1
10.	Pump related terms- capacity, suction lifts, suction head, discharge head, friction head, pressure head, total head, velocity head, net positive suction head, maximum practical suction lift of pumps, water horsepower, shaft horse power, pump efficiency, brake horse power.	2
11.	Measurement of irrigation water- volume method, velocity- area method, water meter, weirs- rectangular, cipolletti, 90^{o} v- notch.	2
12.	Drip irrigation method- Adoptability, limitation, components and layout.	1
13.	Sprinkler irrigation method- adoptability, limitations, types, components and layout.	1

Lecture schedule: Practical

S.N.	Topic	No. of lectures
1	General status of soil conservation in India and Rajasthan	1
2	Calculation of erosion index	1
3	Estimation of soil loss.	2
4	Preparation of contour maps	2
5	Numericals on design of contour bunds	2
6	Numerical problems on friction head, velocity head, total head and horse power calculation of pumps.	2
7	Measurement of irrigation water in the field by different methods and related numericals.	2
8	Study of different components of drip irrigation system	1
9	Study of different components of sprinkler irrigation system	1
10	Visit to nearby watersheds	2

References:

1. Land and Water Management Engineering. 1982. Murthy V.V.N. Kalyani Pubhliers, New Delhi.
2. Irrigation: Theory and Practices.2012. Michael A.M. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Principles of Agricultural. Engineering. Vol. II. 2012. Michael A.M. and T.P. Ojha. Jain Brothers, New Delhi.
4. Soil and Water Conservation Water Management. 2010. Mahnot, S.C., Singh P.K. and Chaplot, P.C.,. Apex Publication House, Udaipur.

AENGG-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, 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.	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- thermosiphon 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 for 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

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1	Study of different components of I.C. engine.	1
2	To study air cleaning and fuel supply system of engine,	1
3	Study of cooling and lubricating 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 reaper and thresher	2

References:

1. Principles of Agricultural Engineering. Vol. I. 2012. Michael, A.M. and T.P. Ojha. Jain Brothers, Jodhpur.
2. Farm Tractors, Maintenance and Repair.1989. Rai and Jain. Tata Mc Graw Hill Publ. New Delhi.
3. Elements of Farm Machinery.1989. Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
4. Elements of Agricultural Engineering, Vol. I & III. 1989. Singhal, O.P. Suraj Prakashan, Allahabad.
5. Element of Agricultural Engineering. 1990. Sahay, Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna.

AENGG-311 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 its application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, 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 dryers. To study solar distillation system.

Lecture schedule: Theory

S.N.	Topic	No. of lectures
1.	Classification of energy sources, contribution of these sources in agricultural sector.	1
2.	Familiarization with biomass utilization for bio fuel production and their application	2
3.	Familiarization with different types of biogas plants.	2
4.	Biogas production techniques and various uses of biogas.	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	2
8	Solar thermal applications in different gadgets	2
9	Solar photovoltaic techniques and applications.	1
10	Introduction of wind energy and its application	1

Lecture schedule: Practical

S.N.	Topic	No. of lectures
1	Study of fixed dom and floating drum type biogas plants	2
2	Study of cross draft, updraft and down draft gasifiers	2
3	To study briquetting machine	1
4	Study of box type solar cooker	1
5	Study of solar water heating system	1
6	Study of solar distillation system	1
7	Study of solar dryer	2
8	Study of solar animal concentrate cooker	1
9	Study of solar photovoltaic water pumping system and visit to nearby solar photovoltaic water pumping system	2
10	Study of solar photovoltaic sprayer	1
11	Study of wind mill	1
12	Study of improved cook stove	1

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2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology.

AENGG-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 green houses, 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 dynamic aero & hydrodynamic of cereals, pulses and oil seed. 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 green houses 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 green house equipments. Visit to various Post Harvest Laboratories. Determination of moisture content of various grain 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.N.	Topic	No. of lectures
1.	Introduction to green house 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 green house equipments	1
4	Materials of construction for traditional and low cost green houses	1
5	Irrigation systems used in green houses	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 dynamic aero & hydrodynamic of cereals, pulses and oilseed	1
10	Concepts of cleaning and grading vibratory and rotary type air cleaner	1
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

Lecture schedule: Practical

S.N.	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 green house 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

References:

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic and A.N.Mathur. Himanshu Publication, Udaipur.
2. Green House Technology- Application and Practice. Sharma A and V.M.Salokhe. 2006. Agro Tech. publication, Udaipur
3. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.
4. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
5. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

DEPARTMENT OF PLANT PATHOLOGY

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF PLANT PATHOLOGY

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	PPATH-121	Fundamentals of Plant Pathology	3(2+1)
Part-II	**III Semester**		
	PPATH-211	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)
	IV Semester		
	PPATH-221	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)
Part-III	**V Semester**		
	PPATH-311	Epidemiology and Principles of Integrated Disease Management	2(1+1)
	VI Semester- NIL		

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-421**	Production Technology for Bioagents and Biofertilizer	0+10	Plant Pathology + Microbiology
2.	**READY-423**	Mushroom Cultivation Technology	0+10	Plant Pathology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

PPATH-121 Fundamentals of Plant Pathology 3(2+1)

Theory:

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes 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, classification of fungi (key to Domain to Phylum).

Bacteria and mollicutes: general morphological characters, reproduction and classification of plant pathogenic bacteria.

Viruses: nature, structure and transmission.

Role of enzymes and toxins in disease development. Defense mechanism in plants.

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

Practical:

Acquaintance with various laboratory equipments and microscopy. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Staining and identification of plant pathogenic bacteria. Identification of plant parasitic nematodes (*Heterodera, Meloidogyne* and *Anguina*). Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
1.	Introduction**:** Importance of plant diseases, scope and objectives of Plant Pathology.	02
2.	History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology.	02
3.	Pathogenesis. Causes and classification of plant diseases, diseases and symptoms due to abiotic causes.	02
4.	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.	07
5.	Fungi**:** general characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual).	03
6.	Nomenclature, Binomial system of nomenclature, Classification of fungi (key to Domain to Phylum).	03
7.	Bacteria and mollicutes: general morphological characters	02
8.	Reproduction and classification of plant pathogenic bacteria.	02

9.	Viruses**:** nature, structure and transmission.	02
10.	Role of enzymes and toxins in disease development. Defense mechanism in plants.	02
11.	Nematodes**:** General morphology and Outline of classification	02
12.	Symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne* and *Anguina*).	03

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Acquaintance with various laboratory equipments and microscopy.	02
2.	Preparation of media, isolation and Koch's postulates.	02
3.	General study of different structures of fungi.	03
4.	Study of symptoms of various plant diseases.	03
5.	Staining and identification of plant pathogenic bacteria.	01
6.	Identification of plant parasitic nematodes (*Heterodera*, *Meloidogyne* and *Anguina*).	03
7.	Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.	02

References:

1. Agrios GN. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York. (Indian Ed.)
2. Mehrotra, R.S. and Aggarawal, A. 2007. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Singh, R.S. 2005. 4th ed. Principles of Plant Pathology. Oxford & IBH, New Delhi.
4. Nene, Y.L. 2015. Fungicides in Plant Diseases Control. Oxford & IBH published Co. Pvt. Ltd., New Delhi
5. Vander plank, J.E. (2014) Host Pathogen Interactions in Plant Diseases. A.P.
6. Singh, R.P. 2013. Plant Pathology. Kalyani Publishers
7. Alexopoulos CJ, Mims CW & Blackwell M. 2000. *Introductory Mycology*.5th Ed. John Wiley & Sons, New York.
8. Dube, H.C. 2012. Mordern Plant Pathology, Agro Bios , India
9. Lakshman, H.C. 2014. Bio-fertilizers and Bio-pesticides. Pointer Publishers
10. डा. बी. पी. सिंह 2004, 11th ed. पादप रोग विज्ञान, रामा पब्लिशिंग हाउस, मेरठ।

PPATH- 211 Diseases of Field & Horticultural Crops & their Management-I 3 (2+1)

THEORY:

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

Field crops::

Rice: Blast, brown spot, bacterial blight, sheath blight, khaira and tungro. 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: Phytophthora blight and bacterial blight. 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 and Bacterial blight. Date palm: Graphiola leaf spot. Coconut: Root root, wilt, cadang cadang and bud rot. Tea: Blister blight and red rust. Coffee: Rust. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. 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.

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: leaf blights and downy mildews. Sorghum: Grain smut and anthracnose. Bajra: Downy mildew and ergot. Groundnut: Tikka, collar rot and peanut clump virus. 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: zinc deficiency. Papaya: Leaf curl Pomegranate: leaf spots and Bacterial blight. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Brinjal: Little leaf. Tomato: Damping off, early blight, leaf curl and root knot. Okra: Yellow vein mosaic. Date palm: Graphiola leaf spot.

Note: Students should submit 20 pressed and well-mounted specimens.

Lecture Schedule: Theory

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

S.N.	Topic	No. of lectures
1.	Rice: Blast, brown spot, bacterial blight, sheath blight, khaira and tungro.	2
2.	Maize: Stalk rots, leaf blights and downy mildews.	2
3.	Sorghum: Grain smut and anthracnose.	1
4.	Bajra: Downy mildew and ergot.	1
5.	Groundnut: Tikka, collar rot and peanut clump virus.	2
6.	Soybean: Rhizoctonia blight and bacterial pustule.	2
7.	Pigeonpea: Sterility mosaic.	1

8.	Moong, urd and moth beans: Web blight and yellow mosaic.	2
9.	Castor: Phytophthora blight and bacterial blight.	1
10.	Guar: Bacterial blight and Alternaria blight.	2
11.	Sesamum: Stem & root rot and phyllody.	2
12.	Cotton: Wilt, root rot, bacterial blight and leaf curl.	2
13.	Guava: Wilt and zinc deficiency.	1
14.	Banana: Panama wilt, Sigatoka and bunchy top.	2
15.	Papaya: Foot rot, leaf curl, ring spot and root knot.	1
16.	Pomegranate: leaf spots and Bacterial blight.	1
17.	Date palm: Graphiola leaf spot. Coconut: Root wilt, cadang cadang and bud rot.	2
18.	Tea: Blister blight and red rust, Coffee: Rust.	1
19.	Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot.	1
20.	Brinjal: Phomopsis blight and little leaf.	1
21.	Tomato: Damping off, bacterial wilt, early blight, leaf curl and root knot.	1
22.	Okra: Yellow vein mosaic. Ginger: Rhizome rot	1

Lecture Schedule: 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.

S.N.	Topic	No. of lectures
1.	Maize: 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.	Pigeon pea: Sterility mosaic.	1
6.	Moong, urd and moth beans: Web blight and yellow mosaic.	1
7.	Castor: Bacterial blight, Sesamum: Phyllody.	1
8.	Guar: Bacterial blight and Alternaria blight.	1
9.	Cotton: Wilt, root rot, bacterial blight and leaf curl.	1
10.	Guava: zinc deficiency.	1
11.	Papaya: Leaf curl	1
12.	Pomegranate: leaf spots and Bacterial blight.	1
13.	Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot	1
14.	Brinjal: Little leaf, Tomato: Damping off, early blight, leaf curl and root knot.	1
15.	Okra: Yellow vein mosaic.	1
16.	Date palm: Graphiola leaf spot	1

*Note : Student should submit at least 20 pressed well mounted disease specimens

References:

1. Cook, A. A. 1981. Diseases of tropical and sub-tropical field fiber and oil plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul, Y S 2008. IInd ed. Diseases of field crops. Kalyani Publishing Co. ND.
3. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata McGraw-Hill Publishing Co Ltd. ND.
4. Mishra A , Bohra A and Mishra , A. 2005. Plant Pathology. Agrobios. Jodhpur (India).
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6. Singh R S .2007. 8thed. Plant Diseases. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
7. Gupta ,V. K. 2014. Diseases of Fruit Crops. Kalyani Publishers
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10. Singh , R.P. 2013. Plant Pathology. Kalyani Publishers
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12. Gangawane, L.V. and Khilare, V.C. 2008. Crop diseases identification and management. Daya publishing house, New Delhi.
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14. Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd, . New Delhi.
15. Singh, R.S. 2006. Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
16. Singh, R.S.1994 Diseases of vegetable crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
17. मुखोपाध्याय एंव सिंह 1984, IIth ed. फसलों के रोग, हरिश महाश्वरी मैर्सस एंव डी प्रिंटर्स रामनगर, वाराणसी पब्लिशिंग हाउस, मेरठ।

PPATH-221 Diseases of Field & Horticultural Crops & 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, flag smut and ear cockle & tundu. Barley: Stripe, covered smut and molya disease. Sugarcane: Red rot, whip smut, grassy shoot, ratoon stunting and Pokkah boeng. 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. Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Cabbage: Alternaria leaf spot and black rot. Pea: 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 crops. 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. Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia stem rot. Gram: Root rot, wilt and Ascochyta blight. Isabgol: Downy mildew. Cumin: Wilt, powdery mildew and Alternaria blight. Fenugreek: Powdery mildew. Mango: Malformation Citrus: Canker, dieback Ber: Powdery mildew. Potato: Late blight, black heart Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Cabbage: Alternaria leaf spot and black rot. Pea: powdery mildew. Carrot: Alternaria blight. Rose: Dieback and powdery mildew.

Note: Students should submit 20 pressed and well-mounted specimens.

Lectures Schedule: Theory

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

S.N.	Topic	No. of lectures
1.	Wheat: Rusts	2
2.	Wheat: loose smut, karnal bunt, flag smut and ear cockle & tundu.	2
3.	Barley: Stripe, covered smut and molya disease.	2
4.	Sugarcane: Red rot, whip smut, grassy shoot, ratoon stunting and Pokk boeng.	3
5.	Lentil: Wilt	1
6.	Mustard: Alternaria blight, white rust and Sclerotinia rot.	2
7.	Gram: Root rot, wilt and Ascochyta blight.	2
8.	Isabgol: Downy mildew, Coriander: Stem gall.	1
9.	Cumin: Wilt, powdery mildew and Alternaria blight, Fenugree Powdery mildew	2

10.	Mango: Malformation and black tip.	1
11.	Citrus: Canker, dieback and gummosis	1
12.	Grape vine: Downy mildew and anthracnose	1
13.	Apple: Scab	1
14.	Ber: Powdery mildew.	1
15.	Aonla: Rust.	1
16.	Potato: Late blight, black heart, golden nematode and leaf roll.	2
17.	Onion: Purple blotch.	1
18.	Chillies: Anthracnose and leaf curl	1
19.	Cabbage: Alternaria leaf spot and black rot	2
20.	Pea: powdery mildew	1
21.	Carrot: Alternaria blight.	1
22.	Rose: Dieback and powdery mildew. Marigold: Blight	1

Lecture Schedule: 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.

S.N.	Topic	No. of lectures
1.	Wheat: Rusts, loose smut, karnal bunt and ear cockle.	1
2.	Barley: Stripe, covered smut and molya disease.	1
3.	Sugarcane: Red rot.	1
4.	Field visit to diagnose the diseases and collect of disease specimen	1
5.	Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia stem rot.	1
6.	Gram: Root rot, wilt and Ascochyta blight.	1
7.	Isabgol: Downy mildew. Cumin: Wilt, powdery mildew and Alternaria blight.	1
8.	Field visit to diagnose the diseases and collect of disease specimen	1
9.	Fenugreek: Powdery mildew.	1
10.	Mango: Malformation Citrus: Canker, dieback	1
11.	Ber: Powdery mildew.	1
12.	Potato: Late blight, black heart Onion: Purple blotch. Chillies: Anthracnose and leaf curl.	2
13.	Cabbage: Alternaria leaf spot and black rot. Pea: powdery mildew.	2
14.	Carrot: Alternaria blight. Rose: Dieback and powdery mildew	1

*Note: Students should submit 20 pressed and well-mounted specimens.

References:

1. Cook, A. A. 1981. Diseases of tropical and sub-tropical field fiber and oil plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul, Y S 2008. IInd ed. Diseases of field crops. Kalyani Publishing Co. ND.
3. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata McGraw-Hill Publishing Co Ltd. ND.
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5. Rangaswamy,G and Mahadevan, A . 2012. 4th ed. Diseases of crop plants in India. Prentice hall of India Pvt Ltd, New Delhi.
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PPATH-311 Epidemiology & Integrated Disease Management 2(1+1)

Theory:

Epidemiology and factors affecting disease development. Diagnosis of plant diseases. Disease triangle and tetrahedron. Forecasting of plant diseases. Principles of plant disease management. Methods of integrated disease management: Host plant resistance, cultural, physical, legislative, biological and chemical control. IDM modules for wheat, rice, sugarcane, cotton, groundnut, citrus and chickpea. Integrated nematode management in protected cultivation. Nature, chemical combination, general classification of fungicides and antibiotics. Safety issues in fungicidal uses. Pest risk analysis.

Practical:

Diagnosis of plant diseases. Methods of plant disease measurement. Assessment of crop yield losses. Identification of bio-control agents. Mass multiplication of *Trichoderma*, *Pseudomona*s and *Bacillus*. Methods of pesticide application and their safe use. Study of structural details of sprayers, dusters and seed dressers. Awareness campaign at farmer's fields.

Lecture Schedule: Theory

S.N.	Topics	No. of Lectures
1.	Epidemiology and factors affecting disease development	01
2.	Diagnosis of plant diseases	01
3.	Disease triangle and tetrahedron and forecasting of plant diseases	02
4.	Principles of plant disease management	02
5.	Methods of integrated disease management:- Host plant resistance, cultural, physical, legislative, biological and chemical control	02
6.	IDM modules for wheat, rice, sugarcane, cotton, groundnut, citrus and chickpea	02
7.	Integrated nematode management in protected cultivation	02
8.	Nature, chemical combination, general classification of fungicides and antibiotics	02
9.	Safety issues in fungicidal uses	01
10.	Pest risk analysis	01

Lecture Schedule: Practical

S.N.	Topic	No. of lectures
1.	Diagnosis of plant diseases	01
2.	Methods of plant disease measurement	02
3.	Assessment of crop yield losses	04
4.	Identification of bio-control agents.	01
5.	Mass multiplication of *Trichoderma, Pseudomona*s and *Bacillus*	04
6.	Methods of pesticide application and their safe use	01
7.	Study of structural details of sprayers, dusters and seed dressers.	02
8.	Awareness campaign at farmer's fields.	01

References:

1. Agrios GN. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York. (Indian Ed.)
2. Mehrotra, R.S. and Aggarawal, A. 2007. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Nene Y.L. 2015. Fungicides in Plant Diseases Control. Oxford & IBH published Co. Pvt. Ltd., New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of crop plants in India. Prentice hall of India Pvt Ltd. New Delhi.
5. Singh, R.S. 1996. An Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.

DEPARTMENT OF HORTICULTURE

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF HORTICULTURE

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	HORT-111	Fundamentals of Horticulture	2(1+1)
	II Semester- NIL		
Part-II	**III Semester**		
	HORT-211	Production Technology for Vegetables and Spices	2(1+1)
	IV Semester		
	HORT-221	Production Technology for Fruit and Plantation Crops	2(1+1)
	HORT-222	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
	HORT-223	Hi-tech. Horticulture	3(2+1)*
Part-III	**V Semester**		
	HORT- 311	Landscaping	3(2+1)*
	VI Semester		
	HORT-321	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-427**	Commercial Horticulture	0+10	Horticulture
2.	**READY-428**	Floriculture and Landscaping	0+10	Horticulture
3.	**READY-429**	Food Processing	0+10	Horticulture
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

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; Nursery raising and its importance; Plant propagation-methods; Propagating structures; Seed dormancy and Seed germination; Principles of orchard establishment; Principles and Methods of training and pruning; Juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; Medicinal and Aromatic plants- importance and scope; 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. Layout and components of a model nursery. Visits to commercial nurseries/orchard.

Lecture Schedule:Theory

S.N.	Topics	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.	Medicinal and Aromatic plants- importance and scope	2
12.	Importance of plant bio-regulators in horticulture	1
13.	Irrigation – methods, Fertilizer application in horticultural crops	1

Lecture Schedule:Practical

S.N.	Topics	No.of lectures
1.	Identification of Horticultural crops	1

2.	Identification of garden tools	1
3.	Preparation of seed bed/nursery bed	1
4.	Practice of sexual and asexual methods of propagation	3
5.	Micro-propagation	1
6.	Layout and planting of orchard	2
7.	Training and pruning of fruit trees	1
8.	Preparation of potting mixture	1
9.	Fertilizer application in different crops	1
10.	Layout and components of a model nursery	2
11.	Visits to commercial nurseries/orchard	2

Reference:

1. Chadha, K.L. Handbook of Horticulture (2002) ICAR, NewDelhi
2. D.K. Salunkhe and S.S. Kadam A handbook of Fruit Science and Technology (2013) CRC Press
3. Jitendra Singh Basic Horticulture (2011) Kalyani Publications, New Delhi
4. K.V.Peter Basics Horticulture (2009) New India Publishing Agency
5. Kausal Kumar Misra and Rajesh Kumar Fundamentals of Horticulture 2014 Biotech Books
6. Kumar, N. Introduction to Horticulture (1990) Rajyalakshmi publications, Nagarcoil, Tamilnadu
7. Neeraj Pratap Singh Basic concepts of Fruit Science (2005) IBDC Publishers
8. Prasad and Kumar Principles of Horticulture 2nd Edn. 2014 Agrobios (India)
9. S. Prasad and U. Kumar A handbook of Fruit Production (2010) Agrobios (India)
10. Singh Jitender Precision farming NIPA
11 Singh, H.P. Advances in Horticulture Biotechnology Vol.-7: Diagnostics for Horticulture crops Westville
12 Singh, H.P. Advances in horticulture Biotechnology, Vol-1: Fruit Crops Westville
13 Kapoor, B. Ethnobotany: A recent approach, Madhu
14 Basra, A.S. Plant Growth Regulators in Agriculture & Horticulture: Their Role and commercial use IBD
15 Swain, S. Precision Farming in Horticulture: Approaches and Strategies NPH
16 Sharma, N. Biometrical methods in Horticultural Sciences NIPA

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

Theory

Importance of vegetables & spices in human nutrition and national economy, Classification of Vegetables; Types of vegetable gardening with special reference to 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 (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas and Okra; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato and Sweet potato; Leafy vegetables such as Amaranth and Palak; Perennial vegetables such as drumstick and pointed gourd; Seed spices: Coriander, cumin, fenugreek & fennel; Black pepper and Cardamom; Turmeric & Ginger.

Practical:

Identification of vegetables & spice crops and their seeds; Nursery raising. Direct seed sowing and transplanting; Study of morphological characters of different vegetables & spices, Solanaceous crops (Tomato, Brinjal, Capsicum) Cucurbitaceous crops, Bulb crops, Beans, Pea and Okra, Root crops, Tuber crop (Potato and Sweet Potato), Leafy vegetables, Seed spices, Black pepper and Cardamom, Ginger and Turmeric; Fertilizers applications; Harvesting & preparation for market; Economics of vegetables and spices cultivation.

Lecture Schedule: Theory

S.N.	Topics	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 important vegetable and spices:Tomato,	1
5.	Brinjal, Chilli, Capsicum,	1
6.	Cucumber, Melons, Gourds, Pumpkin,	1
7.	French bean, Peas and Okra	1
8.	Cole crops such as Cabbage, Knol-khol, Cauliflower	1
9.	Bulb crops such as Onion and Garlic	1
10.	Root crops such as Carrot, Radish, Beet-root	1

11.	Tuber crops such as Potato and Sweet potato	1
12.	Leafy vegetables such as Amaranthus and Palak	1
13.	Perennial vegetables such as drumstick and pointed gourd	1
14.	Seed spices: Coriander, cumin, fenugreek & fennel	1
15.	Black pepper and Cardamom	1
16.	Turmeric & Ginger	1

Lecture Schedule: Practical

S.N.	Topics	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	1
11.	Black pepper and Cardamom	1
12.	Ginger and Turmeric	1
13.	Fertilizers applications	1
14.	Harvesting & preparation for market	1
15.	Economics of vegetables and spices cultivation	2

References:

1 B.R.Choudhary A Text book on production technology of vegetables (2009) Kalyani Publishers
2 K S Yawalkar Vegetable crops in India (2008) Agri-Horticultural Pub. House. Nagpur
3 K.V.Kamath Vegetable Crop Production (2007) Oxford Book Company
4 M.K.Rana Olericulture in India (2008) Kalyani Publishers
5 M.S.Dhaliwal Handbook of Vegetable Crops (2008) Kalyani Publishers
6 Nath Prem Vegetables for the Tropical Regions (1994) ICAR New Delhi
7 P.Hazra Modern Technology in Vegetable Production (2011) New India Publishing Agency, New Delhi
8 Pruthi, J.S Major Spices of India- Crop Management Postharvest Technology (1993) ICAR

9 Pruthi, J.S Minor Spices of India- Crop Management Postharvest Technology (2001) ICAR
10 S. Thamburaj Text book of vegetable, tuber crops and Spices (2014) ICAR
11 Shanmugavelu, K.G. Kumar, N and Peter, K.V Production technology of spices and plantation crops (2005) Agrosis, Jodhpur
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13 Singh, Umashankar Indian Vegetables (2008) Anmol Publications. Pvt.Ltd .New Delhi
14 T.K.Bose Vegetable Crops (2002) Nayaprakash, Kolkata
15 T.R.Gopal Krishnan Vegetable Crops (2007) New India Publishing Agency. New Delhi
16 D.N. Singh etal. Winter Vegetables: Advances & Developments Satish Serial Pub. House
17 Ramchandra R.K. Breeding of Vegetable crops Jaya Publishing House
18 Sharma & Katoch Practicals on Vegetable Production Technology Jaya Publishing House
19 Mishra, R. Diseases of Vegetable crops and their integrated management: A colour handbook NIPA
20 Boswell, V.R. Seeds Production: Vegetables & Root Crops ISPG

HORT-221 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- Date palm, Ber, Aonla, Custard apple, Bael and Strawberry, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Layout and planting of fruits and plantation crops. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Fertilizer application in fruits and plantation crops Irrigation methods in fruits and plantation crops, Training and pruning of fruits and plantation crops, Weed management of fruits and plantation crops, Visit to commercial orchards.

Lecture schedule: Theory

S.N.	Topics	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.	Minor fruits- Date palm, Ber, Aonla, Custard apple, Bael and Strawberry	2
12.	Pineapple and Pomegranate	1
13.	Plantation crops-Coconut and Cashew nut	1
14.	Areca nut & Rubber	1
15.	Tea and Coffee	1

Lecture schedule: Practical

S.N.	Topics	No.of lectures
1	Description and identification of fruit	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
	Important physiological disorders of fruits and plantation crops	2
7	Fertilizer application in fruits and plantation crops	1
8	Irrigation methods in fruits and plantation crops	1
9	Training and pruning of fruits and plantation crops	1
10	Weed management of fruits and plantation crops	1
11	Visit to commercial orchards	1

References:

1 Bal, J.S. Fruit Growing (2010) Kalyani Publishers

2 Banday F.A. and Sharma M.K. Advances in Temperate Fruit Production (2010) Kalyani Publishers

3 Bose, T.K., Mitra, S.K. and Sanyal, D. Tropical and Sub-Tropical-Vol-I (2002) Nayaprakash, Kolkata

4 Chadha, T.R Text Book of Temperate Fruits (2001) ICAR Publication

5 Chattopadhyay T.K. A text book on Pomology-IV Devoted to Temperate fruits (2009) Kalyani Publishers

6 Das B.C and Das S.N . Cultivation of Minor Fruits Kalyani Publishers

7 K.L.Chadda Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi

8 Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I. Introduction to spices, Plantation crops and Aromatic plants (1997) Oxford & IBH, New Delhi

9 Radha T and Mathew L. Fruit crops (2007) New India Publishing Agency

10 S.P. Singh Commercial fruits (2004) Kalyani Publishers

11 W S Dhillon Fruit Production in India (2013) Narendra Publishing House

12 S.N. Ghosh Tropical & Sub-tropical Fruit Crops: Crop Improvement and varietal Wealth- 2 parts Jaya Publishing House

13 Ghosh, Verma Thakur Temperate Fruit Breeding Jaya Publishing House

14 S.N. Ghosh Breeding of underutilized Fruit crops Jaya Publishing House

15 Ramchandra etal Breeding of Fruit Crops Jaya Publishing House

16 Dinesh, M.R. Fruit Breeding NIPA

17 Bikash Ghosh, Sayan Sau, Upto Date Fruit Science Jaya Publishing House

18 Dhillon/Bhatt Jaya Fruit tree Physiology Publishing House

19 Rathore, G.S. Disease management of Fruit crops ATPA

HORT-222 Production Technology for Ornamental Crops, MAPs 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, and carnation, 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, safed musli, aloe, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical (Production Technology for Ornamental Crops, MAPs and Landscaping)**:**

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Propagation of Ornamental and MAPs, 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.N.	Topics	No.of lectures
1.	Importance and scope of ornamental crops, medicinal and aromatic plants	1
2.	Importance and scope landscaping 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.	Gerbera and carnation under protected conditions	2
6.	Gladiolus, tuberose, chrysanthemum under open conditions	2
7.	Package of practices for loose flowers like marigold and jasmine under open conditions	1
8.	Production technology of important medicinal plants like ashwagandha, asparagus, safed musli	1
9.	Aloe, Cinnamon, periwinkle, isabgol	1
10.	Aromatic plants like mint, lemongrass	1
11.	Citronella, palmarosa	1
12.	Ocimum, rose	1
13.	Geranium, vetiver	1
14.	Processing and value addition in ornamental crops and MAPs produce	1

Lecture schedule: Practical

S.N.	Topics	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. Bed preparation and planting of MAP	2
7.	Protected structures – care and maintenance	1
8.	Intercultural operations in flowers and MAP	1
9.	Harvesting and post harvest handling of cut and loose flowers. Processing of MAP	3
10.	Visit to commercial flower and MAP unit	2

References:

1 A.K. Tiwari and R. Kumar Fundamentals of ornamental horticulture and landscape gardening (2012) New India

2 Arora, J.S. Introductory Ornamental Horticulture (2006) Kalyani Publishers

3 Atal, E. K. and Kapur, B. Cultivation and Utilization of Medicinal and Aromatic plants (1982) CSIR, New Delhi

4 Azhar Ali Farooqui and Sreeramu, B.S. Cultivation of medicinal and aromatic plants (2001) United Press Limited

5 Bimaldas Chowdhury and Balai Lal Jana Flowering Garden trees (2014) Pointer publishers, Jaipur

6 Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash

7 Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers

8 Chadha, K.L. and Chaudhary, B. Ornamental Horticulture in India (1986) ICAR

9 H.S.Grewal and Parminder Singh Landscape designing and ornamental plants (2014)

10 K.V.Peter. Ornamental plants (2009) New India publishing agency

11 R.K. Roy Fundamentals of Garden designing (2013) New India publishing agency

12 Rajesh Srivastava Fundamentals of Garden designing (2014) Agrotech press, Jaipur

13 Randhawa, G.S. Amitabha Mukhopadhyay Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi

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15 Gupta, R.D. Agrotechniques and Uses of Medicinal Plants Astral

16 Vermeulin, N. Complete Encyclopedia of House Plants: A comprehensive cross reference guide to popular house plant Rebo

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

Theory

Introduction & importance of Hi-tech Horticulture; 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.N.	Topics	No.of lectures
1.	Introduction & importance of Hi-tech Horticulture	2
2.	Nursery management and mechanization	2
3.	Micro propagation of horticultural crops	2
4.	Modern field preparation and planting methods	2
5.	Protected cultivation: advantages, controlled conditions, method and techniques	2
6.	Micro irrigation systems and its components	2
7.	EC, pH based fertilizer scheduling	2
8.	Canopy management	3
9.	High density orcharding	2
10.	Components of precision farming: 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)	3
15.	Mechanized harvesting of produce	2

Lecture schedule: Practical

S.N.	Topics	No.of lectures
1.	Types of polyhouses and shade net houses	2
2.	Intercultural operations	2
3.	Tools and equipments identification and application	1
4.	Micro propagation	2
5.	Nursery-protrays	1
6.	Micro-irrigation	1
7.	EC, pH based fertilizer scheduling	2
8.	Canopy management	4
9.	Visit to hi-tech orchard/nursery	1

References:

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1. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, New Delhi.
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7. Tiwari GN. 2003. *Green House Technology for Controlled Environment*. Narosa Publ. House.

HORT-311 Landscaping 3(2+1)

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, 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 and shade loving plants. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping (roof garden), 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, shrubs and trees, 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 lath house. Use of computer software, visit to important gardens/ parks/ institutes.

Lecture schedule: Theory

S.N.	Topics	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

Lecture schedule: Practical

S.N.	Topics	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

References:

1. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya
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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; Maturity indices, 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

Identification and Applications of different types of packaging, containers for shelf life extension. Identification of important tools/equipments/ machines and chemicals required for PHT laboratory, Demonstration of Zero energy cool chamber, Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits (drying and dehydration). Extraction and preservation of pulps and juices. Preparation of jam, jelly, Pickles, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products (sauce and ketchup), canned products. Quality evaluation of products - physico-chemical (Moisture, TSS, acidity and ascorbic acid) and sensory. Visit to processing unit/ industry.

Lecture schedule: Theory

S.N.	Topics	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 and changes occurring during ripening	1
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

Lecture schedule: Practical

S.N.	Topics	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

References:

1 Battacharjee, S. K. and De, L. C Post Harvest Technology of Flowers and Ornamentals Plants (2005) Pointer Publisher

2 Jacob John, P A Handbook on Post Harvest management of Fruits and vegetables (2008) Daya Publishing House, Delhi

3 Manoranjan, K and Sangita, S. Food Preservation & Processing (1996) Kalyani Publishers

4 Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International

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6 Saraswathy, S. et. al. Post harvest Management of Horticultural Crops (2008) Agribios

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8 Verma, L. R. and Joshi, V. K. Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000) Indus Publishing Co., New Delhi
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10 Mayani, Desai, Vagadia Post Harvest management of Horticultural crops Jaya Publishing House
11 Ed. M.K. Jatav, etal. Good management Practices for Horticultural Crops NIPA
12 Sharma, Satish Post Harvest management & Processing of fruits & vegetables- Instant notes NIPA
13 Sharma, Satish Post Harvest of Horticultural Crops- Practical manual Series Vol.2 NIPA
14 Rosa L.A. Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen
15 Ryall, A. Handling, transportation and Storage of Fruits & Vegetables Vol.1 2nd Ed (Vegetables & Melons) Sci Int
16 Ryall, A. Handling, transportation and Storage of Fruits & Vegetables Vol.2, 2nd Ed (Fruits & tree nuts) Sci Int
17 Saini, R. Laboratory Manual of Analytical Techniques in Horticulture Agro Bot
18 Chavan, U. Nutritional Value and Health benefits from fruits, vegetable, nuts & spices Daya
19 Lal, S. Olive: Improvement, Production and Processing Astral
20 Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya
21 Sasikaumar, R. Post Harvest Technology of fruits and Vegetables Biotech

DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY

Syllabus and Lecture Schedule

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY

B.Sc. (Hons) Ag **Semester wise distribution of courses**

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester- NIL		
Part-II	**III Semester- NIL**		
	IV Semester- NIL		
Part-III	**V Semester- NIL**		
	VI Semester		
	FSN-321	Principles of Food Science & Nutrition	2(2+0)

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)
VIII semester- NIL				

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.N.	Topic	No.of Lectures
1.	Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.);	5
2.	Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions)	5
3.	Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods)	5
4.	Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.)	4
5.	Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins)	5
6.	Balanced/ modified diets, Menu planning,	4
7.	New trends in food science and nutrition	4

References:

1 Srilakshmi, B. (2010). Text Book of Food Science. New age international (P) limited, publisher, New Delhi

2 Sehgal, S. and Raghuvanshi, R.S. (2007). Text Book of Community Nutrition, ICAR Publication

3 Khaddar V., (1999). Text Book of Food. Storage and Preservation. Kalyani Publishers, New Delhi.

4 Srilakshmi, B. (2010). Text Book of Nutrition Science. New age international (P) limited, publisher, New Delhi

5 Swaminathan. M. (1993). Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore, p. 576.

DEPARTMENT OF AGRICULTURAL EXTENSION & COMMUNICATION

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF AGRICULTURAL EXTENSION & COMMUNICATION

B.Sc. (Hons) Ag **Semester wise distribution of courses**

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	AGEXT-111	Rural Sociology & Educational Psychology	2(2+0)
	II Semester		
	AGEXT-121	Fundamentals of Agricultural Extension Education	3(2+1)
	AGEXT-122	Communication Skills and Personality Development	2(1+1)
Part-II	**III Semester-NIL**		
	IV Semester- NIL		
Part-III	**V Semester**		
	AGEXT-311	Entrepreneurship Development and Business Communication	2(1+1)
	VI Semester		
	AGEXT- 321	Agricultural Journalism	3(2+1)*

***Elective courses**

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)
VIII semester - NIL				

AGEXT 111 Rural Sociology & Educational Psychology 2(2+0)

Theory

Part – I

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology: Definition, objectives, history, challenges and social ecology in Indian context, Rural society: Important characteristics, differences & Relationship between Rural and Urban societies. Social Groups: Meaning, Definition, Classification, Factors considered in formation and organization of groups. Social Stratification – Meaning, Definition, Functions, Forms of Social stratification. Culture concept: Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension. Social Institution: Meaning, Definition, Major institutions in Rural society and Functions, Social Change & Development: Meaning, Definition, Nature of Social change and factors of social change. Social process- Meaning, Definition and types. Social Control- Meaning, Definition, Need and Means of Social control. Rural Leadership: concept, definition, types and roles of leaders in rural context; Methods of selection of leaders.

Part-II

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Cognitive skills, Personality- Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension., Motivation; Meaning , Definition, Importance in extension, Theories of Motivation, Intelligence- Meaning, Definition, Types, Factors affecting intelligence. Teaching Learning Process process- Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.

Lecture Schedule:Theory

S.N.	Topic	No.of Lectures
1.	Sociology and Rural sociology: Definition and scope, its significance in agriculture extension	2
2.	Social Ecology: Definition, objectives, history, challenges 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	1
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	1
8.	Major institutions in Rural society and Functions	1
9.	Social Change & Development: Meaning, Definition, Nature of Social change and factors of social change	2
10.	Social process- Meaning, Definition and types	1

11.	Social Control- Meaning, Definition, Need and Means of Social control	1
12.	Rural Leadership: concept, definition, types and roles of leaders in rural context; Methods of selection of leaders	2
13.	Educational psychology: Meaning & its importance in agriculture extension	1
14.	Behavior: Cognitive, affective, psychomotor domain, Cognitive skills	1
15.	Personality- Meaning, Definition, Types	1
16.	Factors influencing the Personality and Role of Personality in Agricultural Extension	1
17.	Motivation; Meaning , Definition, Importance in extension	1
18.	Theories of Motivation	1
19.	Intelligence-Meaning, Definition, Types, Factors affecting intelligence	2
20.	Teaching Learning Process process- Meaning and Definition of Teaching	2
21.	Learning, Learning experience and Learning situation	1
22.	Elements of learning situation and its characteristics	1

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1. Chitambar, J.B. 1973. Introductory rural sociology. New York, John Wilex and Sons.
2. Desai, A.R. 1978. Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Doshi, S.L. 2007. Rural sociology. Rawat Publishers, Delhi.
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11. Mondal, S. 2014. Text Book of Rural Sociology and Educational Psychology. Kalyani Publishers, New Delhi.
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AGEXT 121 Fundamentals of Agricultural Extension Education 3(2+1)

Theory

Part – I

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development

Part-II

Extension systems in India: Extension efforts in Pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.). 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, ATMA, NAIP, NARP, ATIC,RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM etc.)

Part- III

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. T & V System, SGSY, ICDS, IRDP, NHM,MNREGA, Rajiv Ganghi Scheme for empowerment of Adolesenct girls / Boys, Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana,

Part- IV

Community Development- Meaning, definition, concept & principles, Philosophy of C.D, Panchayati Raj System. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; Transfer of technology: concept and models, capacity building of extension personnel.

Practical

To get acquainted with university extension system. A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning.

Lecture Schedule:Theory

S.N.	Topic	No.of Lectures
1.	Education: Meaning, definition & Types	1
2.	Extension Education- meaning, definition, scope and process	1
3.	Objectives and principles of Extension Education	2
4.	Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development	2
5.	Extension systems in India: Extension efforts in Pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon	2

	Experiment, etc.)	
6.	Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.)	2
7.	Various extension/ agriculture development programmes launched by ICAR/ Govt. of India - IADP, IAAP,.	1
8.	HYVP, KVK, IVLP, ORP, ND,	1
9.	NATP, ATMA, NAIP,	1
10.	NARP, ATIC,RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM etc	2
11.	New trends in agriculture extension, privatization extension,	1
12.	cyber extension/ e-extension market-led extension, farmer-led extension, expert systems, etc	2
13.	Rural Development: Concept, meaning, definition	1
14.	Various rural development programmes launched by Govt. of India	1
15.	T & V System, SGSY	1
16.	ICDS, IRDP	1
17.	NHM,MNREGA, Rajiv Ganghi Scheme for empowerment of Adolesenct girls / Boys	1
18.	Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana	2
19.	Community Development- Meaning, definition, concept & principles	1
20.	Philosophy of C.D, Panchayati Raj System	1
21.	Extension administration: meaning and concept, principles and functions	1
22.	Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes	2
23.	Transfer of technology: concept and models, capacity building of extension personnel	2

Lecture Schedule:Practical

S.N.	Topic	No.of Lectures
1.	To get acquainted with university extension system	3
2.	A visit to village to understand the problems being encountered by the villagers/ farmers	3
3.	To study organization and functioning of development departments at district level	3
4.	Visit to NGO and learning from their experience in rural development	3
5.	Understanding PRA techniques and their application in village development planning	4

References:

1. Adivi Reddy, A., 2001, *Extension Education*, Sree Lakshmi press, Bapatla.
2. Dahama, O. P. and Bhatnagar, O. P., 1998, *Education and Communication for Development*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
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8. Van Den Ban, A. W. and Hawkins, H. S., *Agricultural Extension*, S. K .Jain for CBS Publishers & Distributors, New Delhi.
9. Debabrata Das Gupta. Extension Education. Agrobios (India), Agro house behind Nasrani Cinema, Chaupasani Road, Jodhpur- 342402, Phone -0291-2642319, Fax- 0291-2643993, Email- agrobios@sify.com
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AGEXT 122 Communication skills and Personality Development 2(1+1)

Theory

Part – I

Communication: Meaning, definition and process of communication; verbal and nonverbal communication; principles and functions of communication, models and barriers to communication. Communication skills: listening, 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. Soft Skills.

Part- II

Extension teaching methods: meaning, classification-individual, group and mass contact methods. ICT Applications in TOT (New and Social Media), media mix strategies; Diffusion and adoption of innovation: Meaning, concept, process, stages of adoption and 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. Handling and use of audio visual equipments- digital camera and LCD projector; Group discussion- exercise; presentation skills exercise; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Script writing, writing for print and electronic media, developing script for radio and television. Visit to community radio/radio station. Exposure to mass media

Lecture Schedule:Theory

S.N.	Topic	No.of Lectures
1.	Communication: Meaning, definition and process of communication	1
2.	Verbal and nonverbal communication; principles and functions of communication, models and barriers to communication	2
3.	Communication skills: listening, note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures	2
4.	Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting	2
5.	Individual and group presentations, impromptu presentation, public speaking	1
6.	Group discussion. Organizing seminars and conferences. Soft Skills	2
7.	Extension teaching methods: meaning, classification-individual, group and mass contact methods	2
8.	ICT Applications in TOT (New and Social Media), media mix strategies	1
9.	Diffusion and adoption of innovation: Meaning, concept, process	2
10.	Stages of adoption and adopter categories	1

Lecture Schedule:Practical

S.N.	Topic	No.of Lectures
1.	Listening and note taking, writing skills, oral presentation skills	2
2.	Field diary and lab record; indexing, footnote and bibliographic procedures	2
3.	Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting	1
4.	Individual and group presentations.	1
5.	Handling and use of audio visual equipments- digital camera and LCD projector	2
6.	Group discussion- exercise; presentation skills exercise	1
7.	Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories	2
8.	Script writing, writing for print and electronic media, developing script for radio and television	2
9.	Visit to community radio/radio station/newspaper office	2
10.	Exposure to mass media	1

References:

1. Sandhu, A. S. (1999). Textbook on Agricultural Communication; process and methods oxford RIBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. (1960). The process of Communication. Nw Yark, Holt, Rinehart and Winston Inc.
3. Dahama, O. P. and Bhatnagar, O.P., 1998, *Education and Communication for Development*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
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AGEXT 311 Entrepreneurship Development and Business Communication 2(1+1)

Theory

Part – I

Concept of Entrepreneur, Entrepreneurship Development: Concept and Meaning. Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agri-enterprises, Entrepreneurial Development Process; Business Leadership Skills;

Part – II

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, Practice on SWOT analysis, Practicing 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 interaction with entrepreneurs.

Lecture Schedule:Theory

S.N.	Topic	No.of Lectures
1.	Concept of Entrepreneur, Entrepreneurship Development	1
2.	Concept and Meaning	1
3.	Characteristics of entrepreneurs	1
4.	SWOT Analysis & achievement motivation	1
5.	Government policy and programs and institutions for entrepreneurship development	2
6.	Impact of economic reforms on Agribusiness/ Agri-enterprises	1
7.	Entrepreneurial Development Process; Business Leadership Skills	1
8.	Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)	2
9.	Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills)	2
10.	Problem solving skill, Supply chain management and Total quality management	2
11.	Project Planning Formulation and report preparation	1
12.	Financing of enterprise, Opportunities for agri-entrepreneurship and	1

Lecture Schedule:Practical

S.N.	Topic	No.of Lectures
1.	Assessing entrepreneurial traits	2
2.	Practice on SWOT analysis	2

3.	Practicing problem solving skills, managerial skills and achievement motivation	3
4.	Exercise in creativity, time audit through planning, monitoring and supervision	2
5.	Identification and selection of business idea	2
6.	Preparation of business plan and proposal writing	2
7.	Visit to entrepreneurship development institute and interaction with entrepreneurs	3

References:

1. Harold Koontz & Heinz Weihrich. 2004. *Essentials of Management: An International Perspective,* 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Chole, R. R. Kapse, P. S. and Deshmukh, P. R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
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AGEXT 321 Agricultural Journalism 3(2+1)*

Theory

Part – I

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.

Part – II

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, lay-outing. Testing copy with a readability formula. Visit to a publishing office.

Lecture Schedule:Theory

S.N.	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	2
3.	Newspapers and magazines as communication media	1
4.	Characteristics; kinds and functions of newspapers and magazines	2
5.	Characteristics of newspaper and magazine readers	2
6.	Form and content of newspapers and magazines	1
7.	Style and language of newspapers and magazines	1
8.	Parts of newspapers and magazines	2
9.	The agricultural story: Types of agricultural stories	2
10.	Subject matter of the agricultural story, structure of the agricultural story	2
11.	Gathering agricultural information: Sources of agricultural information	2
12.	Interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources	2

13.	Writing the story: organizing the material, treatment of the story	2
14.	Writing the news lead and the body, readability measures	2
15.	Illustrating agricultural stories	2
16.	Use of photographs, use of artwork (graphs, charts, maps, etc.)	2
17.	Writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing	2

Lecture Schedule:Practical

S.N.	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 artwork for the agricultural story	2
5.	Selecting pictures and artwork for the agricultural story	2
6.	Practice in editing, copy reading, headline and title writing, proofreading, lay-outing	3
7.	Testing copy with a readability formula. Visit to a publishing office	2

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VII Semester

Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE & AIA)

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S.No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

DEPARTMENT OF BIOCHEMISTRY, PHYSIOLOGY, MICROBIOLOGY & ENVIRONMENTAL SCIENCE

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF BIOCHEMISTRY, PHYSIOLOGY, MICROBIOLOGY & ENVIRONMENTAL SCIENCE

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester		
	PPHYS-121	Fundamentals of Crop Physiology	2(1+1)
	MICROB-121	Agricultural Microbiology	2(1+1)
Part-II	**III Semester**		
	ESDM-211	Environmental Studies & Disaster Management	3(2+1)
	IV Semester- NIL		
Part-III	**V Semester**		
	BIOCH-311	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
	VI Semester- NIL		

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-421**	Production Technology for Bioagents and Biofertilizer	0+10	Plant Pathology + Microbiology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

PPHYS-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, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

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 CO2 assimilation by Infra Red Gas Analyser (IRGA).

Lecture Schedule:Theory

S. N.	Topic	No. of lectures
1	Introduction: Definition of crop physiology and its importance in Agriculture and Horticultural crops	1
2	Plant cell: an overview discussion and structure and functions of cell organalles	1
3	Diffusion and Osmosis: Definition, differences and its importance in plant physiology	1
4	Plant water relationship: concept, Importance of water, water absorption mechanism,	2
5	Transpiration: definition and significance of transpiration in relation to crop productivity; Stomatal physiology: structure, frequency, distribution and stomatal opening and closing mechanism	2
6	Mineral Nutrition: Criteria of essentiality, beneficial nutrients, Functions and deficiency symptoms of nutrients, mineral salt absorption mechanism	2
7	Photosynthesis: Light and dark reaction, C3, C4 and CAM plants and photorespiration	2
8	Respiration: Glycolysis, TCA cycle and ETS	1
9	Fat Metabolism: fatty acid synthesis and its breakdown	1
10	Plant growth regulators: Definition, classification and role of PGR’s in agricultural crops	1
11	Physiological aspects of growth and development of major crops	1
12	Growth analysis: definitions and mathematical formulae, role of growth parameters in crop productivity	1

Lecture Schedule:Practical

S. N.	Topic	No. of lectures
1	Plant cell: An overview study, Structure and functions of major plant cell organelles	2
2	Structure and distribution of stomata	2
3	Demonstration of imbibitions, osmosis and plasmolysis	2
4	Measurement of root pressure	1
5	Measurement of transpiration by different methods	1
6	Separation of photosynthetic pigments through paper chromatography	2
7	Measurement of respiration by using Ganong's respirometer.	1
8	Tissue tests for mineral nutrients	2
9	Estimation of relative water content (RWC)	1
10	Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA)	2

References:

1. N. K. Gupta & Sunita Gupta, 2004. Plant Physiology. Oxford and IBH publication, New Delhi.
2. S. N. Pandey and B. K. Sinha (1995). Vikas Publishing House Pvt. Ltd., new Delhi
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MICROB-121 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: bio-fertilizers, bio-pesticides, bio-fuel production and biodegradation of agro-wastes.

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. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium, Azotobacter* and BGA. Staining and microscopic examination of microbes. Enumeration of microbial population in soil- bacteria, fungi and actinomycetes.

Lecture Schedule: Theory

S.N.	Topic	No. of lectures
1.	Introduction to microbial world: Prokaryotic and eukaryotic microbes.	1
2.	Sterilization, disinfection, pasteurization and Koch's postulates.	1
3.	Bacteria: cell structure, growth	2
4.	Gram positive and Gram negative bacteria, chemoautotrophy and photoautotrophy.	2
5.	Bacterial genetics: Genetic recombination: transformation, conjugation and transduction, plasmids, transposon.	2
6.	Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles	2
7.	Biological nitrogen fixation: symbiotic, associative and asymbiotic.	2
8.	Azolla, blue green algae and mycorrhiza	1
9.	Rhizosphere and phyllosphere	1
10.	Microbes in human welfare: bio-fertilizers, bio-pesticides	1
11.	bio-fuel production and biodegradation of agro-wastes.	1

Lecture Schedule: Practical

S.No.	Topic	No. of lectures
1.	Introduction to microbiology laboratory and its equipments.	2
2.	Microscope: parts, principles of microscopy, resolving power and numerical aperture.	2
3.	Methods of sterilization.	2
4.	Nutritional media and their preparations.	2
5.	Methods of isolation and purification of microbial cultures.	2

6.	Isolation of *Rhizobium, Azotobacter* and BGA.	2
7.	Staining and microscopic examination of microbes.	2
8.	Enumeration of microbial population in soil- bacteria, fungi and actinomycetes	2

References:

1. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.
3. Pelczar, Jr. Michel J. Chan, E.C.S. and Krieg, Noel R. 1997. Microbiology. Tata McGraw -Hill Edition, 1993. India.
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5. Mehrotra, R.S. and Aggarawal, A. 2012. I2th ed. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi
6. Rao, N.S. 2000. Soil Microbiology, Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi.
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8. Prescott , 2014. Microbiology. McGraw Hill & Co.
9. R.P. Singh , 2013. Plant Pathology. Kalyani Publishers
10. डा. बी. पी. सिंह पादप रोग विज्ञान (2004), 11th ed. रामा पब्लिशिंग हाउस, मेरठ।

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

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.

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

Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

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

Human Population and the Environment: population growth, variation among nations, population explosion, 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.

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- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; 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.

Lecture Schedule: Theory

S. N.	Topic	No. of lectures
1.	Multidisciplinary nature of environmental studies Definition, scope and importance.	1
2.	Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems.	1
3.	a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.	1
4.	b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.	1
5.	c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.	1
6.	d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.	1
7.	e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies.	1
8.	f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.	1
9.	Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	1
10.	Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem	1
11.	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	2

	ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	
12.	Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India.	1
13	Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.	1
14.	Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity.	1
15.	Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	1
16.	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.	1
17.	Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	1
18.	Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.	1
19.	Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies.	1
20.	Wasteland reclamation. Consumerism and waste products.	1
21.	Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.	1
22.	Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme.	1
23.	Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.	1
24.	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.	3
25.	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.	2
26.	Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.	3

Lecture Schedule: Practical

S. N.	Topic	No. of lectures
1.	Pollution case studies. Case Studies- Field work	1
2.	Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain,	5
3.	Visit to a local polluted site-Urban/Rural	2
	Visit to a local polluted site- Industrial/ Agricultural	2
4.	Study of common plants	1
5.	Study of common insects	1
6.	Study of common birds	1
7.	Study of simple ecosystems- pond	1
8.	Study of simple ecosystems- river	1
9.	Study of simple ecosystems- hill slopes,	1

References:

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2. Environmental Science: A New Approach- Pushpa Dahiya, Manisha Ahlawat, 2013, Alpha Science
3. Fundamentals of environmental Sciences, Bamanayha B. R. Verma L. N. and Verma A., 2005, Yash publishing house, Bikaner
4. Disaster Management and Risk Reduction: *Role of Environmenta Knowledge*, Editor(s): Anil K. Gupta, Sreeja S. Nair, Florian Bemmerlein-Lux, Sandhya Chatterji, 2013, Alpha Science
5. Environmental Biology, Agarwal K C, 1999, Agro Botanica, Bikaner

BIOCH-311 Fundamentals of Plant Biochemistry and Biotechnology 3 (2+1)

Theory

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

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

Lecture Schedule:Theory

S. N.	Topic	No. of lectures
1.	Importance of Biochemistry.	1
2.	Properties of Water, pH and Buffer.	2
3.	Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides.	3
4.	Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids.	2
5.	Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.	2

6.	Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.	2
7.	Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.	2
8.	Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain.	3
9.	Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.	2
10.	Concepts and applications of plant biotechnology:	1
11.	Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications;	2
12.	Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids;	2
13.	Somaclonal variation and its use in crop improvement; cryo-preservation;	1
14.	Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods;	2
15.	Transgenics and its importance in crop improvement;	1
16.	PCR techniques and its applications;	1
17.	RFLP, RAPD, SSR;	1
18.	Marker Assisted Breeding in crop improvement;	1
19.	Biotechnology regulations	1

Lecture Schedule:Practical

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

References:

1. Plant Biochemistry- V. Arun Kumar, N. Senthil Kumar and K. Siva Kumar, 2010, APH Publishing Corporation, New Delhi.

2. Biotechnolgy-Expanding Horizons, B.D. Singh, 2014, Kalyani Publishers, Ludhiana

3. Principles and Techniqes of Biochemistry and Molecular Biology, Eds. Keith Wilson and John Walker, 7th Edition, 2010, Cambridge University Press

4. A Textbook of Biotechnology, Revised Edtion, 2014, R.C. Dubey, S. Chand Publishing Company, New Delhi

5. Lehninger Principles of Biochemistry by Albert Lehninger, David Nelson and Michael Cox, Seventh Edition, 2017 Macmillan Publishers.

DEPARTMENT OF STATISTICS, COMPUTER APPLICATION AND IPR

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

उत्तमा वृत्तिस्तु कृषिकर्मेव

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF STATISTICS, COMPUTER APPLICATION & IPR

B.Sc. (Hons) Ag **Semester wise distribution of courses**

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	ENG-111	Comprehension & Communication Skills in English	2(1+1)
	AGINFO-111	Agri-Informatics	2 (1+1)
	II Semester- NIL		
Part-II	**III Semester**		
	STAT-211	Statistical Methods	2(1+1)
	IV Semester- NIL		
Part-III	**V Semester**		
	IPR-311	Intellectual Property Rights	1(1+0)
	VI Semester- NIL		

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)
VIII semester-NIL				

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 &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. N.	Topic	No. of lectures
1.	War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond	2
2.	B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw	1
3.	Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words	1
4.	Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar	2
5.	Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration	1
6.	Written Skills: Paragraph writing	1
7.	Precise writing, Report writing and Proposal writing The Style:	1
8.	Importance of professional writing	1
9.	Preparation of Curriculum Vitae and Job applications	2
10.	Synopsis Writing	2
11.	Interviews: kinds, Importance and process.	2

Lecture Schedule: Practical

S. N.	Topic	No. of lectures
1.	Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature)	3
2.	Oral Communication: Phonetics, stress and intonation, Conversation practice	2
3.	Conversation: rate of speech, clarity of voice, speaking and Listening	1
4.	Politeness &Reading skills	2
5.	Reading dialogues, rapid reading	2
6.	Intensive reading, improving reading skills	1
7.	Mock Interviews: testing initiative	1
8.	team spirit, leadership, intellectual ability	2
9.	Group Discussions	2

AGINFO-111 Agri-Informatics 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice 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) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

Lecture Schedule: Theory

S. N.	Topic	No. of lectures
1.	Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing,	1
2.	Data presentation, interpretation and graph creation	1
3.	Statistical analysis, mathematical expressions, Database, concepts and types,	1
4.	Uses of DBMS in Agriculture	1
5.	World Wide Web (WWW	1
6.	Concepts and components. Introduction to computer programming languages	1
7.	Concepts and standard input/output operations	1
8.	e-Agriculture, concepts and applications	1
9.	Use of ICT in Agriculture. 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.	Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc	1
13.	Geospatial technology for generating valuable agri-information. Decision support systems	1
14.	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

Lecture Schedule: Practical

S. N.	Topic	No. of lectures
1.	Study of Computer Components, accessories, practice of important DOS Commands	2
2.	Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.	2
3.	Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document.	2
4.	MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data	2
5.	MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system	2
6.	Introduction to World Wide Web (WWW). Introduction of programming languages	2
7.	Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost	1
8.	Computation of water and nutrient requirements of crop using CSM and IT tools	1
9.	Introduction of Geospatial Technology for generating valuable information for Agriculture	1
10.	Hands on Decision Support System. Preparation of contingent crop planning	1

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. 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 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. Selection of random sample using Simple Random Sampling.

Lecture Schedule: Theory

S. N.	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 2X2 Contingency Table	1

11.	Introduction to Sampling Methods	2
12.	Sampling versus Complete Enumeration,	2
13.	Use of Random Number Tables for selection of Simple Random Sample.	2

Lecture Schedule: Practical

S. N.	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 ×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

References:

1. Chandel, S.R.S. 1998. Handbook of Agril. Statistics. Achal Prakashan Mandir, Kanpur.
2. Gupta S.P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
3. Agarwal B.L. 1991. Basic Statistics Wiley Eastern, New Delhi.

IPR-311 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. N.	Topic	No. of lectures
1.	Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO	2
2.	Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc	1
3.	Types of Intellectual Property and legislations covering IPR in India:- Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets	1
4.	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	2
5.	Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database	2
6.	Origin and history including a brief introduction to UPOV for protection of plant varieties	1
7.	Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001	1
8.	Breeders, researcher and farmers rights.Traditional knowledge-meaning and rights of TK holders	2
9.	Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA)	2
10.	Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing	2

DEPARTMENT OF LIVE STOCK PRODUCTION AND MANAGEMENT

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

DEPARTMENT OF LIVESTOCK PRODUCTION AND MANAGEMENT

B.Sc. (Hons) Ag **Semester wise distribution of courses**

Year	Course No.	Course Title	Credits
Part-I	**I Semester- NIL**		
	II Semester- NIL		
Part-II	**III Semester**		
	LPM-211	Ruminant Production & Management	2(1+1)
	IV Semester- NIL		
Part-III	**V Semester- NIL**		
	VI Semester		
	LPM-321	Non- Ruminant Production & Management	2(1+1)

VII Semester				
Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)				
S. No	**Course Code**	**Programme**	**Duration (Weeks)**	**credits**
1.	**READY 411**	General orientation & On campus training by different faculties	1	1(NC)
2.	**READY 412**	Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	8	8
		Unit attachment in KVK/Research station	5	5
3.	**READY 413**	Plant Clinic (ENTO+PPATH+HORT+AGRON+SSAC)	2	3
4.	**READY 414**	Agro-Industrial Attachment	3	4
5.		Project Report Preparation and Evaluation	1	1 (NC)

VIII semester.				
Modules for Skill Development and Entrepreneurship				
SN	**Course code**	**Title of the module (ELP)**	**Credits**	**Department**
1.	**READY-426**	Poultry Production Technology	0+10	LPM
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				

LPM-211 Ruminant Production and Management 2 (1+1)

Theory

Role of livestock in the national economy. Reproduction in farm animals. Housing principles, space requirements for different livestock species. Management of calves, growing heifers and milch animals. Management of sheep and goat. Important Indian and exotic breeds of cattle, buffalo, sheep and goat. Improvement of farm animals. Digestion in ruminants. Classification of feed stuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock. Feed supplements and feed additives. Feeding of livestock. Introduction of livestock diseases. Prevention (including vaccination schedule) and control of important diseases of livestock.

Practical

External body parts of cattle, buffalo, sheep and goat. Handling and restraining of livestock. Identification methods of farm animals. Visit to IDF to study breeds of livestock and daily routine farm operations and farm records. Judging of cattle and buffalo. Culling of livestock. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Economics of cattle, buffalo, sheep and goat.

Lecture schedule:Theory:

S. N.	Topic	No. of Lectures
1.	Role of livestock in the national economy.	02
2.	Reproduction in farm animals.	02
3.	Housing principles, space requirements for different livestock species.	01
4.	Management of calves, growing heifers and milch animals.	01
5.	Management of sheep and goat.	02
6.	Important Indian and exotic breeds of cattle, buffalo, sheep and goat	01
7.	Improvement of farm animals.	01
8.	Digestion in ruminants.	01
9.	Classification of feed stuffs. Proximate principles of feed.	01
10.	Nutrients and their functions. Feed ingredients for ration for livestock.	01
11.	Feed supplements and feed additives. Feeding of livestock.	01
12.	Introduction of livestock diseases.	01
13	Prevention (including vaccination schedule) and control of important diseases of livestock.	01

Lecture schedule:Practical:

S. N.	Topic	No. of Lectures
1.	External body parts of cattle and buffalo.	01
2.	External body parts of sheep and goat.	01
3.	Handling and restraining of livestock.	01
4.	Identification methods of farm animals.	01
5.	Visit to IDF to study breeds of livestock and daily routine farm operations and farm records	02
6.	Judging of cattle and buffalo.	01
7.	Culling of livestock	01
8.	Planning and layout of housing for different types of livestock.	01
9.	Computation of rations for livestock.	02
10.	Formulation of concentrate mixtures.	01
11.	Clean milk production, milking methods.	01
12.	Economics of cattle and buffalo.	02
13.	Economics of sheep and goat.	01

References:-

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandary. 8th Ed. Oxford & IBH Pub.CO.Pvt Ltd.N-Delhi.
2. Devendra C and Mecleroy GB, 1982. Goat and Sheep Production in Tropics.
3. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management, Kalyani.
4. Thomas CK and Sastry, NSR. 1991. Dairy Bovine Production. Kalyani.
5. ICAR,Handbook of Animal Husbandry,2011.3 rd revised Ed.

LPM-321 Non Ruminant Production and Management 2 (1+1)

Theory:

Role of poultry and pigs in the national economy. Reproduction in pigs and poultry. Housing principles. space requirements for pigs and poultry. Management of different categories of swine and poultry. Incubation, hatching and brooding. Management of growers and layers.Important Indian and exotic breeds of swine and poultry. Improvement of pigs and poultry.Digestion in pigs and poultry. Feed ingredients for ration for pigs and poultry. Feed supplements and feed additives. Feeding of pigs and poultry.Introduction of poultry and pig diseases. Prevention (including vaccination schedule) and control of important diseases of pigs and poultry.

Practical

External body parts of swine and poultry.Handing and restraining of pigs and poultry. Identification methods of pigs and poultry. Identification methods of pigs and poultry. Judging of pigs,poultry. Culling of poultry. Planning and layout of housing for different types of poultry and pigs. Computation of rations for pigs and poultry. Formulation of concentrate mixtures. Hatchery operations, incubation and hatching equipments. Managements of chicks, growers and layers. Debeaking, dusting and vaccination.

Lecture schedule:Theory:

S. N.	Topic	No. of Lectures
1.	Role of poultry and pigs in the national economy.	01
2.	Reproduction in pigs and poultry.	01
3.	Housing principles. Space requirements for pigs and poultry.	01
4.	Management of different categories of swine and poultry.	01
5.	Incubation, hatching and brooding.	01
6.	Management of growers and layers.	01
7.	Important Indian and exotic breeds of swine and poultry.	02
8.	Improvement of pigs and poultry.	01
9.	Digestion in pigs and poultry.	01
10.	Feed ingredients for ration for pigs and poultry.	01
11.	Feed supplements and feed additives.	01
12.	Feeding of pigs and poultry.	01
13	Introduction of poultry and pig diseases.	01
14.	Prevention (including vaccination schedule) and control of important diseases of pigs and poultry.	02

Lecture schedule:Practical:

S.N.	Topic	No. of lectures
1.	External body parts of swine and poultry.	01
2.	Handing and restraining of pigs and poultry.	01
3.	Identification methods of pigs and poultry.	01
5.	Judging of pigs & poultry.	01
6.	Culling of pigs & poultry.	01
7.	Planning and layout of housing for different types of poultry and pigs.	02
8.	Computation of rations for pigs and poultry.	02
9.	Formulation of concentrate mixtures.	01
10.	Hatchery operations, incubation and hatching equipments.	02
11.	Managements of chicks, growers and layers.	02
12.	Debeaking, dusting and vaccination.	01

References:-

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandary. 8th Ed. ICAR.
2. Dimiri, U, Sharma, M C and Tiwari R. 2013. Swine production and Health Management. New India Pub Agency.
3. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management, Kalyani Pub.
4. Singh, R A. 1996. Poultry Production 3rd Ed. Kalyani.
5. ICAR,Handbook of Animal Husbandry,2011.3 rd revised Ed.
6. Prasad,J.2008. Poultry Production and management. Kalyani Pub.

Remedial and Non- Gradial Courses

Syllabus and Lecture Schedule

for

B.Sc. (Hons) Ag.

Swami Keshwanand Rajasthan Agricultural University,

Bikaner

Remedial and Non- Gradial Courses

B.Sc. (Hons) Ag Semester wise distribution of courses

Year	Course No.	Course Title	Credits
Part-I	**I Semester**		
	BIO-111/ MATH-111	Introductory Biology / Elementary Mathematics	2(1+1)**/ 2(2+0)**
	NSS I/ NCC I/ PHED I	NSS/NCC/Physical Education & Yoga Practices	0*
	HVE-111	Human Values & Ethics	1(1+0)*
	II Semester		
	NSS II/ NCC II/ PHED II	NSS/NCC/Physical Education & Yoga Practices	0*
Part-II	**III Semester**		
	NSS III/ NCC III/ PHED III	NSS/NCC/Physical Education & Yoga Practices	0*
	IV Semester		
	NSS IV/ NCC IV/ PHED IV	NSS/NCC/Physical Education & Yoga Practices	2(0+2)*
Part-III	**V Semester- NIL**		
	VI Semester		
	ET-321	Educational Tour	2(0+2)*

***Non gradial courses ** Remedial courses**

MATH-111 Elementary Mathematics 2(2+0)

Theory

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. 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. N.	Topic	No. of lectures
1.	Functions, Evaluation of Functions, Operations with functions	2
2.	Limits, continuity, $\lim_{x\to a}\frac{x^n - a^n}{x - a}$	2
3.	Limits $\lim_{x\to 0}\frac{\sin x}{x}, \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$	2
4.	Problems on continuity	1
5.	Differentiation of $x^n, e^x, \sin x$ & $\cos x$ from first principle	2
6.	differentiation of sum and product of functions	1
7.	Quotient Rule, function of functions	2
8.	Differentiation of function of functions, Parametric Equation	1
9.	Logarithmic differentiation	1
10.	Differentiation of Inverse Trigonometric functions	1
11.	Successive differentiation, Maxima and minima	2
12.	Integration Formulae	1
13.	Integration by Substitution	2
14.	Integration by Parts	2
15.	Definite Integration	1
16.	Area under curves	2
17.	Matrices, Matrix Addition, equality of matrices, square matrix, identity, null matrix	2

18.	Subtraction, Scalar Multiplication, Matrix Multiplication, Transpose of a Matrix	2
19.	Determinants	1
20.	Inverse up to 3rd order	2

References

1. Krishi Ganita by Gokhroo and Jain
2. Differential Calculus by Gokhroo.
3. Integral Calculus by Gokhroo.

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 & 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. N.	Topic	No. of lectures
1.	Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics.	3
2.	Binomial nomenclature and classification Cell and cell division.	3
3.	Morphology of flowing plants.	2
4.	Seed and seed germination.	3
5.	Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae.	3
6.	Role of animals in agriculture	2

Lecture Schedule: Practical

S. N.	Topic	No. of lectures
1.	Morphology of flowering plants – root, stem and leaf and their modifications	3
2.	Inflorence, flower and fruits.	2
3.	Cell, tissues	3
4.	cell division	2
5.	Internal structure of root, stem and leaf.	2
6.	Study of specimens and slides.	2
7.	Description of plants - Brassicaceae, Fabaceae and Poaceae.	2

HVE- 111 Human Values & Ethics 1(1+0)

Theory

Part – I

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. N.	Topic	No. of lectures
1.	Values and Ethics-An Introduction.	2
2.	Goal and Mission of Life.	2
3.	Vision of Life. Principles and Philosophy.	2
4.	Self Exploration. Self Awareness. Self Satisfaction.	2
5.	Decision Making.	1
6.	Motivation. Sensitivity. Success	2
7.	Selfless Service. Positive Spirit	1
8.	Case Study of Ethical Lives.	1
9.	Body, Mind and Soul. Attachment and Detachment.	2
10.	Spirituality Quotient. Examination	1

NSS/NCC/PHED NSS/NCC/Physical Education & Yoga Practices 2(0+2)

National Service Scheme Credit hours: 2(0+2)

Practical

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Following activities are to be taken up under the NSS course:

1. Introduction and basic components of NSS: Orientation
2. NSS programmes and activities
3. Understanding youth
4. Community mobilisation
5. Social harmony and national integration
6. Volunteerism and shramdan
7. Citizenship, constitution and human rights
8. Family and society
9. Importance and role of youth leadership
10. Life competencies
11. Youth development programmes
12. Health, hygiene and sanitation
13. Youth health, lifestyle, HIV AIDS and first aid
14. Youth and yoga
15. Vocational skill development
16. Issues related environment
17. Disaster management
18. Entrepreneurship development
19. Formulation of production oriented project
20. Documentation and data reporting
21. Resource mobilization
22. Additional life skills
23. Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works.Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Semester I

Course Title: 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 mobilisation

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

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

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

Citizenship, constitution and human rights

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

Family and society

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

Semester II

Course Title: 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

Semester III

Course Title: 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

Semester IV

Course Title: National Service Scheme IV
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 mobilisation
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.

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

Semester I: National Cadet Corps I

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.

Semester II: National Cadet Corps II

1. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
2. Leadership traits, types of leadership. Character/personality development.
3. Civil defense organization, types of emergencies, fire fighting, protection,
4. Maintenance of essential services, disaster management, aid during development projects.
5. Basics of social service, weakersections of society andtheirneeds, NGO's andtheircontribution, contribution of youth towards social welfare and family planning.
6. Structure and function of human body, diet and exercise, hygiene and sanitation.
7. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
8. Adventure activities
9. Basic principles of ecology, environmental conservation, pollution and its control.
10. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

Semester III: National Cadet Corps III

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.

7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technical terms.

Semester IV: National Cadet Corps IV

1. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
2. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
3. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
4. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
5. Field water supplies, tracks and their construction.
6. Nuclear, Chemical and Biological Warfare (NCBW)
7. Judging distance. Description of ground and indication of landmarks.
8. Recognition and description of target. Observation and concealment. Field signals. Section formations.
9. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
10. Types of communication, media, latest trends and developments.

Physical Education and Yoga Practices **Credit hours: 2(0+2)**

Semester I: PHED- I : Physical Education and Yoga Practices

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

Semester II: PHED- II : Physical Education and Yoga Practices

1. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
2. Teaching of some of Asanas – demonstration, practice, correction and practice
3. Teaching of some more of Asanas – demonstration, practice, correction and practice
4. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
5. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
6. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching – Meaning, Scope and importance of Physical Education
8. Teaching – Definition, Type of Tournaments
9. Teaching – Physical Fitness and Health Education
10. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Semester III: PHED- III : Physical Education and Yoga Practices

1. Teaching of skills of Hockey – demonstration practice of the skills and correction.
2. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
3. Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
4. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
5. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation
6. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
7. Teaching of different track events – demonstration practice of the skills and correction.
8. Teaching of different track events – demonstration practice of the skills and correction.
9. Teaching of different track events – demonstration practice of the skills and correction with competition among them.
10. Teaching of different field events – demonstration practice of the skills and correction.

Semester IV: PHED- IV : Physical Education and Yoga Practices

1. Teaching of different field events – demonstration practice of the skills and correction.
2. Teaching of different field events – demonstration practice of the skills and correction.
3. Teaching of different field events – demonstration practice of the skills and correction with competition among them.
4. Teaching of different asanas – demonstration practice and correction.
5. Teaching of different asanas – demonstration practice and correction.
6. Teaching of different asanas – demonstration practice and correction.
7. Teaching of different asanas – demonstration practice and correction.
8. Teaching of weight training – demonstration practice and correction.
9. Teaching of circuit training – demonstration practice and correction.
10. Teaching of calisthenics – demonstration practice and correction.

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

ET 321 Educational Tour 2(0+2)

VIII semester.

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

SN	Course code	Title of the module (ELP)	Credits	Department
1.	READY-421	Production Technology for Bioagents and Biofertilizer	0+10	Plant Pathology + Microbiology
2.	READY-422	Seed Production and Technology	0+10	Genetics & Plant Breeding
3.	READY-423	Mushroom Cultivation Technology	0+10	Plant Pathology
4.	READY-424	Soil, Plant, Water and Seed Testing	0+10	Soil Science + Genetics & Plant Breeding
5.	READY-425	Commercial Beekeeping	0+10	Entomology
6.	READY-426	Poultry Production Technology	0+10	LPM
7.	READY-427	Commercial Horticulture	0+10	Horticulture
8.	READY-428	Floriculture and Landscaping	0+10	Horticulture
9.	READY-429	Food Processing	0+10	Horticulture
10	READY-4210	Agriculture Waste Management	0+10	Soil Science
11	READY-4211	Organic Production Technology	0+10	Agronomy
12	READY-4212	Commercial Sericulture	0+10	Entomology
NOTE: Syllabus of ELP Modules will be decided in the next Board of Studies meeting				