COURSE SCHEME & SYLLABUS
B.Sc. (Hons.) Agriculture
(Four-Year Course)

Department of Agriculture

UISH

Sant Baba Bhag Singh University

2020

FACULTY OF AGRICULTURAL SCIENCES

COURSE SCHEME & SYLLABUS

(STRICTLY IN ACCORDANCE WITH 5TH DEANS' COMMITTEE REPORT)

FOR

B.Sc. (Hons.) Agriculture

(Four-Year Course)

1st to 8th SEMESTER

Examination 2020-2024 onwards

SANT BABA BHAG SINGH UNIVERSITY, KHIALA -1430030, JALANDHAR

Institute Name:	**University Institute of Sciences and Humanities**
Department Name:	**Agricultural Sciences**
Programme Name:	**B.Sc. (Hons.) Agriculture**
Number of Semesters	**8**

Vision:

To be the leading centre to provide quality education in the field of Agriculture, farmer-responsive training and services for the development of Agriculture and Agro- Industry

Mission:

1. To provide relevant education to the students in Processing, Agriculture and life sciences
2. Building expertise through well planned on-field implementation
3. Creating professionals to tackle the dogma from seed to stomach
4. Testing of basic concepts in production, yield enhancement disease resistant and better shelf life of food and flora
5. To disseminate the technology innovation to the producer through integrated extension activities
6. To encourage the youths on entrepreneurship and rural development

Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes

S. No.		Programme Educational Objective (PEO) (The Graduate/Undergraduate will….)
1	PEO1	Imparting detailed knowledge of Agriculture and its allied branches.
	PEO2	Facilitating detailed study of various agriculture forestry, livestock and other allied branches required to raise the income of farmers.
	PEO3	Providing detailed knowledge of agriculture in India and Indian farmers income generating enterprises.
	PEO4	Knowledge dissemination regarding various technique of farming and farming system in India.
	PEO5	Study of market and marketing of agricultural produce.
2	Programme Outcomes (PO) (At the end of Programme/Degree mentioned above, the graduates will be able to ……)	
	PO1.	Fundamental and core knowledge & understanding of agricultural sciences
	PO2.	Transfer relevant knowledge, skills and technology concepts to the producers and to support innovation
	Programme Specific Outcomes (PSO)	
3	PSO1.	Explain the scientific, economic, environmental and business principles underpinning agricultural productivity and production
	PSO2.	Identify and evaluate appropriate agricultural techniques in the crop and animal sectors to enhance efficiency of production and secure long-term food security
	PSO3	Identify and solve technological problems encountered in current crop and livestock production systems
	PSO4	Evaluate the wider consequences of agricultural activities and promote sustainable agricultural practices

INDEX

	Cooperation			
26	Agri-Informatics	CSE231	**67-68**	**3rd**
27	Farm Machinery and Power	AGR207	**69-70**	**3rd**
28	Production Technology for Vegetables and Spices	AGR209	**71-72**	**3rd**
29	Environmental Studies and Disaster Management	AGR211	**73-75**	**3rd**
30	Statistical Methods	MAT209	**76-77**	**3rd**
31	Livestock and Poultry Management	AGR213	**78-79**	**3rd**
32	Crop Production Technology-II (Rabi crops)	AGR202	**80-81**	**4th**
33	Production Technology for Ornamental Crops, MAPs and Landscaping	AGR204	**82-83**	**4th**
34	Renewable Energy and Green Technology	AGR206	**84-85**	**4th**
35	Problematic Soils and their Management	AGR208	**86-87**	**4th**
36	Production Technology for Fruit and Plantation Crops	AGR210	**88-89**	**4th**
37	Principles of Seed Technology	AGR212	**90-91**	**4th**
38	Farming System and Sustainable Agriculture	AGR214	**92-93**	**4th**
39	Agricultural Marketing, Trade and Prices	AGR216	**94-95**	**4th**
40	Introductory Agrometeorology & Climate Change	AGR218	**96-97**	**4th**
41	Principles of Integrated Pest and Disease Management	AGR301	**98-99**	**5th**
42	Manures, Fertilizers and Soil Fertility Management	AGR303	**100-101**	**5th**
43	Pests of Crops and Stored Grains and their Management	AGR305	**102-103**	**5th**

44	Diseases of Field & Horticultural Crops & their Management-I	AGR307	**104-105**	**5th**
45	Crop Improvement – I (Kharif crops)	AGR309	**106-107**	**5th**
46	Entrepreneurship Development and Business Communication	AGR311	**108-109**	**5th**
47	Geoinformatics, Nano-technology and Precision Farming	AGR313	**110-111**	**5th**
48	Practical Crop Production-I (Kharif Crops)	AGR315	**112**	**5th**
49	Intellectual Property Rights	AGR317	**113-114**	**5th**
50	Rainfed Agriculture and Watershed Management	AGR302	**115-116**	**6th**
51	Protected Cultivation and Secondary Agriculture	AGR304	**117-118**	**6th**
52	Diseases of Field & Horticultural Crops & their Management-II	AGR306	**119-120**	**6th**
53	Post-harvest Management and Value Addition of Fruits and Vegetables	AGR308	**121-122**	**6th**
54	Management of Beneficial Insects	AGR310	**123-124**	**6th**
55	Crop Improvement – II (Rabi)	AGR312	**125-126**	**6th**
56	Practical Crop Production-II (Rabi Crops)	AGR314	**127**	**6th**
57	Principles of Organic Farming	AGR316	**128-129**	**6th**
58	Farm Management, Production and Resource Economics	AGR318	**130-131**	**6th**
59	Principles of Food Science and Nutrition	AGR320	**132**	**6th**

60	General orientation & On campus training by different faculties Village attachment Unit attachment in Univ./ College. KVK/ Research Station Attachment	AGR401	**133-134**	**7th**
61	Plant clinic	AGR403	**133-134**	**7th**
62	Agro-Industrial Attachment	AGR405	**133-134**	**7th**
63	Production Technology for Bioagents and Biofertilizer	AGR402	**135-137**	**8th**
64	Seed Production and Technology	AGR404	**135-137**	**8th**
65	Mushroom Cultivation Technology	AGR406	**135-137**	**8th**
66	Soil, Plant, Water and Seed Testing	AGR408	**135-137**	**8th**
67	Commercial Beekeeping	AGR410	**135-137**	**8th**
68	Poultry Production Technology	AGR412	**135-137**	**8th**
69	Commercial Horticulture	AGR414	**135-137**	**8th**
70	Floriculture and Landscaping	AGR416	**135-137**	**8th**
71	Food Processing	AGR418	**135-137**	**8th**
72	Agriculture Waste Management	AGR420	**135-137**	**8th**
73	Organic Production Technology	AGR422	**135-137**	**8th**
74	Commercial Sericulture	AGR414	**135-137**	**8th**
75	Commercial Plant Breeding	AGR220	**138-139**	**4th**
76	Biopesticides & Biofertilizers	AGR222	**140-141**	**4th**
77	Protected Cultivation	AGR224	**142-143**	**4th**
78	Micro propagation Technologies	AGR226	**144-145**	**4th**
79	Hi-tech. Horticulture	AGR319	**146-147**	**5th**

Course Scheme for B.Sc. (Hons.) Agriculture

Scheme of Courses B. Sc. (Hons.) Agriculture Semester I							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR101	Fundamentals of Horticulture	1	0	2	3	2 (1+1)
2.	AGR103	Fundamentals of Genetics	2	0	2	4	3(2+1)
3.	AGR105	Fundamentals of Soil Science	2	0	2	4	3(2+1)
4.	AGR117	Introduction to Forestry	1	0	2	3	2 (1+1)
5.	ENG125	Comprehension & Communication Skills in English	1	0	2	3	2 (1+1)
6.	AGR107	Fundamentals of Agronomy	3	0	2	5	4(3+1)
7.*	AGR109	Introductory Biology*	1	0	2	3	2 (1+1)*
7.*#	MAT107	Elementary Mathematics*#	2	0	0	2	2(2+0)*#
8.	AGR111	Agricultural Heritage	1	0	0	1	1(1+0)
9.	AGR113	Rural Sociology & Educational Psychology	2	0	0	2	2 (2+0)
10.	AGR115	Human Values & Ethics (non gradial)	1	0	0	1	1(1+0)
11.	PT101/103/105	NSS/NCC/Physical Education & Yoga Practices**	0	0	4	4	2 (0+2)**
TOTAL			17	0	18	**35**	**22 +02****

Students who have studied Mathematics (both Biology and Mathematics) in 10+2 will have to opt and pass the course Introductory Biology (Gradial Course: Grades will be counted).

#Students who have studied Biology in 10+2 will have to opt and pass the course Elementary Mathematics#. (Gradial Course: Grades will be counted).

****NC: Non-gradial course**

Total Contact Hours: 35
Total Credit Hours: 22+02**

Scheme of Courses B. Sc. (Hons.) Agriculture Semester II							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR102	Fundamentals of Plant Biochemistry and Biotechnology	2	0	2	4	3(2+1)
2.	AGR104	Agricultural Microbiology	1	0	2	3	2(1+1)
3.	AGR106	Introductory Soil and Water Conservation Engineering	1	0	2	3	2(1+1)
4.	AGR108	Fundamentals of Crop Physiology	1	0	2	3	2(1+1)
5.	AGR110	Fundamentals of Agricultural Economics	2	0	0	2	2(2+0)
6.	AGR112	Fundamentals of Plant Pathology	3	0	2	5	4(3+1)
7.	AGR114	Fundamentals of Entomology	3	0	2	5	4(3+1)
8.	AGR116	Fundamentals of Agricultural Extension Education	2	0	2	4	3(2+1)
9.	AGR118	Communication Skills and Personality Development	1	0	2	3	2(1+1)
TOTAL			16		16	**32**	**24**

Total Contact Hours: 32
Total Credit Hours: 24

Scheme of Courses B. Sc. (Hons.) Agriculture Semester III							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR201	Crop Production Technology – I *(Kharif Crops)*	1	0	2	3	2 (1+1)
2.	AGR203	Fundamentals of Plant Breeding	2	0	2	4	3 (2+1)
3.	AGR205	Agricultural Finance and Cooperation	2	0	2	4	3 (2+1)
4.	CSE231	Agri-Informatics	1	0	2	3	2(1+1)
5.	AGR207	Farm Machinery and Power	1	0	2	3	2 (1+1)
6.	AGR209	Production Technology for Vegetables and Spices	1	0	2	3	2 (1+1)
7.	AGR211	Environmental Studies and Disaster Management	2	0	2	4	3(2+1)
8.	MAT209	Statistical Methods	1	0	2	3	2(1+1)
9.	AGR213	Livestock and Poultry Management	3	0	2	5	4 (3+1)
TOTAL			14		18	**32**	**23**

Total Contact Hours: 32
Total Credit Hours: 23

Scheme of Courses B. Sc. (Hons.) Agriculture Semester IV							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR202	Crop Production Technology –II *(Rabi Crops)*	1	0	2	3	2(1+1)
2.	AGR204	Production Technology for Ornamental Crops, MAPs and Landscaping	1	0	2	3	2(1+1)
3.	AGR206	Renewable Energy and Green Technology	1	0	2	3	2(1+1)
4.	AGR208	Problematic Soils and their Management	0	0	2	2	2(2+0)
5.	AGR210	Production Technology for Fruit and Plantation Crops	1	0	2	3	2(1+1)
6.	AGR212	Principles of Seed Technology	1	0	4	5	3(1+2)
7.	AGR214	Farming System and Sustainable Agriculture	1	0	0	1	1(1+0)
8.	AGR216	Agricultural Marketing, Trade and Prices	2	0	2	4	3(2+1)
9.	AGR218	Introductory Agro-meteorology & Climate Change	1	0	2	3	2(1+1)
10.	AGR220/ AGR222/ AGR224/ AGR226	Elective Course	1/2 ϕ	0	4/2 ϕ	5/4 ϕ	3 credit ϕ
TOTAL			11+ 1/2 ϕ		16+ 4/2 ϕ	**27+5/4ϕ (31/32)**	**22**

ϕ Students have to opt 3 credits course which can be 1+2 or 2+1 course.

Total Contact Hours: 27+5/4ϕ (31/32)

Total Credit Hours: 22

¬ **Note:** SBBSU University will offer elective courses depending upon the availability of faculty (specialization of available faculty).

Scheme of Courses B. Sc. (Hons.) Agriculture Semester V							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR301	Principles of Integrated Pest and Disease Management	2	0	2	4	3(2+1)
2.	AGR303	Manures, Fertilizers and Soil Fertility Management	2	0	2	4	3(2+1)
3.	AGR305	Pests of Crops and Stored Grain and their Management	2	0	2	4	3(2+1)
4.	AGR307	Diseases of Field and Horticultural Crops and their Management –I	2	0	2	4	3 (2+1)
5.	AGR309	Crop Improvement-I *(Kharif Crops)*	1	0	2	3	2 (1+1)
6.	AGR311	Entrepreneurship Development and Business Communication	1	0	2	3	2 (1+1)
7.	AGR313	Geoinformatics and Nano-technology and Precision Farming	1	0	2	3	2 (1+1)
8.	AGR315	Practical Crop Production – I (*Kharif* crops)	0	1	4	4	2 (0+2)
9.	AGR317	Intellectual Property Rights	1	0	0	1	1(1+0)
10.	AGR319/ AGR318/ AGR323/ AGR325	Elective Course	1/2 ϕ	0	4/2 ϕ	5/4 ϕ	3 credit ϕ
TOTAL			12+ 1/2 ϕ		18+ 4/2 ϕ	**30+5/4ϕ (34/35)**	**24**

ϕ Students have to opt 3 credits course which can be 1+2 or 2+1 course.

Total Contact Hours: 30+5/4ϕ (34/35)

Total Credit Hours: 24

¬ **Note:** SBBSU University will offer elective courses depending upon the availability of faculty (specialization of available faculty) .

Scheme of Courses B. Sc. (Hons.) Agriculture Semester VI							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1.	AGR302	Rainfed Agriculture & Watershed Management	1	0	2	3	2 (1+1)
2.	AGR304	Protected Cultivation and Secondary Agriculture	1	0	2	3	2 (1+1)
3.	AGR306	Diseases of Field and Horticultural Crops and their Management-II	2	0	2	4	3 (2+1)
4.	AGR308	Post-harvest Management and Value Addition of Fruits and Vegetables	1	0	2	3	2 (1+1)
5.	AGR310	Management of Beneficial Insects	1	0	2	3	2 (1+1)
6.	AGR312	Crop Improvement-II *(Rabi crops)*	1	0	2	3	2 (1+1)
7.	AGR314	Practical Crop Production –II (*Rabi* crops)	0	1	4	4	2 (0+2)
8.	AGR316	Principles of Organic Farming	1	0	2	3	2 (1+1)
9.	AGR318	Farm Management, Production & Resource Economics	1	0	2	3	2 (1+1)
10	AGR320	Principles of Food Science and Nutrition	2	0	0	2	2(2+0)
11.	AGR322/ AGR324/ AGR326/ AGR328	Elective Course	1/2 ϕ	0	4/2 ϕ	5/4 ϕ	3 credit ϕ
TOTAL			11+ 1/2 ϕ		20+ 4/2 ϕ	**31+5/4ϕ (35/36)**	**24**

ϕ Students have to opt 3 credits course which can be 1+2 or 2+1 course. (preferably 2+1 course.)

Total Contact Hours: 31+5/4ϕ (35/36)

Total Credit Hours: 24

¬ **Note:** SBBSU University will offer elective courses depending upon the availability of faculty (specialization of available faculty).

Scheme of Courses B. Sc. (Hons.) Agriculture Semester VII							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1 2 3	**AGR401**	General orientation & On campus training by different faculties Village attachment Unit attachment in Univ./ College. KVK/ Research Station Attachment	0	1	28	28	14
4	**AGR403**	Plant clinic	0	1	2	2	2
5	**AGR405**	Agro-Industrial Attachment	0	1	4	4	4
			0	**0**	**34**	**34**	**20**

Total Contact Hours: 34
Total Credit Hours: 20

Instructions to conduct RAWE &AIA for the B.Sc. (Hons.) Agriculture VII Semester			
SN.	**Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)**		
	Activities	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		20	20

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

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	
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 for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing-value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

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

¬ **Note:** SBBSU University will offer the RAWE component depending upon the availability of sources or faculty (specialization of available faculty) .

Scheme of Courses B. Sc. (Hons.) Agriculture
Semester VIII

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.**

- **Note:** SBBSU University will offer the modules depending upon the availability of sources/ faculty (specialization of available faculty).

S. No.	Subject/ Paper Code	Subject/Module Name	Contact Hours (Lecture)	Contact Hours (Tutorial)	Contact Hours (Practical)	Total Contact Hours	Total Credit Hours
1	AGR402	Production Technology for Bioagents and Biofertilizer	0	1	20	20	0+10
2	AGR404	Seed Production and Technology	0	1	20	20	0+10
3	AGR406	Mushroom Cultivation Technology	0	1	20	20	0+10
4	AGR408	Soil, Plant, Water and Seed Testing	0	1	20	20	0+10
5	AGR410	Commercial Beekeeping	0	1	20	20	0+10
6	AGR412	Poultry Production Technology	0	1	20	20	0+10
7	AGR414	Commercial Horticulture	0	1	20	20	0+10
8	AGR416	Floriculture and Landscaping	0	1	20	20	0+10
9	AGR418	Food Processing	0	1	20	20	0+10
10	AGR420	Agriculture Waste Management	0	1	20	20	0+10
11	AGR422	Organic Production Technology	0	1	20	20	0+10
12	AGR424	Commercial Sericulture	0	1	20	20	0+10

Total Credit Hours: 20

Evaluation of Experiential Learning Programme/ HOT

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

LIST OF ELECTIVE COURSES

A student can select one elective courses out of the following and offer each during 4th, 5th and 6th semesters.

NOTE: The Student of 6th semester should prefer 2+1 course (3 credits course).

S. No.	Subject/ Paper Code	Subject Name	Semester	Contact Hours (Lecture)	Contact Hours (Tutorial)	Contact Hours (Practical)	Total Contact Hours	Total Credit Hours
1	**AGR220**	Commercial Plant Breeding	IV	1	0	4	5	3(1+2)
2	**AGR222**	Biopesticides & Biofertilizers	IV	2	0	2	4	3(2+1)
3	**AGR224**	Protected Cultivation	IV	2	0	2	4	3(2+1)
4	**AGR226**	Micro propagation Technologies	IV	1	0	4	5	3(1+2)
5	**AGR319**	Hi-tech. Horticulture	V	2	0	2	4	3(2+1)
6	**AGR321**	Weed Management	V	2	0	2	4	3(2+1)
7	**AGR323**	System Simulation and Agro-advisory	V	2	0	2	4	3(2+1)
8	**AGR325**	Agricultural Journalism	V	2	0	2	4	3(2+1)
9	**AGR322**	Agribusiness Management	VI	2	0	2	4	3(2+1)
10	**AGR324**	Agrochemicals	VI	2	0	2	4	3(2+1)
11	**AGR326**	Landscaping	VI	2	0	2	4	3(2+1)
12	**AGR328**	Food Safety and Standards	VI	2	0	2	4	3(2+1)

Scheme of Courses B. Sc. (Hons.) Agriculture
SEMESTER-I

Course Code	AGR101	
Course Title	Fundamentals of Horticulture	
Type of course	Theory and Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of the Fundamentals of Horticulture subject is to introduce the students to Horticulture.	
Course outcomes	CO1	Students will understand the basic horticulture biology, taxonomy, and morphology.
	CO2	Students will learn basic horticultural principles and practices
	CO3	Students will learn different methods of propagation used in horticulture

Fundamentals of Horticulture

Theory

UNIT-I

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops.

UNIT-II

Plant propagation-methods and propagating structures; Seed dormancy, Seed germination.

UNIT-III

Principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy.

UNIT-IV

Medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

1. Identification of garden tools.

2. Identification of horticultural crops.

3. Preparation of seed bed/nursery bed.

4. Practice of sexual and asexual methods of propagation including micro-propagation.

5. Layout and planting of orchard. Training and pruning of fruit trees.

6. Preparation of potting mixture. Fertilizer application in different crops.

7. Visits to commercial nurseries/orchard.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Fruit physiology and production	Amar Singh	Kalyani Publishers
2	Fruit Culture in India	Dr. Shyam Singh, Dr. S. Krishnamurthi and Dr. S. L. Katyal	ICAR, New Delhi
4	Fundamentals of Horticulture	Jitendra Singh	Kalyani Publishers

Course Code	AGR103	
Course Title	Fundamentals of Genetics	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the students about the fundamentals of genetics	
Course outcomes	CO1	Able to use subject knowledge to under inheritance, linkage, different crosses in plant breeding, mutation
	CO2	Students will able to calculate the probability of trait transfer from one generation
	CO3	Students will learn about methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation

Fundamentals of Genetics

Theory

UNIT-I

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance-cell cycle and cell division- mitosis and meiosis. Probability and Chi-square.

UNIT-II

Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation.

UNIT-III

Crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation.

UNIT-IV

Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept:

Gene structure, function and regulation, Lac and Trp operons.

Practical

1. Study of microscope. Study of cell structure.
1. Mitosis and Meiosis cell division.
2. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross,
3. Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division,
4. Experiments on probability and Chi-square test.
5. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data).
6. Study on sex linked inheritance in Drosophila.
7. Study of models on DNA and RNA structures.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Genetics (III Ed)	Strickberger MW	Prentice Hall, New Delhi, India
2	Principles Of Genetics	Gardner, Simmons, Snustad	Wiley
3	Concepts of Genetics	William S. Klug, Michael R. Cumming, Charlotte A. Spencer, Michael A. Palladino	Pearson

Course Code	AGR105	
Course Title	Fundamentals of Soil Science	
Type of course	Theory and Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students about the properties of soil and its impact on crops.	
Course outcomes	CO1	Students will be aware about the soil, its types, pedological and edaphological concept, earth spheres, different minerals and rocks existing on earth
	CO2	Students will be aware about soil forming processes and physical properties of the soil
	CO3	Students will understand the concept of soil survey and classification, soil taxonomy and soil orders

Fundamentals of Soil Science

Theory

UNIT-I

Soil- Pedological and edaphalogical concepts. Soil Science-scope and branches of soil science. Earth spheres and composition of earth crust. Minerals-classification, formation and properties of silicate and non-silicate minerals, Rocks-classification, formation and properties of igneous, sedimentary and metamorphic rocks. Weathering-type, factors of weathering, products of weathering.

UNIT-II

Soil formation-soil forming factors and soil forming processes. Soil profile-master horizons, subordinate horizons. Soil physical properties-Soil texture-classification of soil separates, properties of soil separates, Particle size analysis- Stokes law-assumptions and limitations, textural classes.

UNIT-III

Soil structure-classification, soil aggregates, evaluation of soil structure, significance. Pore space-types, factors affecting porosity, manipulation. Bulk density and particle density- relationships, factors, significance and manipulation. Soil colour-factors, attributes and significance. Soil consistency-forms, factors, limits and significance. Soil crusting- factors and significance.

UNIT-IV

Soil temperature-thermal properties of soils, flow of heat, soil temperature regimes, influence of soil temperature on plant growth. Soil air-composition, gaseous exchange, influence of soil air on

plant growth. Soil water-classification, potentials, soil moisture constants, movement of soil water, infiltration, percolation, hydraulic conductivity. Soil survey- types and methods. Soil classification-systems of classification. Soil taxonomy-advantages, structure, formative elements, diagnostic horizons, keys to soil orders. Soils of Karnataka and India.

Practical

1. Study of general properties of minerals

2. Study of minerals-silicate and non-silicate minerals

3. Study of rocks-igneous, sedimentary and metamorphic rocks

4. Study of a soil profile; Collection and processing of soil for analysis

5.Study of soil texture-feel method, mechanical analysis

6. Determination of bulk density, particle density and soil porosity; Determination of soil colour.

7. Study of soil structure and aggregate analysis

8. Determination of soil moisture, Determination of soil moisture constants-field capacity; water holding capacity;

9. Study of infiltration rate of soil; Study of soil temperature.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Nature and properties of soils	Brady Nyle C and Ray R Well,	Pearson Education Inc.
2	Fundamentals of Soil Science	Indian Society of Soil Science	IARI, New Delhi
3	Introductory Soil Science	Sehgal J. A.	Kalyani Publishers, Ludhiana

Course Code	AGR117	
Course Title	Introduction to Forestry	
Type of course	Theory and Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students about forestry and its importance.	
Course outcomes	CO1	Students will able to identify the abiotic and biotic factors in a forest ecosystem
	CO2	Students will able to understand various factors affect tree growth and forest ecosystem development, forest ecology
	CO3	Students will understand the economic value of forest and know many of the products they provide to people and society

Introduction to Forestry

Theory

UNIT-I

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies.

UNIT-II

Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.

UNIT-III

Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.

UNIT-IV

Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind

breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

Practical

1. Identification of tree-species.

2. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees.

3. Height measurement of standing trees by shadow method, single pole method and hypsometer.

4. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques.

5. Forest plantations and their management. Visits of nearby forest based industries.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	A Manual of Indian Forest Botany	Bore, N.L	International Book Dist. New Delhi
2	A Text Book of Silviculture	Diwivedi, A.P	International Book Distributor
3	Forestry Principles and Applications	Antony Joseph Raj and S B Lal	Scientific Publisher
4	Introduction to Forestry and Natural Resources	Donald L. Grebner, Peter Bettinger and Jacek P. Siry	Elsevier

Course Code	ENG125	
Course Title	Comprehension and Communication Skills in English	
Type Course	Theory and Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course Pre-requisite	10+2 (Non Medical or Medical) or Equivalent	
Course Objective (CO)	The objective this subject is to increase the communication and comprehension skills of the students	
Course outcomes	CO1	Students will able to increase their communication skills
	CO2	Students will able to increase their comprehension skills
	CO3	Students will learn about the preparation of curriculum vitae and job applications and synopsis writing

Comprehension and Communication Skills in English

Theory

UNIT-I

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.

UNIT-II

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.

UNIT-III

Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing.

UNIT-IV

Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical:

1. Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature).

2. Oral Communication: Phonetics, stress and intonation, Conversation practice.
3. 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.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Comprehension and Communication Skills in English	Dr. G. Shravan Kumar, Ms. S.M. Padmasri, Mr. P. Ramesh Babu	Acharaya N.G. Ranga Agricultural University, Hyderabad
2	Communication Skills: A Workbook	Sanjay Kumar, and Pushp Lata	Oxford University Press India

Course Code	AGR107	
Course Title	Fundamentals of Agronomy	
Type of course	Theory and Practical	
L T P	3 0 1	
Credits	4 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students to fundamentals of Agronomy.	
Course outcomes	CO1	Students will learn about seeds and sowing, tillage and tilth, crop density and geometry
	CO2	Students will learn about crop nutrition, manures and fertilizers, nutrient use efficiency and water resources
	CO3	Students will learn about importance, classification of weeds, crop weed competition and concepts of weed management

Fundamentals of Agronomy

Theory

UNIT-I

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry.

UNIT-II

Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.

UNIT-III

Weeds- importance, classification, crop weed competition, concepts of weed management principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

UNIT-IV

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

1. Identification of crops, seeds, fertilizers, pesticides and tillage implements.

2. Study of agro climatic zones of India.

3. Identification of weeds in crops.

4. Methods of herbicide and fertilizer application.

5. Study of yield contributing characters and yield estimation,\.

6. Seed germination and viability test.

7. Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement.

8. Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill.

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Introduction to Crops of India	Das, N. R.	Scientific Publ.
2	Hand Book of Agriculture	ICAR	ICAR. New Delhi

Course Code	AGR109	
Course Title	Introductory Biology	
Type of course	Theory and Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the non-medical students to working of biological systems especially plants.	
Course outcomes	CO1	Students will able to gain knowledge about biological systems especially plants
	CO2	Students will learn about diversity and characteristics of life, origin of life, evolution and eugenics
	CO3	Students will learn about binomial nomenclature and classification of cell and cell division

Introductory Biology

Theory

UNIT-I

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics.

UNIT-II

Binomial nomenclature and classification Cell and cell division.

UNIT-III

Morphology of flowing plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, F abaceae and Poaceae.

UNIT-IV

Role of animals in agriculture.

Practical

1. Morphology of flowering plants – root, stem and leaf and their modifications.
2. Inflorescence, flower and fruits.
3. Cell, tissues & cell division.
4. Internal structure of root, stem and leaf.
5. Study of specimens and slides.
6. Description of plants - Brassicaceae, Fabaceae and Poaceae.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Introduction to Biology	D. G. Mackean	John Murray
2	Introduction to Biology	Jane Horlings	Kendall/Hunt Publishing Company
3	Introduction to Biology and Biotechnology	K. Vaidyanath, K. Pratap Reddy, K. Satya Prasad	CRC Press

Course Code	**MAT107**	
Course Title	**Elementary Mathematics**	
Type of course	Theory	
L T P	2 0 0	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce medical students about the fundamentals of mathematics being used in agriculture sciences.	
Course outcomes	CO1	Students will able to understand about fundamentals of mathematics being used in agriculture sciences
	CO2	Students will learn about differential calculus : definition of function, limit and continuity, simple problems on limit, simple problems on continuity
	CO3	Students will learn about integral calculus : integration of simple functions, integration of product of two functions, integration by substitution method,

Elementary Mathematics

Theory

UNIT-I

Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.

UNIT-II

Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x2 + y2 = a2$.

UNIT-III

Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple
problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric

functions. Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it).

UNIT-IV

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**.**

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Mathematics for Agriculture	D. G. Mackean	John Murray
2	Mathematics for students of agriculture	Rasor, Samuel Eugene	Macmillan, New York.

Course Code	AGR111	
Course Title	Agricultural Heritage	
Type of course	Theory	
L T P	1 0 0	
Credits	1 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to make the students to understand the agriculture practice and heritage in past, journey of Indian agriculture from past to modern era.	
Course outcomes	CO1	Students will understand the agriculture practice and heritage in past
	CO2	Students will understand the journey of Indian agriculture from past to modern era
	CO3	Students will learn about importance of agriculture and agricultural resources available in India

Agricultural Heritage

Theory

UNIT-I

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture;

UNIT-II

Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era;

UNIT-III

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;

UNIT-IV

Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Ancient and Medieval History of Indian Agriculture	Choudhary, S.L., Sharma, G.S. and Nene, Y.L.	Rajasthan College of Agriculture, Udaipur
2	Principles & Practices of Agronomy	S S Singh	Kalyani Publishers
3	Handbook of Agriculture	ICAR	ICAR New Delhi

Course Code	AGR113	
Course Title	Rural Sociology & Educational Psychology	
Type of course	Theory	
L T P	2 0 0	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students to Rural Sociology & Educational psychology so that students can communicate with farmer and easily implement the agricultural policies.	
Course outcomes	CO1	Students will learn about rural sociology & educational psychology
	CO2	Students will able to communicate with farmer and easily implement the agricultural policies
	CO3	Students will about behavior: cognitive, affective, psychomotor domain, personality, learning, motivation, theories of motivation, intelligence

Rural Sociology & Educational Psychology

Theory

UNIT-I

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension,

UNIT-II

Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

UNIT-III

Educational psychology: Meaning & its importance in agriculture extension.

UNIT-IV

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Fundamentals of Rural Sociology and Educational Psychology	O.P. Sharma and L.L. Somani	Agrotech Publishing Academy, 2012
2	Fundamentals of Rural Sociology and Educational Psychology	ecourse developed by ICAR	ICAR
3	Rural Sociology & Psychology In Extension Education	N K Tripathi	Aman Publishing House

Course Code	AGR115	
Course Title	Human Values & Ethics (non gradial)	
Type of course	Theory	
L T P	1 0 0	
Credits	1 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to develop the ethic and human values inside the students.	
Course outcomes	CO1	Students will learn about ethic and human values
	CO2	Students will understand the concept of decision making, motivation, sensitivity, success, selfless service
	CO3	Students will learn about principles and philosophy, self exploration, self awareness, self satisfaction

Human Value and Ethics

Theory

UNIT-I

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life.

UNIT-II

Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction

UNIT-III

Decision Making. Motivation, Sensitivity. Success. Selfless Service.

UNIT-IV

Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Professional Ethics and Human Values	Govindarajan M	Prentice Hall India Learning Private Limited
2	Ethics - Integrity and Aptitude	Santosh Ajmera and Nanda Kishore Reddy	McGraw Hill Education
3	A Textbook On Professional Ethics And Human Values	R.S. Naagarazan	New Age International

Course Code	PT 101/103/105
Course Title	NSS/NCC/Physical Education & Yoga Practices
Type of course	Theory
L T P	0 0 2
Credits	2 0 0
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent
Course objective	Main objective of this subject to make aware the students about national service scheme and involve the students into different activities of NSS/NCC/Physical education and Yoga.

National Service Scheme

8. 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

2. NSS programmes and activities

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

3. Understanding youth

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

4. Community mobilization

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

6. **Social harmony and national integration**

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

7. **Volunteerism and shramdan**

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

8. **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

9. **Family and society**

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	National Service Scheme A Youth Volunteers Programme For Under Graduate Students As Per Ugc Guidelines	J D S, Amit K Jain & Brijesh K Rathi Panwar (Author)	Astral international
2	National Service Scheme in India: A Case Study of Karnataka	M. B. Dilshad	Trust Publications

National Cadet Corps Credit

National Cadet Corps

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
11. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, free fighting, protection,
14. Maintenance of essential services, disaster management, aid during development projects.
15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution,

contribution of youth towards social welfare and family planning.

16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
18. Adventure activities

19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	National Cadet Corps Youth in Action		Lancer Publishers
2	NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations	RPH Editorial Board	Ramesh Publishing House

Physical Education and Yoga Practices

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

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

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.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Health ,Yoga And Physical Education	Dr. H.L. Khatri and Dr. Suman Lata	Paragon International Publishers
2	Gender and Physical Education: Contemporary Issues and Future Directions	Dawn Penney	Pages displayed by permission of Psychology Press

SEMESTER II

Course Code	AGR102	
Course Title	Fundamentals of Plant Biochemistry and Biotechnology	
Type of course	Theory and Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students to fundamentals of biochemistry and biotechnology.	
Course outcomes	CO1	To impart the skills in biochemical analysis, biotechnological tools, plant tissue culture, Enzyme Kinetics and implications in enhancing crop productivity algae
	CO2	To impart hands-on skills in preparation of buffers and solution
	CO3	Students will learn about concepts and applications of plant biotechnology

Fundamentals of Plant Biochemistry and Biotechnology

Theory

UNIT-I

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 Poly saccharides.

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.

UNIT-II

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.

UNIT-III

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;

UNIT-IV

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

1. Preparation of solution, pH & buffers,
2. Qualitative tests of carbohydrates and amino acids.
3. Quantitative estimation of glucose/ proteins.
4. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action,
5. Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides.
6. Sterilization techniques.
7. 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.
8. Demonstration on isolation of DNA.
9. Demonstration of gel electrophoresis techniques and DNA finger printing.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Principles of Biochemistry	A L Lehninger	WH Freeman publisher & Co.
2	Biochemistry- Environment & Agriculture	A P S Maan, S K Munshi and A K Gupta	Kalyani Publishers
3	Fundamentals of Biochemistry	J L Jain	S Chand
4	Introduction to plant tissue culture	M K Razdan	Science Pub Inc

Course Code	AGR104	
Course Title	Agricultural Microbiology	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the student about the microbiology	
Course outcomes	CO1	Students will able to apply subject knowledge prokaryotic and eukaryotic microbes,about the biofuel production and biodegradation of agro-waste
	CO2	To gain knowledge about bacterial genetics
	CO3	Students will learn about silage production, biofertilizers, bio pesticides, biofuel production and biodegradation of agro-waste

Agricultural Microbiology

Theory

UNIT-I

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.

UNIT-II

Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposon.

UNIT-III

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.

UNIT-IV

Microbes in human welfare: silage production, biofertilizers, bio pesticides, biofuel production and biodegradation of agro-waste.

Practical

1. Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture.

2. Methods of sterilization.

3. Nutritional media and their preparations.

4. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes.

5. Methods of isolation and purifcation of microbial cultures.

6. Isolation of *Rhizobium* from legume root nodule.

7. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots.

8. Isolation of BGA. Staining and microscopic examination of microbes.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Microbiology	R P Singh	Kalyani Publishers
2	General Microbiology	R P Singh	Kalyani Publishers
3	Mushroom cultivation	PAU	PAU
4	Agricultural Microbiology	N Mukhrjee & T Ghose	Kalyani Publishers

Course Code	AGR106	
Course Title	Introductory Soil and Water Conservation Engineering	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students about soil and water importance to crops	
Course outcomes	CO1	Students will learn about the importance of conservation of soil and water
	CO2	Students will identify the degradation of soil's chemical and physical properties
	CO3	Students will understand about different forms of erosion

Introductory Soil and Water Conservation Engineering

Theory

UNIT-I

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion.

UNIT-II

Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques.

UNIT-III

Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design.

UNIT-IV

Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

1. General status of soil conservation in India.
2. Calculation of erosion index. Estimation of soil loss.
3. Measurement of soil loss.
4. Preparation of contour maps.
5. Design of grassed water ways. Design of contour bunds.
6. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Basic concepts of Soil Science	Kolay, A.K., 1983	Wiley Eastern Ltd., New Delhi
2	Fundamentals of Soil Science (8th Edition)	Foth, H.D., 1991	John Wiley & Sons, New Delhi
3	Introductory Soil Science (3rd Edition)	Das, D .K., 2011	Kalyani publisher, Ludhiana (India).
4	Soil, Plant, Water and Fertilizer Analysis (2nd Edition)	Gupta, P.K. 2009	AGROBIOS, Jodhpur (India).

Course Code	AGR108	
Course Title	Fundamentals of Crop Physiology	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the students about the physiology of the plants	
Course outcomes	CO1	To understand plant cell structure, organization, and apply specific biochemical functions to all compartments of the plant cell, the process of imbibitions, osmosis, plasmolysis
	CO2	To learn about the plant growth regulators
	CO3	To gain the knowledge about Glycolysis and TCA cycle

Fundamentals of Crop Physiology

Theory

UNIT-I

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology.

UNIT-II

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.

UNIT-III

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

1. Study of plant cells, structure and distribution of stomata.
2. Imbibitions, osmosis, plasmolysis, measurement of root pressure.
3. Rate of transpiration.
4. Separation of photosynthetic pigments through paper chromatography.
5. Photosynthesis, respiration, tissue test for mineral nutrients.
6. Estimation of relative water content,

7. Measurement of photosynthetic CO2 assimilation by Infra Red Gas Analyser (IRGA)

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Plant Physiology	Lincoln Taiz, Eduardo Zeiger	Sinauer Associates Inc
2	Plant Physiology	H N Srivastava	Pradeep Publishers
3	Plant Physiology	N K Gupta & Sunita Gupta	Oxford and IBH publications, New Delhi
4	Seed Technology	R L Aggarwal	Oxford and IBH publications, New Delhi

Course Code	AGR110	
Course Title	Fundamentals of Agricultural Economics	
Type of course	Theory & Practical	
L T P	2 0 0	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the crop and economics	
Course outcomes	CO1	Identify elements of business success in agriculture and food-processing
	CO2	Identify elements that determine economic role of agriculture in national economy
	CO3	Recognize biological and economic laws in agricultural production and in decision-making process on agricultural and rural development at micro and macroeconomic level. Recognize biological and economic laws in agricultural production and in decision-making process on agricultural and rural development at micro and macroeconomic level.

Fundamentals of Agricultural Economics

Theory

UNIT I

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.

UNIT II

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, 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.

UNIT III

Laws of returns: Law of variable proportions and law of returns to scale. *Cost:* concepts, short run and long run cost curves. Supply: Stock v/s supply, law of 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 form 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.

UNIT IV

Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax:* meaning, direct and indirect taxes, agricultural taxation, VAT. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Economics	Lekhi, R.K. and Singh, J	Kalyani publishers, Ludhiana
2	Elementary Principles of Economics	Jather & Berry	Mcmillan Co.
3	Modern Economics Theory	K K Dewitt	Premier Publishing Co.
4	Economics & Introductory Analysis	Paul Samuelson	McGraw Hill Book Co.

Course Code	AGR112	
Course Title	Fundamentals of Plant Pathology	
Type of course	Theory & Practical	
L T P	3 0 1	
Credits	4 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the crops and plant disease due to pests	
Course outcomes	CO1	Students will know about concept of disease, causal agents of plant diseases
	CO2	Identification of methods and management of crop diseases
	CO3	Students will be able to discuss the main principles and concepts of plant pathology and plant-pathogen interactions

Fundamentals of Plant Pathology

Theory

UNIT-I

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 / factors affecting disease development: disease triangle and tetrahedron 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.

UNIT-II

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

UNIT-III

Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.

Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites.

Nematodes: General morphology and reproduction, classification, symptoms and nature of

damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Radopholus* etc.)

UNIT-IV

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants**.**
Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

1. Acquaintance with various laboratory equipments and microscopy.
2. Collection and preservation of disease specimen.
3. Preparation of media, isolation and Koch's postulates.
4. General study of different structures of fungi. Study of symptoms of various plant diseases.
5. Study of representative fungal genera.
6. Staining and identification of plant pathogenic bacteria.
7. Transmission of plant viruses.
8. Study of phanerogamic plant parasites.
9. Study of morphological features and identification of plant parasitic nematodes.
10. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.
11. Study of fungicides and their formulations. Methods of pesticide application and their safe use.
12. Calculation of fungicide sprays concentrations**.**

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Economics	Lekhi, R.K. and Singh, J	Kalyani publishers, Ludhiana
2	Elementary Principles of Economics	Jather & Berry	Mcmillan Co.
3	Modern Economics Theory	K K Dewitt	Premier Publishing Co.
4	Economics & Introductory Analysis	Paul Samuelson	McGraw Hill Book Co.

Course Code	AGR114	
Course Title	Fundamentals of Entomology	
Type of course	Theory & Practical	
L T P	3 0 1	
Credits	4 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject about the insect importance, relationships and disadvantages with crops	
Course outcomes	CO1	Students will learn about Insect Ecology: Introduction, Environment and its components
	CO2	Students will learn about classification of insecticides, toxicity of insecticides and formulations of insecticides
	CO3	Students will learn about biotype, sub-species, species, genus, family and order

Fundamentals of Entomology

UNIT-I

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

UNIT-II

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

UNIT-III

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

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

UNIT-IV

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

Practical

1. Methods of collection and preservation of insects including immature stages.

2. External features of Grasshopper/Blister beetle;

3. Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus.

4. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper);

5. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Tysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. 6. Insecticides and their formulations. Pesticide appliances and their maintenance.

7. Sampling techniques for estimation of insect population and damage.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Pests of South Asia and Their Management.	A. S. Atwal and G.S Dhaliwal	Kalyani Publishers, Ludhiana
2	Principles of Insect Pest Management	G. S. Dhaliwal and Ramesh Arora	National Agricultural Technology Information Centre, Ludhiana

Course Code	AGR116	
Course Title	Fundamentals of Agricultural Extension Education	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of the extension subject is to introduce the students to communication skills for transfer of technology.	
Course outcomes	CO1	Students will be aware about the extension program planning meaning, process, principles and steps in program development
	CO2	Students will learn about extension efforts in pre-independence and post independence era of rural development
	CO3	They will learn about the extension dministration, monitoring and evaluation, transfer of technology and extension teaching methods

Fundamentals of Agricultural Extension Education

Theory

UNIT-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.

UNIT-II

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

UNIT-III

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.

UNIT-IV

Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension

personnel; extension teaching
methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

1. To get acquainted with university extension system.

2. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector;

3. Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories;

4. Presentation skills exercise; micro teaching exercise;

5. A visit to village to understand the problems being encountered by the villagers/ farmers;

6. To study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development;

7. Understanding PRA techniques and their application in village development planning; exposure to mass media:

8. Visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agriculture Demonstration and Extension Communication	Ram Krishan	P S Jayasinghe Asia Publishing House
2	A Text book of Rural Sociology	S L Mondal & G L Ray	Kalyani Publishers

Course Code	AGR118	
Course Title	Communication Skills and Personality Development	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of the extension subject is to introduce the students to communication skills and personality development.	
Course outcomes	CO1	Students will learn about structural and functional grammar; meaning and process of communication, verbal and nonverbal communication
	CO2	Students will about listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures
	CO3	Students will able to understand reading and comprehension of general and technical articles, precise writing, summarizing, abstracting

Communication Skills and Personality Development

Theory

UNIT-1

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication.

UNIT-1I

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

UNIT-1II

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

UNIT-1V

Individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical

1. Listening and note taking, writing skills, oral presentation skills.

2. Field diary and lab record; indexing, footnote and bibliographic procedures.

3. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agriculture Demonstration and Extension Communication	Ram Krishan	P S Jayasinghe Asia Publishing House
2	Communication Skills and Personality Development		Kalyani Publishers. Ludhiana,
3	Communication Skills and Personality Development		Nirali Prakashan

Semester III

Course Code	AGR201	
Course Title	Crop Production Technology – I (Kharif Crops)	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to know about the kharif crops and their cultivation techniques	
Course outcomes	CO1	Students will learn the origin, geographical distribution, economic importance of kharif crops
	CO2	Students will learn the soil and climatic requirements, varieties of Kharif crops
	CO3	Students will learn the cultural practices and yield of Kharif crops

Crop Production Technology-I (Kharif Crops)

Theory

UNIT-I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops.

UNIT-II

Cereals – rice, maize, sorghum, pearl millet and finger millet.

UNIT-III

Pulses-pigeon pea, mung bean and urd bean; Oilseeds- groundnut, and soybean.

UNIT-IV

Fiber crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

1. Rice nursery preparation, transplanting of rice.
2. Sowing of soybean, pigeon pea and mung bean, maize, groundnut and cotton.
3. Effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops.
4. 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.

5. Study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Principles of Crop Husbandary	S R Reddy	Kalyani Publishers Ludhiana
2	Package of Practices for Kharif Crops	PAU	PAU Publications Ludhiana

Course Code	AGR203	
Course Title	Fundamentals of Plant Breeding	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the basic of plant breeding	
Course outcomes	CO1	Students will learn about modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options
	CO2	Students will learn about centers of origin/ diversity, components of Genetic variation; Heritability and genetic advance
	CO3	Students will able to understandgGenetic basis and methods of breeding cross pollinated crops, modes of selection

Fundamentals of Plant Breeding

Theory

UNIT-I

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options.

UNIT-II

Domestication, Acclimatization and Introduction; Centers of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept.

UNIT-III

Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes, Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization

UNIT-IV

Maintenance of breeding records and data collection; Wide hybridization and prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted

selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Plant Breeding	Singh, B.D.	Kalyani publishers, New Delhi
2	Essentials of plant breeding	Singh, P	Kalyani publishers,New Delhi

Course Code	AGR205	
Course Title	Agricultural Finance and Cooperation	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the financial conditions and different types of cooperation	
Course outcomes	CO1	Students will understand the different credit needs and its role in Indian agriculture,credit analysis, sources of agricultural finance
	CO2	Students will understand how the commercial banks are working, functioning the RRB's, KCC and lead bank scheme,preparing the income statements, balance sheets and project proposal
	CO3	Students will be familiarizing about the different cooperatives working in India

Agricultural Finance and Co-Operation

Theory

UNIT-I

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.

UNIT-II

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.

UNIT-III

An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

UNIT-IV

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

1. Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise.
2. Analysis of progress and performance of cooperatives using published data.
3. Analysis of progress and performance of commercial banks and RRBs using published data.
4. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures.
5. Estimation of credit requirement of farm business – A case study.
6. Preparation and analysis of balance sheet – A case study.
7. Preparation and analysis of income statement – A case study.
8. Appraisal of a loan proposal – A case study.
9. Techno-economic parameters for preparation of projects.
10. Preparation of Bankable projects for various agricultural products and its value added products.
11. Seminar on selected topics.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Economics	Lekhi, R.K. and Singh, J	Kalyani publishers, Ludhiana
2	Principles and methods of farm management	Tandon, P.K. and Dhandyal, S.P	Kalyani publishers, Ludhiana,

Course Code	CSE231	
Course Title	Agri-Informatics	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of the Agri-Informatics subject is to introduce the students to uses of information technology in agriculture sciences.	
Course outcomes	CO1	Students will learn about MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions
	CO2	Students will learn about Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW)
	CO3	Students will learn about computer models for understanding plant processes

Agri-Informatics

Theory

UNIT-I

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.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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

1. Study of Computer Components, accessories, practice of important DOS Commands.
2. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.
3. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific document.
4. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data.
5. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.
6. Introduction to World Wide Web (WWW). Introduction of programming languages.
7. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost;
8. Computation of water and nutrient requirements of crop using CSM and IT tools.
9. Introduction of Geospatial Technology for generating valuable information for Agriculture.
10. Hands on Decision Support System. Preparation of contingent crop planning.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Computer Fundamentals	B. Ram	
2	Computers Today	Basandra	
3	Agro-informatics	G. Vanitha	New India Publishing Agency

Course Code	AGR207	
Course Title	Farm Machinery and Power	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the machinery and power unutilized in the farm.	
Course outcomes	CO1	Students will learn about different components of I.C. engine, I.C. engine terminology and solved problems
	CO2	Students will learn about air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor
	CO3	Students will learn about primary and secondary tillage implement and Implement for hill agriculture

Farm Machinery and Power

Theory

UNIT-I

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.

UNIT-II

Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines.

UNIT-III

Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system: clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement.

UNIT-IV

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

Practical

1. Study of different components of I.C. engine.

2. To study air cleaning and cooling system of engine.
3. Familiarization with clutch, transmission, differential and final drive of a tractor.
4. Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine.
5. Learning of tractor driving, Familiarization with operation of power tiller.
6. Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow.
7. Familiarization with seedcum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter.
8. Familiarization with different types of sprayers and dusters.
9. Familiarization with different intercultivation equipment,
10. Familiarization with harvesting and threshing machinery.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Farm Power and Machinery Management Vol - 1	D. N & S Mukesh Sharma	Asha Book House
2	Farm Power and Machinery	ICAR ECourse Pdf book	ICAR (Agrimoon.com

Course Code	AGR209	
Course Title	Production Technology for Vegetables and Spices	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject to know about the production technology for vegetables and species	
Course outcomes	CO1	Understand and analyze the factors that affect the distribution of the industry at the global to regional levels, from small community and roof-top gardens to large acreage, commercial production for local consumption, processing and export
	CO2	Students will assess and modify cultural practices used in the production of vegetable crops, including the integration of soil science, plant physiology, plant nutrition, agro meteorology and crop protection
	CO3	Students will understand the challenges and opportunities facing the vegetable industry in the 21st Century

Production Technology for Vegetable and Spices

Theory

UNIT-I

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices.

UNIT-II

Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol.

UNIT-III

Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot

UNIT-IV

Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables.

Practical

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Handbook of vegetable crops	Dhaliwal M.S	Kalyani Publishers. Ludhiana
2	Vegetable crops of India,	Das , P.C.,	Kalyani Publishers Ludhiana
3	Food Science	Potter, N.N	AVI Publishing Company, Connecticut.

Course Code	AGR211	
Course Title	Environmental Studies and Disaster Management	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about Environmental Studies and Disaster Management	
Course outcomes	CO1	Students will learn about environmental studies
	CO2	Students will learn about natural disasters and their management
	CO3	Students will learn about biodiersity and its conservation

Environmental Studies and Disaster Management

Theory

UNIT-I

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.

UNIT-II

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. Treats 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.

UNIT-III

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.

UNIT-IV

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 free, coal free, forest free, oil free, 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

1. Pollution case studies. Case Studies- Field work:

2. Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain,
3. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural,
4. Study of common plants, insects, birds and study of simple ecosystems-pond, river,hill slopes, etc.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Environment Education and Disaster Management	V D Harma	CBS Publisher and Distributors, New Delhi
2	Environment Engineering and Disaster Management	Sanjay K Sharma	Laxmi Publisher

Course Code	MAT209	
Course Title	Statistical Methods	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the students about the statistical methods used in the analysis of crops data	
Course outcomes	CO1	Students will learn about the basics of statistic and its use in agriculture
	CO2	They will learn how to represent the graphical data of their analysis
	CO3	They will learn about the various central tendencies and dispersion

Statistical Methods

Theory

UNIT-I

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

UNIT-II

Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation.

UNIT-III

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.

UNIT-IV

Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

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

3. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles.
4. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data).
5. Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data).
6. Correlation & Regression Analysis.
7. Application of One Sample t-test. Application of Two Sample Fisher's t-test.
8. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2 ×2 contingency table.
9. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification.
10. Selection of random sample using Simple Random Sampling

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Statistical Methods	S P Gupta	S Chand
2	Fundamentals of Mathematical Statistics	S C Gupta and V K Kapoor	Pearson Education

Course Code	AGR213	
Course Title	Livestock and Poultry Management	
Type of course	Theory & Practical	
L T P	3 0 1	
Credits	4 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the management of live stocks and poultry	
Course outcomes	CO1	Students will learn about the management of live stocks
	CO2	Students will learn about the management of poultry
	CO3	Students will learn about prevention (including vaccination schedule) and control of important diseases of livestock and poultry

Livestock & Poultry Management

Theory

UNIT I

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves,
growing heifers and milch animals.

UNIT II

Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.

UNIT III

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

UNIT IV

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

Practical

1. External body parts of cattle, buffalo, sheep, goat, swine and poultry.
2. Handling and restraining of livestock.
3. Identification methods of farm animals and poultry.
4. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.
5. Judging of cattle, buffalo and poultry.
6. Culling of livestock and poultry.
7. Planning and layout of housing for different types of livestock. Computation of rations for livestock.
8. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments.
9. Management of chicks, growers and layers.
10. Debeaking, dusting and vaccination.
11. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Handbook of Animal Husbandry	Harbans Singh	ICAR Publications New Delhi
2	Animal Husbandry	Ashok kumar	Discovery Publishing House, New Delhi

Semester IV

Course Code	AGR202	
Course Title	Crop Production Technology-II (Rabi crops)	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this course is to familiarize the students about the rabi crops and their management.	
Course outcomes	CO1	Study of crop varieties suited for different zones
	CO2	Study of morphological characteristics of rabi crops
	CO3	Study of rabi forage experiments, oil extraction of medicinal crops

Crop Production Technology-II (Rabi crops)

Theory

UNIT-I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea. lentil, peas

UNIT-II

Oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane.

UNIT-III

Medicinal and aromatic crops- mentha, lemon grass and citronella.

UNIT-IV

Forage crops-berseem, Lucerne and oat.

Practical

1. Sowing methods of wheat and sugarcane,
2. Identification of weeds in *rabi* season crops,
3. Study of morphological characteristics of *rabi* crops,
4. Study of yield contributing characters of *rabi* season crops, yield and juice quality analysis of sugarcane,
5. Study of important agronomic experiments of *rabi* crops at experimental farms.

6. Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Principles of Crop Husbandry	S R Reddy	Kalyani Publishers Ludhiana
2	Package of Practices for Rabi Crops	PAU	PAU Publications Ludhiana

Course Code	AGR204	
Course Title	Production Technology for Ornamental Crops, MAPs and Landscaping	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the Ornamental Crops, MAPs and their landscaping	
Course outcomes	CO1	Students will be able to identify different types of ornamental and medicinal crops
	CO2	Student will be able to planned and layout of garden
	CO3	Students will be able to do intercultural operations in flowers and medicinal and aromatic crops

Production Technology for Ornamental Crops, MAPs and Landscaping

Theory

UNIT I

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

UNIT II

Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected condition sand gladiolus, tuberose, chrysanthemum under open conditions.

UNIT III

Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

UNIT IV

Processing and value addition in ornamental crops and MAPs produce.

Practical

1. Identification of Ornamental plants.
2. Identification of Medicinal and Aromatic Plants.
3. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants.
4. Planning and layout of garden. Bed preparation and planting of MAP.

5. Protected structures – care and maintenance. Intercultural operations in flowers and MAP.
6. Harvesting and post-harvest handling of cut an d loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Introductory Ornamental Horticulture	Arora, J.S	Kalyani Publishers, Ludhiana
2	Flowers and Trees	Randhawa, M.S.,	National book trust-New Delhi

Course Code	AGR206	
Course Title	Renewable Energy and Green Technology	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the student about renewable Energy and Green Technology	
Course outcomes	CO1	Students will learn the environmental aspects of non-conventional energy resources.
	CO2	Students will know the need of renewable energy resources and latest developments
	CO3	Students will acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications

Renewable Energy and Green Technology

Theory

UNIT-I

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application,

UNIT-II

Familiarization with types of biogas plants and gasifiers, biogas, bio alcohol, biodiesel and bio oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application.

UNIT-III

Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application,

UNIT-IV

Introduction of wind energy and their application.

Practical

1. Familiarization with renewable energy gadgets.
2. To study biogas plants,

3. To study gasifier
4. To study the production process of biodiesel,
5. To study briquetting machine,
6. To study the production process of bio-fuels.
7. Familiarization with different solar energy gadgets.
8. To study solar photovoltaic system: solar light, solar pumping, and solar fencing.
9. To study solar cooker.
10. To study solar drying system.
11. To study solar distillation and solar pond.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Energy Technology (Non-Conventional, Renewable and Conventional)	Rao	Khanna
2	Renewable Energy: Power for a Sustainable Future	Boyle	Oxford University Press

Course Code	AGR208	
Course Title	Problematic Soils and their Management	
Type of course	Theory	
L T P	2 0 0	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to understand and solve the problems of soils and their management	
Course outcomes	CO1	Demonstrate fundamental knowledge to identify problematic soils and associated problems
	CO2	To identify processes resulting in deterioration of soil physical and chemical properties
	CO3	To use the fundamentals of soil science disciplines for the reclamation of degraded soils

Problematic Soils and their Management

Theory

UNIT-I

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties.

UNIT-II

Reclamation and management of Saline and sodic soils, Acid soils, Acid sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

UNIT-III

Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils.

UNIT-IV

Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Elements of the Nature and Properties of Soils (3rd Edition),	Brady, N. C. and Weil, R. R.,	Pearson Education, New Delhi

2	Properties and Management of Forest Soils	Pritchett and Fisher RF	John Wiley, New York
3	Soil, Plant, Water and Fertilizer Analysis (2nd Edition)	Gupta, P.K.	AGROBIOS, Jodhpur (India)
4	Soil, Plant and Water Analysis (2nd Edition),	Jaiswal, P.C.	Kalyani Publishers, Ludhiana
5	Elements of the Nature and Properties of Soils *(3rd Edition)*,	Brady, N. C. and Weil, R. R.,	Pearson Education, New Delhi.

Course Code	AGR210	
Course Title	Production Technology for Fruit and Plantation Crops	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the student about Production Technology for Fruit and Plantation Crops	
Course outcomes	CO1	Students will be able to accurately describe the supply chain of horticultural crops, including world and Indian production; peak industry bodies; industry programs; areas of priority
	CO2	Students will be able to accurately describe a wide range of tropical and dryand horticultural crops
	CO3	Students will be able to accurately describe a wide range of plantation crops

Production Technology for Fruit and Plantation Crops

Theory

UNIT-I

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits

UNIT-II

Mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond

UNIT-III

Minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry

UNIT-IV

Plantation crops-coconut, areca nut, cashew, tea, coffee & rubber.

Practical

1. Seed propagation. Scarification and stratification of seeds.
2. Propagation methods for fruit and plantation crops.
3. Description and identification of fruit.
4. Preparation of plant bio regulators and their uses.
5. Important pests, diseases and physiological disorders of above fruit and plantation crops.

6. Visit to commercial orchards.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Preservation of fruits and vegetables	Lal, G., Siddappa, S. And Tandon, G.L.	Indian Council of Agricultural Research, New Delhi
2	Fruits	Singh, R	National Book Trust of India, New Delhi
3	Principles of Horticulture.	Adams, C.R. and M. P. Early	Butterworth – Heinemam, Oxford University Press
4	Handbook of Horticulture	Chadha, K.L.	ICAR, New Delhi.

Course Code	AGR212	
Course Title	Principles of Seed Technology	
Type of course	Theory & Practical	
L T P	1 0 2	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of the seed technology subject is to understand the processing, preservation and marketing of different crops	
Course outcomes	CO1	Students will able to perform basic seed quality tests
	CO2	Students will acquire knowledge on seed legislation and trading
	CO3	Students will Gain knowledge on biological and technological aspects of seed production

Principles of Seed Technology

Theory

UNIT-I

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.

UNIT-II

Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. 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.

UNIT-III

Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production. Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.

UNIT-IV

Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Practical

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Seed Technology	R L Aggarwal	Oxford and IBH publications, New Delhi
2	Seed health testing- principal and protocol,	Vishunavat, K	Kalyani Publishers. New Delhi
3	Seed science and technology	Sen Subir, and Ghosh N	Kalyani Publishers. New Delhi

Course Code	AGR214	
Course Title	Farming System and Sustainable Agriculture	
Type of course	Theory	
L T P	1 0 0	
Credits	1 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the students about different types of farming system and sustainable agriculture.	
Course outcomes	CO1	To provide maximum possible return and profitability
	CO2	To provide an opportunity to increase economic yield
	CO3	To ensure optional utilization and conservation of available resources

Farming System and Sustainable Agriculture

Theory

UNIT-I

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

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Economics	Lekhi, R.K. and Singh, J	Kalyani publishers, Ludhiana
2	Principles and methods of farm management	Tandon, P.K. and Dhandyal, S.P	Kalyani publishers, Ludhiana,
3	Biofertilizers for Sustainable Agriculture.	Sharma, A.K.	Agrobios (India), Jodhpur.
4	Introduction to Soil Microbiology	Alexander, M.	John Wiley & Sons, Inc., New York

Course Code	AGR216	
Course Title	Agricultural Marketing, Trade and Prices	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the student about the agriculture marketing, trades and prices.	
Course outcomes	CO1	Students will learn about the agriculture marketing, trades and prices
	CO2	Students will learn about marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange
	CO3	Students will understand role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions

Agricultural Marketing, Trade and Prices

Theory

UNIT-I

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.

UNIT-II

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.

UNIT-III

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;

UNIT-IV

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

1. Plotting and study of demand and supply curves and calculation of elasticities**.**
2. Study of relationship between market arrivals and prices of some selected commodities.
3. Computation of marketable and marketed surplus of important commodities.
4. Study of price behaviour over time for some selected commodities; Construction of index numbers.
5. 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.
6. Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning.
7. Application of principles of comparative advantage of international trade.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agricultural Marketing in India,	Acharya, S.S. and Agrawal, N.L.	Oxford & IBH publishing Co. Pvt Ltd. New Delhi,
2	Agricultural Price Policy in India,	Kahlon, A.S, and Tyagi R.S.	Allied Publishers Private Limited, New Delhi.

Course Code	AGR218	
Course Title	Introductory Agrometeorology & Climate Change	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 0 0	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about agro - meteorology and climate change and their impact to the crops.	
Course outcomes	CO1	To introduce agrometeorology (definitions, aims, scope and importance)
	CO2	To understand roles of agrometeorology in agriculture and its relation to other areas of agriculture
	CO3	To acquaint with recent developments in agrometeorology with historical developments

Introductory Agro-meteorology & Climate Change

Theory

UNIT-I

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.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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 normal 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

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Fundamentals of Agro-metrology and Climate Change	Mahi, G.S. and Kingra, P. K.	Kalyani Publisher
2	Climate Change and Agriculture	G. S. L. H. V. Prasada Rao, G. G. S. N. Rao and V. U. M. Rao	Printice Hall India Learning Private Limited

Semester V

Course Code	AGR301	
Course Title	Principles of Integrated Pest and Disease Management	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3(2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this course is to familiarize the students about the pest and disease and their management in the crops	
Course outcomes	CO1	Students will learn the importance of studying the disease cycles
	CO2	Students will learn different types of symptoms during infection by various types of pathogens and the role of weather and disease forecasting before the spread of epidemics
	CO3	Students will learn prevention and control measures during the disease spread, disease cycle and integrated pest managements in cereal and millet, major oil crops, legumes and other miscellaneous crops

Principles of Integrated Pest and Disease Management

Theory

UNIT-I

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases.

UNIT-II

Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment.

UNIT-III

Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module.

UNIT-IV

Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

Practical

1. Methods of diagnosis and detection of various insect pests, and plant diseases
2. Methods of insect pests and plant disease measurement
3. Assessment of crop yield losses, calculations based on economics of IPM
4. Identification of biocontrol agents, different predators and natural enemies
5. Mass multiplication of Trichoderma, Pseudomonas, Trichogramma, NPV
6. Identification and nature of damage of important insect pests and diseases and their management.
7. Crop (agroecosystem) dynamics of a selected insect pest and diseases.
8. /Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases .
9. Awareness campaign at farmers fields.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Integrated Pest Management -concepts and Approaches	G S Dhaliwal and R Arora	Kalyani
2	Integrated Management of Insects in Stored Products	B Subramanyam and D W Hagstrum	Marcel Dekker
3	Introduction of Insect Pest management	S S Ignacimuthu and S.Jayaraj	Elite, New Delhi

Course Code	AGR303	
Course Title	Manures, Fertilizers and Soil Fertility Management	
Type of course	Theory	
L T P	2 0 1	
Credits	3(2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	To introduce basic postulates of soil fertility and nutrient management. Introduction to basic fundamentals of soil fertility and nutrient management.	
Course outcomes	CO1	Students will be aware about the management of manures, its applications and composition and different methods for its preparation.
	CO2	Students will be aware about management of fertilizers, its applications and composition and different methods for its preparation.
	CO3	Students will understand the concept of soil fertility and productivity and how it can be enhanced.

Manures, Fertilizers and Soil Fertility Management

Theory

UNIT-I

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

UNIT-II

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

UNIT-III

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.

UNIT-IV

Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Manures and Fertilizers	P. C. Das	Kalyani
2	Soil Fertility and fertilizers (5^{th} ed.)	S. L. Tisdale	Prentice Hall of India Pvt. Ltd
3	Manures and fertilizers	K S Yawalkar	Agriculture-Horticulture Publishing House, Nagpur

Course Code	AGR305	
Course Title	Pests of Crops and Stored Grains and their Management	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to manage pest of crops from stored grains and crops	
Course outcomes	CO1	To learn how to control identify the crop pest and management.
	CO2	Students must be able to understand: the ecological approach to insect pest management
	CO3	Students must be able to understand chemical control using conventional insecticides; managing stored grains pest

Pests of Crops and Stored Grains and their Management

Theory

UNIT-I

General account on nature and type of damage by different arthropods pests.

UNIT-II

Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution,

UNIT-III

nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments.

UNIT-IV

Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

1. Identification of different types of damage.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Insects and Mites of Crops in India	M.R.G.K. Nayar	ICAR, New Delhi
2	A Text Book of Entomology Vol.I & II	K.P. Shrivastava	Kalyani Publishers, New Delhi

Course Code	AGR307	
Course Title	Diseases of Field & Horticultural Crops & their Management-I	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3(2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint student about the diseases of field and horticultural crops and their management	
Course outcomes	CO1	Students will learn the importance of studying the disease cycles
	CO2	Students will learn different types of symptoms during infection by various types of pathogens and the role of weather and disease forecasting before the spread of epidemics
	CO3	Students will learn prevention and control measures during the disease spread, disease cycle and integrated pest management of horticultural crops

Diseases of Field & Horticultural Crops & their Management-I

Theory

UNIT-I

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro

UNIT-II

Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic

UNIT-III

Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight

UNIT-IV

Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Crop diseases and their management	Y S Ahlawat and S Nagarajan	Kalyani
2	Diseases of Field crops	V K Gupta & Y S Paul	Indus Publishing Co. New Delhi
3	Diseases of Fruit Crops	RS Singh 2012	Oxford and IBH Publishing Co.Pvt.Ltd. New Delhi
4	Diseases of Vegetable Crops 3rd ed.	R S Singh 1998	Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

Course Code	AGR309	
Course Title	Crop Improvement – I (Kharif crops)	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the student about the improvement of the kharif crops	
Course outcomes	CO1	Students will learn about modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options
	CO2	Students will learn about centers of origin/ diversity, components of Genetic variation; Heritability and genetic advance
	CO3	Students will able to understandgGenetic basis and methods of breeding cross pollinated crops, modes of selection

Crop Improvement – I (Kharif crops)

Theory

UNIT-I

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

UNIT-II

Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops

UNIT-III

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)

UNIT-IV

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

Practical

1. Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Maize,

2. Floral biology, emasculation and hybridization techniques in different crop species; viz Sorghum, Pearl millet
3. Floral biology, emasculation and hybridization techniques in different crop species; viz Ragi, Pigeonpea, Urdbean, Mungbean,
4. Floral biology, emasculation and hybridization techniques in different crop species; viz Soybean, Groundnut, Seasame, Caster, Cotton,
5. Floral biology, emasculation and hybridization techniques in different crop species; viz Cowpea, Jute, Tobacco, Brinjal, Okra and Cucurbitaceous crops.
6. Maintenance breeding of different kharif crops.
7. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods;
8. Study of field techniques for seed production and hybrid seeds production in Kharif crops;
9. Estimation of heterosis, inbreeding depression and heritability;
10. Layout of field experiments;
11. Study of quality characters, donor parents for different characters;
12. Visit to seed production plots; Visit to AICRP plots of different field crops.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Crop Improvement: Challenges in the Twenty-first century (Edt.)	Manjit S. Kang	International Book Distributing Co. Lukhnow
2	Breeding Technology of Crop Plants (Edt.).	A.K. Sharma	Yash Publishing House, Bikaner

Course Code	AGR311	
Course Title	Entrepreneurship Development and Business Communication	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective this subject is to build the possibility of entrepreneurship development and business communication so that he can take bold decision and become self-reliant	
Course outcomes	CO1	Student will able to know the parameters to assess opportunities for new besiness ideas
	CO2	Students will able to design strategies for successful implementation of ideas
	CO3	Students will able to build the possibility of entrepreneurship development

Entrepreneurship Development and Business Communication

Theory

UNIT-I

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development,

UNIT-II

Impact of economic reforms on Agribusiness/ Agri enterprises, Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)

UNIT-III

Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill

UNIT-IV

Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri entrepreneurship and rural enterprise.

Practical

1. Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation

2. Exercise in creativity, time audit through planning, monitoring and supervision
3. Identification and selection of business idea
4. preparation of business plan and proposal writing
5. visit to entrepreneurship development institute and entrepreneurs

/

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Entrepreneurship Development and Communication skills	R. R. Chole and P.S. Kapse	Scientific Publishers (India) Jodhpur
2	A text book of Agricultural Extension Management	C Karthikeyan *et al*	Atlantic Publishers, New Delhi

Course Code	AGR313	
Course Title	Geoinformatics, Nano-technology and Precision Farming	
Type of course	Theory	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is familiarize the student about the latest technology of geo information, nanotechnology and precision farming	
Course outcomes	CO1	Student will able to know the Precision agriculture: concepts and techniques
	CO2	Students will able to understand nanotechnology, concepts and techniques applied in agriculture
	CO3	Students will able to understand the image processing and interpretation; Global positioning system (GPS), components and its functions

Geoinformatics, Nano-technology and Precision Farming

Theory

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

1. Introduction to GIS software, spatial data creation and editing.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	An introduction to Geo informatics	G.S. Shrivastava 2014	McGrew Hill Education(India)Pvt Ltd.
2	Applied Nanotechnology in Agriculture	S. Choudhary	Arise Publishers & Distributors
3.	Principles of Geo informatics	R K Gupta	Jain Brothers, New Delhi

Course Code	AGR315	
Course Title	Practical Crop Production-I (Kharif Crops)	
Type of course	Practical	
L T P	0 0 2	
Credits	2 (0+2)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main of objective of this subject is to give experience of crop production in the field to the students	
Course outcomes	CO1	Students will learn field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management
	CO2	Students will learn management of insect pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce
	CO3	Students will learn about preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students

Practical Crop Production-I (Kharif Crops)

Practical

1. Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management
2. Management of insect-pests diseases of crops, harvesting,
3. Threshing, drying winnowing, storage and marketing of produce.
4. 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.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Principles and practices of Agronomy	P Subramaniyan	Agribios (India), Jodhpur
2	Manures and Fertilizers (10^{th} ed.)	K S Yawalkar & J.P. Aggarwal	Agri-Horticultural Publishing House, Nagpur

Course Code	AGR317	
Course Title	Intellectual Property Rights	
Type of course	Theory	
L T P	1 0 0	
Credits	1 (1+0)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the technical difficulties in world trades and intellectual property rights followed all over the world	
Course outcomes	CO1	To impart the skills in intellectual property, GATT, WTO, TRIPs and WIPO, Treaties for IPR protection
	CO2	To impart UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India
	CO3	Students will learn about traditional knowledge-meaning and rights of TK holders

Intellectual Property Rights

Theory

UNIT-I

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.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Law Relating to Intellectual Property Rights	V K Ahuja	Jain Book Agency
2	Intellectual Property Rights	Neeraj Pandey and Khushdeep Dharni	UBS

Semester VI

Course Code	AGR302	
Course Title	Rainfed Agriculture and Watershed Management	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2(1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is familiarize the student about rainfed agriculture and watershed management	
Course outcomes	CO1	Students will able to identify the Soil and climatic conditions prevalent in rainfed areas
	CO2	Students will able to understand various water harvesting: importance, its techniques, efficient utilization
	CO3	Students will understand the contingent crop planning for aberrant weather conditions

Rainfed Agriculture and Watershed Management

Theory

UNIT-I

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India

UNIT-II

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

UNIT-III

Water harvesting: importance, its techniques, efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas,

UNIT-IV

Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

1. Studies on climate classification,
2. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1.	Dryland Agriculture	C Jayanthi & R Kalpana 2016	Kalyani Publishers
2.	Crop Management under Irrigated and Rainfed Conditions	S S Singh	Kalyani Publishers
3.	Sustainable Development of Dryland Agriculture in India	R P Singh	Scientific Publishers, Jodhpur

Course Code	AGR304	
Course Title	Protected Cultivation and Secondary Agriculture	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint students about new technology of protected cultivation to make the agriculture more sustainable	
Course outcomes	CO1	Students will able to perform protected cultivation practices
	CO2	Students will able to perform post harvest practices
	CO3	Students will able to understand types of Green Houses; Plant response to Green house environment

Protected Cultivation and Secondary Agriculture

Theory

UNIT-I

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment

UNIT-II

Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying.

UNIT-III

Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

UNIT-IV

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Greenhouse Technology-Applications and Practices	A Sharma and V Salokhe	Agro Tech publication,Udaipur
2	Greenhouse: Science and Technology	S.S.Kothari	Himanshu publication, Udaipur

Course Code	AGR306	
Course Title	Diseases of Field & Horticultural Crops & their Management-II	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the diseases in fields and horticulture	
Course outcomes	CO1	Students will learn the importance of studying the disease cycles
	CO2	Students will learn different types of symptoms during infection by various types of pathogens and the role of weather and disease forecasting before the spread of epidemics
	CO3	Students will learn prevention and control measures during the disease spread, disease cycle and integrated pest management of horticultural crops

Diseases of Field & Horticultural Crops & their Management-II

Theory

UNIT-I

Symptoms, etiology, disease cycle and management of following diseases: Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng.

UNIT-II

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

UNIT-III

Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot.

UNIT-IV

Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies:

anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

1. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.
2. Field visit for the diagnosis of field problems.
3. Collection and preservation of plant diseased specimens for herbarium.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Crop diseases and their management	Y S Ahlawat and S Nagarajan	Kalyani
2	Diseases of Field crops	V K Gupta & Y S Paul	Indus Publishing Co. New Delhi
3	Diseases of Fruit Crops	R S Singh 2012	Oxford and IBH Publishing Co.Pvt.Ltd. New Delhi
4	Diseases of Vegetable Crops 3rd ed.	R S Singh 1998	Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi

V

Course Code	AGR308	
Course Title	Post-harvest Management and Value Addition of Fruits and Vegetables	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the student about the post-harvest management and value addition of fruits and vegetables	
Course outcomes	CO1	Students will understand importance and use of processing and value addition of fruits and vegetables
	CO2	Students will identify the post harvest diseases
	CO3	Students will identify the physiological disorders of horticultural crops and perform post harvest practices.

Post-harvest Management and Value Addition of Fruits and Vegetables

Theory

UNIT-I

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;

UNIT-II

Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation

UNIT-III

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

1. Applications of different types of packaging, containers for shelf life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.

4. Extraction and preservation of pulps and juices.
5. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products.
6. Quality evaluation of products -- physico-chemical and sensory.
7. Visit to processing unit/ industry.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Post-harvest Management and Value Addition of Fruits and Vegetables	Asha Kumari	Enkay Publishing House
2	Postharvest Management and processing of Fruits and Vegetables- Instant notes	S K Sharma	New India Publishing Agency

Course Code	AGR310	
Course Title	Management of Beneficial Insects	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to learn about the management of beneficial insects by the students	
Course outcomes	CO1	Students will understand importance of beneficial Insects, beekeeping and pollinators
	CO2	Students will identify diseases of beneficial insect and their management.
	CO3	Students will understand the silkworm, voltinism and biology of silkworm. Mulberry cultivation.

Management of Beneficial Insects

Theory

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Practical

1. Honey bee species, castes of bees.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1.	Biological Control by Natural enemies	P. DeBach	Cambridge University Press
2.	Integrated Pest Management: Concepts and approaches	G S Dhaliwal & R. Arora 2001	Kalyani Publishers
3.	A text book of Entomology	K P Shrivastava Vol.I	Kalyani Publishers, New Delhi

Course Code	AGR312	
Course Title	Crop Improvement – II (Rabi)	
Type of course	Theory	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to learn about the rabi crop improvement	
Course outcomes	CO1	Students will learn centers of origin, distribution of species, wild relatives in different crops
	CO2	Students will learn plant genetic resources, its utilization and conservation
	CO3	Students will learn about major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties

Crop Improvement – II (Rabi)

Theory

UNIT-I

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops

UNIT-II

Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters;

UNIT-III

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);

UNIT-IV

Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

Practical

1. Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion;

2. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods;
3. Study of field techniques for seed production and hybrid seeds production in Rabi crops; Estimation of heterosis, inbreeding depression and heritability;
4. Layout of field experiments; Study of quality characters,
5. Study of donor parents for different characters;
6. Visit to seed production plots; Visit to AICRP plots of different field crops

Recommended Books:

S.No.	Name	Author(S)	Publisher
1.	Biological Control by Natural enemies	P. DeBach	Cambridge University Press
2.	Integrated Pest Management: Concepts and approaches	G S Dhaliwal & R. Arora 2001	Kalyani Publishers
3.	A text book of Entomology	K P Shrivastava vol.I	Kalyani Publishers, New Delhi

Course Code	AGR314	
Course Title	Practical Crop Production-II (Rabi Crops)	
Type of course	Practical	
L T P	0 0 2	
Credits	2 (0+2)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to impart practical knowledge of crop production in rabi crops	
Course outcomes	CO1	Students will learn field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management
	CO2	Students will learn management of insect pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce
	CO3	Students will learn about preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students

Practical Crop Production-II (Rabi Crops)

Practical

1. Crop planning, raising field crops in multiple cropping systems:
2. 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.
3. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies.
4. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Crop Improvement: Challenges in the Twenty-first century (Edt.)	Manjit S. Kang	International Book Distributing Co. Lukhnow
2	Breeding Technology of Crop Plants (Edt.).	A.K. Sharma	Yash Publishing House, Bikaner

Course Code	AGR316	
Course Title	Principles of Organic Farming	
Type of course	Theory & Practical	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main object this subject is to acquaint students about the organic farming and reduce the impact of poisonous and harmful fertilizers and pesticides	
Course outcomes	CO1	Students will identify and explain the key principles and practices involved in maintaining soil fertility
	CO2	Explain plant productivity and health in organic systems
	CO3	Explain the role of livestock and forage production in organic farming systems

Principles of Organic Farming

Theory

UNIT-I

Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture;

UNIT -II

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;

UNIT-III

Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP;

UNIT-IV

Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Organic Farming for Sustainable Agriculture (2nd edition)	A K Dharma	Agrobios (India), Jodhpur
2	Organic Farming in India, Problems and Prospects , Agertech	U Thapa and P. Tripathy	Publishing Academy , Udaipur
3.	A Handbook of Organic Farming	Arun K.Sharma	Agrobios(India),Jodhpur

Course Code	AGR318	
Course Title	Farm Management, Production and Resource Economics	
Type of course	Theory	
L T P	1 0 1	
Credits	2 (1+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to make understanding in the students about the farm management, production and resource economics	
Course outcomes	CO1	Students will know about concept farm management, objectives and relationship with other sciences.
	CO2	Identification use of production function in decision-making on a farm, factor-product, factor-factor and product relationship
	CO3	Students will be able to discuss Farm business analysis: meaning and concept of farm income and profitability

Farm Management, Production and Resource Economics

Theory

UNIT-I

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

UNIT-II

Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.

UNIT-III

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.

UNIT-IV

Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

1. Preparation of farm layout.
2. Determination of cost of fencing of a farm.
3. Computation of depreciation cost of farm assets.
4. 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.
5. Determination of least cost combination of inputs. Selection of most profitable enterprise combination.
6. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.
7. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.
8. Collection and analysis of data on various resources in India.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Principles and Methods of Farm Management	R. K. Tandan & S.P. Dhondiyal	Kalyani
2	Fundamental of Farm Business Management	S.S. Johl and T.P. Kapoor	Kalyani

Course Code	AGR320	
Course Title	Principles of Food Science and Nutrition	
Type of course	Theory	
L T P	2 0 0	
Credits	2 (2+0)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the students about the principles of food science and nutrition	
Course outcomes	CO1	Students will learn about the food science, food composition and chemistry water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactive, important reactions.
	CO2	Identification use food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods
	CO3	Students will be able to discuss food and nutrition, malnutrition (over and under nutrition), nutritional disorders

Principles of Food Science and Nutrition

Theory

UNIT-I

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.).

UNIT-II

Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).

UNIT-III

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.)

UNIT-IV

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.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Food Science and Nutrition (second edition)	Sunetra Roday	Oxford
2	Food facts and Principles	N. Shakuntala Manay	New Age

Scheme of Courses B. Sc. (Hons.) Agriculture Semester VII							
S. No.	**Subject/ Paper Code**	**Subject Name**	**Contact Hours (Lecture)**	**Contact Hours (Tutorial)**	**Contact Hours (Practical)**	**Total Contact Hours**	**Total Credit Hours**
1 2 3	**AGR401**	General orientation & On campus training by different faculties Village attachment Unit attachment in Univ./ College. KVK/ Research Station Attachment	0	1	28	28	14
4	**AGR403**	Plant clinic	0	1	2	2	2
5	**AGR405**	Agro-Industrial Attachment	0	1	4	4	4
			0	**0**	**34**	**34**	**20**

Agro- Industrial Attachment: The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working. Educational tour will be conducted in break between IV & V Semester or 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 y Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.

Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processingvalue addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

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

Scheme of Courses B. Sc. (Hons.) Agriculture
Semester VIII

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.**

- **Note:** SBBSU University will offer the modules depending upon the availability of sources/ faculty (specialization of available faculty).

S. No.	Subject/ Paper Code	Subject/Module Name	Contact Hours (Lecture)	Contact Hours (Tutorial)	Contact Hours (Practical)	Total Contact Hours	Total Credit Hours
1	**AGR402**	Production Technology for Bioagents and Biofertilizer	0	1	20	20	0+10
2	**AGR404**	Seed Production and Technology	0	1	20	20	0+10
3	**AGR406**	Mushroom Cultivation Technology	0	1	20	20	0+10
4	**AGR408**	Soil, Plant, Water and Seed Testing	0	1	20	20	0+10
5	**AGR410**	Commercial Beekeeping	0	1	20	20	0+10
6	**AGR412**	Poultry Production Technology	0	1	20	20	0+10
7	**AGR414**	Commercial Horticulture	0	1	20	20	0+10
8	**AGR416**	Floriculture and Landscaping	0	1	20	20	0+10
9	**AGR418**	Food Processing	0	1	20	20	0+10
10	**AGR420**	Agriculture Waste Management	0	1	20	20	0+10
11	**AGR422**	Organic Production Technology	0	1	20	20	0+10
12	**AGR414**	Commercial Sericulture	0	1	20	20	0+10

Sl. No.	Title of the module	Credits
1	Production Technology for Bioagents and Biofertilizer	0+10
2	Seed Production and Technology	0+10
3	Mushroom Cultivation Technology	0+10
4	Soil, Plant, Water and Seed Testing	0+10
5	Commercial Beekeeping	0+10
6	Poultry Production Technology	0+10
7	Commercial Horticulture	0+10
8	Floriculture and Landscaping	0+10
9	Food Processing	0+10
10	Agriculture Waste Management	0+10
11	Organic Production Technology	0+10
12	Commercial Sericulture	0+10

NOTE: In addition to above ELP modules other important modules may be given to the students by SAUs

Evaluation of Experiential Learning Programme/ HOT

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

9.	Report Writing Skills	10
10	Final Presentation	10
	Total	100

SYLLABUS OF ELECTIVE COURSES

A student can select one elective courses out of the following and offer each during 4th, 5th and 6th semesters.

NOTE: The Student of 6th semester should prefer 2+1 course (3 credits course).

Course Code	AGR220	
Course Title	Commercial Plant Breeding	
Type of course	Theory & Practical	
L T P	1 0 2	
Credits	3 (1+2)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the student about the commercial plant breeding techniques which are used to produce new high yielding varieties by the industries	
Course outcomes	CO1	Students will understand the aims and objectives of commercial plant breeding
	CO2	Students will understand principles and techniques of hybrid seed production and registration
	CO3	Students will understand intellectual property rights

Commercial Plant Breeding

Theory

UNIT-I

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.

UNIT-II

Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.

UNIT-III

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.

UNIT-IV

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

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

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Plant Breeding	Singh, B.D	Kalyani Publishers. New Delhi
2	Principles of Plant Genetics and Breeding (Second Edition)	George Acquaah	John Wiley & Sons Ltd.

Course Code	AGR222	
Course Title	Biopesticides & Biofertilizers	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objectives of this subject is to familiarize the students about the biopesticides and biofertilizers which are free from harmful chemicals and more environment friendly and future of the crop production	
Course outcomes	CO1	Students will learn about biopesticides. importance, scope and potential of biopesticides
	CO2	Students will be aware about bio fertilizers its status and scope. characteristic features of various bacterial bio fertilizers.
	CO3	Students will be aware about production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier

Biopesticides & Biofertilizers

Theory

UNIT-I

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and bio rationales. Botanicals and their uses.

UNIT-II

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 biopesticides.

UNIT-III

Bio fertilizers - Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza. Nitrogen fxation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.

UNIT-IV

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. Bio fertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of bio fertilizers.

Practicals

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

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Biofertilizers and Biopesticides	Channabasava A and Lakshman, H. C.	Pointers Publishers
2	Biofertilizers and Biopesticides	Shalini Suri	Aph Publishing Corporation

Course Code	AGR224	
Course Title	Protected Cultivation	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to let student learn about protected farming to produce cash and medicinal crops with new and advanced technology.	
Course outcomes	CO1	Students will be aware about the protected cultivation, cladding material involved in greenhouse/ poly house.
	CO2	Students will be aware about the irrigation and fertigation management in polyhouse.
	CO3	Students will understand the concept of cultivation of economically important medicinal and aromatic plants.

Protected Cultivation

Theory

UNIT-I

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate.

UNIT-II

Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, Portrays lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers.

UNIT-III

Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.

UNIT-IV

Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

1. Raising of seedlings and saplings under protected conditions, use of Portrays in quality planting material production,
2. Bed preparation and planting of crop for production,
3. Inter cultural operations, Soil EC and pH measurement,
4. Regulation of irrigation and fertilizers through drip, fogging ad misting.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Greenhouse Technology-Applications and Practices	A Sharma and V Salokhe	Agro Tech publication, Udaipur
2	Greenhouse: Science and Technology	S.S. Kothari	Himanshu publication, Udaipur
3	Protected Cultivation of Vegetables Crops	Balraj Singh	Kalyani Publishers
4	Protected Cultivation of Horticultural Crops	D K Singh and K V Peter	New India Publishing Agency

Course Code	AGR226	
Course Title	Micro propagation Technologies	
Type of course	Theory & Practical	
L T P	3 0 2	
Credits	3 (1+2)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to learn about the tissue culture and micro propagation technology	
Course outcomes	CO1	Students will be aware about types of cultures (seed, embryo, organ, callus, cell)
	CO2	Students will be aware about Stages of micropropagation, axillary bud proliferation
	CO3	Students will understand the concept of organogenesis (callus and direct organ formation), somatic embryogenesis, cell suspension cultures.

Micro propagation Technologies

Theory

UNIT-I

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell),

UNIT-II

Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture),

UNIT-III

Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures,

UNIT-IV

Production of secondary metabolites, Somaclonal variation, Cryopreservation

Practical

1. Identification and use of equipments in tissue culture Laboratory,
2. Nutrition media composition, sterilization techniques for media, containers and small instruments,

3. Sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium,
4. Culturing of explants: Seeds, shoot tip and single node, Callus induction,
5. Induction of somatic embryos regeneration of whole plants from different explants,
6. Hardening procedures.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Plant Tissue Culture	S Kumar	Scientific Publishers Journals Dept
2	Introduction to plant tissue culture	M K Razdan	Science Pub Inc

Course Code	AGR319	
Course Title	Hi-tech. Horticulture	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students about latest technology in the field of horticulture.	
Course outcomes	CO1	Students will understand nursery management and mechanization; micro propagation of horticultural crops
	CO2	Students will learn basic modern field preparation and planting methods, protected cultivation
	CO3	Students will learn different methods and components of precision farming: Remote sensing, Geographical Information System (GIS)

Hi-tech. Horticulture

Theory

UNIT-I

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops.

UNIT-II

Modern field preparation and planting methods, protected cultivation: advantages, controlled conditions, method and techniques.

UNIT-III

Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding.

UNIT-IV

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

1. Types of polyhouses and shade net houses,
2. Intercultural operations, tools and equipments identification and application,
3. Micro propagation,
4. Nursery-protrays, micro-irrigation,

5. EC, pH based fertilizer scheduling,
6. Canopy management,
7. Visit to hi-tech orchard/nursery.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Hi Tech Horticulture	S Parsad, Dharam Singh and B L Bhardwaj	Agro Bios
2	Greenhouse Management for Horticulture Crops	S Prasad and U Kumar	Agro Bios

Course Code	AGR321	
Course Title	Weed Management	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to let learn the student about the management of weeds with different technique	
Course outcomes	CO1	Students will able to understand the cycle of weeds and crop weed competition, different methods of weed control
	CO2	Students will understand integrated weed management, classifications and formulations of herbicides
	CO3	Students will identify aquatic and problematic weed and their control

Weed Management

Theory

UNIT-I

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds.

UNIT-II

Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity.

UNIT-III

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.

UNIT-IV

Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical

1. Techniques of weed preservation. Weed identification and their losses study.
2. Biology of important weeds.
3. Study of herbicide formulations and mixture of herbicide.
4. Herbicide and agrochemicals study.

5. Shift of weed flora study in long term experiments.
6. Study of methods of herbicide application, spraying equipments.
7. Calculations of herbicide doses and weed control efficiency and weed index.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	A Text Book of Weed Management	B L Jana	Pointer
2	Weed Management	R K Pawar	ABD Publisher

Course Code	AGR323	
Course Title	System Simulation and Agroadvisory	
Type of course	Theory	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to introduce the students about the system simulation and agro advisory which helps the farmer about the early warning about the disease and climate and let the farmer ready reduces the losses	
Course outcomes	CO1	Students will able to understand the system approach for representing soil-plant-atmospheric continuum, system.
	CO2	Students will understand crop models, concepts & techniques, types of crop models, data requirements, relational diagrams
	CO3	Students will able to understand the weather forecasting, types, methods, tools & techniques

System Simulation and Agroadvisory

Theory

UNIT-I

System Approach for representing soil-plant-atmospheric continuum, system boundaries.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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

1. Preparation of crop weather calendars.

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Fundamentals of Agro-metrology and Climate Change	Mahi, G.S. and Kingra, P. K.	Kalyani Publisher
2	Climate Change and Agriculture	G. S. L. H. V. Prasada Rao, G. G. S. N. Rao and V. U. M. Rao	Printice Hall India Learning Private Limited
3	A text book on Agricultural Meteorology	Ram Nivas, Surender Singh,Diwan Singh, Khichar Ml and Raj Singh	CCS, HAU, Hissar

Course Code	AGR325	
Course Title	Agricultural Journalism	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to acquaint the students about the agriculture journalism	
Course outcomes	CO1	Students will able to understand agricultural journalism.
	CO2	Students will understand newspapers and magazines as communication media.
	CO3	Students will able to understand writing the story: organizing the material, treatment of the story.

Agricultural Journalism

Theory

UNIT-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.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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

1. Practice in interviewing.
2. Covering agricultural events.
3. Abstracting stories from research and scientific materials and from wire services.
4. Writing different types of agricultural stories.
5. Selecting pictures and artwork for the agricultural story.
6. Practice in editing, copy reading, headline and title writing, proofreading, lay outing.
7. Testing copy with a readability formula.
8. Visit to a publishing office.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Agricultural Journalism	B L Jana	ATPA
2	Farm Journalism and Media Management	C Bhaskaran	Agrotech publishing Academy

Course Code	AGR322	
Course Title	Agribusiness Management	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is to familiarize the student about the agri business management which enables him to set commercial agribusiness of big farms	
Course outcomes	CO1	Students will get knowledge about Importance of agribusiness management in the Indian economy, Management structure and definitions, capitol management and financial management
	CO2	Students will learn types of agro-based industries, different marketing systems, different pricing systems and procedure for setting up a agro based industry
	CO3	Students will learn method of making of balance sheets, profit and loss statements

Agribusiness Management

Theory

UNIT-I

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy.

UNIT-II

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 and support primary activities and their linkages.

UNIT-III

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.

UNIT-IV

Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Agribusiness Management	Freddie L. Barnard, Jay T. Akridge and Frank J. Dooley	Routledge
2	Principles of agribusiness management	James G Beierlein	Waveland Press

Course Code	AGR324	
Course Title	Agrochemicals	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	Main objective of this subject is familiarize the students about the different types of agro chemicals used in the form of insecticides, pesticides and fertilizers	
Course outcomes	CO1	Students will understand the agrochemicals, their type and role in agriculture.
	CO2	Students will learn about herbicides-major classes, properties and important herbicides.
	CO3	Students will learn different fertilizers and their importance.

Agrochemicals

Theory

UNIT-I

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

UNIT-II

Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides-Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.

UNIT-III

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

UNIT-IV

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers.

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

Practical

1. Sampling of fertilizers and pesticides.
2. Pesticides application technology to study about various pesticides appliances.
3. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer.
4. Calculation of doses of insecticides to be used.
5. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea.
6. Estimation of water soluble P2O5 and citrate soluble P2O5 in single super phosphate.
7. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer.
8. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide.
9. Determination of thiram. Determination of ziram content.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Agro Chemical Industries	EIRI	
2	Manures, Fertilizers and Agrochemicals	ECource ICAR	ICAR

Course Code	AGR326	
Course Title	Landscaping	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	The main objective of this subject is to know about the landscaping	
Course outcomes	CO1	Student will be able to landscaping terrace gardening, vertical gardening, garden components, adornments etc.
	CO2	Students will learn about climber and creepers: importance, selection, propagation, planting.
	CO3	Students will learn different landscaping of urban and rural areas.

Landscaping

Theory

UNIT-I

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

UNIT-II

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.

UNIT-III

Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management.

UNIT-IV

Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

1. Identification of trees, shrubs, annuals, pot plants;
2. Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting,

3. Identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance,
4. layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house.
5. Use of computer software, visit to important gardens/ parks/ institutes.

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	Garden Design and Landscaping	Rachel Mathews	Successful garden Design
2	Introductory Ornamental Horticulture	Arora, J.S	Kalyani Publishers, Ludhiana
3	Flowers and trees	Randhawa, M.S.,	National book trust-New Delhi

Course Code	AGR328	
Course Title	Food Safety and Standards	
Type of course	Theory & Practical	
L T P	2 0 1	
Credits	3 (2+1)	
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent	
Course objective	The main objective of this subject is to know about the landscaping	
Course outcomes	CO1	Students will understand the food safety, hazards and risks, types of hazards - biological, chemical, physical hazards.
	CO2	Students will understand food storage, product design. hygiene and sanitation
	CO3	Students will understand food laws and standards Indian food regulatory regime

Food Safety and Standards

Theory

UNIT-I

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control.

UNIT-II

Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene.

UNIT-III

Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.

UNIT-IV

Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

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

Recommended Books:

S.No.	Name	Author(S)	Publisher
1	The Food Safety and Standard Act 2006	A Sharma and V Salokhe	Commercial law Publishers
2	Food Safety and Standard Act, Rules and Regulation	Kumar Jain and Vidhi Jain	Akalank Publications