

DAV UNIVERSITY, JALANDHAR



FACULTY OF AGRICULTURAL SCIENCES
AND
TECHNOLOGY

COURSE CURRICULUM

FOR

B.Sc. AGRICULTURE (HONOURS)

(4 Years Course)

1st to 8th SEMESTER

1. Mode of Admission: Entrance examination for seats filled by ICAR. DAVU may follow entrance examination or merit at 10+2 or a combination.

2. Reservation of seats: Reservation of seats shall be governed by the rules of State government.

3. Semester Duration: The minimum duration of 110 working days, consisting of 95 instructional days and 15 examination days.

4. Credit Definition: One credit is defined as one-hour lecture/2 hours lab/3 hours field work per week.

5. Attendance

- 75 percent

- Relaxation in minimum attendance requirement should be given only in the case of indoor hospitalization.

6. Maximum Permissible Course Workload

27 credits per semester

7. Course Curriculum and minimum credits requirement

- The minimum credit requirement for the graduate degree should be 160 credits excluding non-credit courses for language, physical education/NCC/NSS

Semester 1 (For Academic Batch 2013-14)

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1	AGR 101	Introductory Agriculture and Principles of Agronomy	3	0	0	3	25	25	25	25	75
2	AGR 103	Fundamentals of Soil Science and soil water and conservation engineering	4	0	0	4	25	25	25	25	100
3	AGR 108	Principles of Agronomy Laboratory	0	0	2	1				25	25
4	AGR 110	Fundamentals of soil, water and conservation engineering Laboratory	0	0	2	1				25	25
5	AGR 109	Introduction to Soil Science Laboratory	0	0	2	1				25	25
6	AGR 106	Principles of Genetics	2	0	0	2	25	25	25	25	50
7	AGR 112	Principles of Genetics lab	0	0	1	1				25	25
8	AGR 105	Plant Pathogens and Principles of Plant Pathology	3	0	0	3	25	25	25	25	75
9	AGR 111	Plant Pathogens and Principles of Plant Pathology Lab	0	0	1	1				25	25
10	AGR 107	Principles of Agril. Economics	2	0	0	2	25	25	25	25	50
11	ENG 151	Basic Communication Skills in English	4	0	0	4	25	25	25	25	100
12	SGS 102	General Knowledge and Current Affairs	2	0	0	0	25	25	25	25	50
			20	0	8	25					625

* The students with PCM in 10 +2 has to register General Botany and General Zoology

** The students with PCB in 10 +2 has to register Basic Mathematics.

The students with both PCMB has the option to opt for any of these courses.

Note1: BOT 155, SGS 102, SGS104 and MTH 170 are Non-credit courses so credits and weightage is not added to core courses.

Note2: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

BOT 155 comprises of Theory course BOT 155 and Laboratory course BOT 156

SGS 104 comprises of Theory course SGS 104 and Laboratory course SGS 105

Note: 1. Students of Academic year 2013-14 has studied **AGR 103** which comprises of Introduction to Soil Science and Fundamentals of soil water conservation and engineering which are otherwise **AGR 113** and **AGR 114** under normal circumstances.

2. AGR 106 and AGR 112 read by 2013-14 batch is equivalent to AGR 112 for other batches.

3. AGR 105 and AGR 111 read by 2013-14 batch is equivalent to AGR 115 for other batches.

4. ENG 151 read by 2013-14 batch is equivalent to ENG 153 and ENG 154 for other batches.

5. AGR 107 read by 2013-14 batch is equivalent to AGR 124 for other batches.

Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)
Semester 2 (2013-14 Batch)

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 121	Introductory Nematology	1	1	1	2	20	20	20	20	20	50
2	ECO 151	Statistics	3	0	0	3	25	25	25	25		75
3	AGR 122	Water management including micro irrigation	2	1	1	3	20	20	20	20	20	75
4	AGR 123	Principles of Seed Technology	2	1	1	3	20	20	20	20	20	75
5	AGR 125	Dimensions of Agril. Extension	1	1	1	2	20	20	20	20	20	50
6	AGR 126	Agricultural Microbiology	2	0	1	3	20	20	20	20	20	75
7	CSA 155	Introduction to computer application	1	0	1	2	20	20	20	20	20	50
8	AGR 127	Soil Chemistry, Soil Fertility and Nutrient Management	2	1	1	3	20	20	20	20	20	75
9	AGR 128 †	Principles of Agricultural Meteorology	2	0	1	3	20	20	20	20	20	75
10	ZOO 152*	General Zoology	2	0	1	0	20	20	20	20	20	75
11	BOT 155*	General Botany	2	0	1	0	20	20	20	20	20	75
12	MTH 170	Basic Mathematics**	2	0	0	0	25	25	25	25		50
			16	5	7	23						600

- A: Continuous Assessment: Based on Objective Type & Subjective Type Test
 B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type & Subjective Type Test
 F: Practical Exam: Based on Continuous Assessment and Exam.
 E: Total Weightage
L: Lectures T: Tutorial P: Practical Cr: Credits

* The students with PCM in 10 +2 has to register General Botany and General Zoology
ZOO 152 and ZOO 153 are Non-credit courses so credits and weightage is not added to core courses.

† **AGR 128** is the additional course for first batch of Academic year 2013-14. This batch has read **AGR 101** which comprises of Principles of Agronomy and Introductory Agriculture (Ancient, Heritage, Agriculture, Scenario and gender equity in Agriculture) which are otherwise **AGR 111** and **AGR 117** under normal circumstances.

CSA 155 comprises of Theory course CSA 155 and Laboratory course CSA 156

ZOO 152 comprises of Theory course ZOO 152 and Laboratory course ZOO 153

BOT 155 comprises of Theory course BOT 155 and Laboratory course BOT 156

Note: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)

Semester 3

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 211	Field Crops-I (Kharif)	2	1	1	3	20	20	20	20	20	75
2	AGR 212	Principles of Plant Breeding	2	1	1	3	20	20	20	20	20	75
3	AGR 213	Insect Morphology and Systematics	2	1	1	3	20	20	20	20	20	75
4	AEC 211	Agricultural Finance and Co-operation	1	1	1	2	20	20	20	20	20	50
5	AGR 214	Farm power and machinery	1	1	1	2	20	20	20	20	20	50
6	AGR 215	Production Technology of Vegetables & Flowers	2	1	1	3	20	20	20	20	20	75
7	AGR 216	Livestock Production and Management	2	0	1	3	20	20	20	20	20	75
8	AGR 217	Organic Farming	2	1	1	3	20	20	20	20	20	75
9	AGR 218	Crop Physiology	2	0	1	3	20	20	20	20	20	75
			16	7	9	25						625

- A: Continuous Assessment: Based on Objective Type & Subjective Type Test
 B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type & Subjective Type Test
 F: Practical Exam: Based on Continuous Assessment and Exam.
 E: Total Weightage
L: Lectures T: Tutorial P: Practical Cr: Credits

Note: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)

Semester 4

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 221	Field crops-II (Rabi)	2	1	1	3	20	20	20	20	20	75
2	AGR 222	Manures, Fertilizers and Agrochemicals	2	1	1	3	20	20	20	20	20	75
3	AGR 223	Insect Ecology & Integrated pest management including beneficial insects	2	1	1	3	20	20	20	20	20	75
4	AEC 221	Agricultural marketing, Trade and Prices	2	0	1	3	20	20	20	20	20	75
5	AGR 224	Protected cultivation and Post-harvest Technology	1	1	1	2	20	20	20	20	20	50
6	AGR 225	Diseases of Field Crops and their management	2	1	1	3	20	20	20	20	20	75
7	AGR 226	Production technology of spices, Aromatics Medicinal and Plantation crops	2	1	1	3	20	20	20	20	20	75
8	SGS 101*	Human Values and Ethics	2	0	0	0	25	25	25	25		50
9	AGR 228	Production technology of fruit crops	2	1	1	3	20	20	20	20	20	75
			17	7	8	23						575

- A: Continuous Assessment: Based on Objective Type & Subjective Type Test
 B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type & Subjective Type Test
 F: Practical Exam: Based on Continuous Assessment and Exam.
 F: Practical Exam: Based on Continuous Assessment and Exam.
 E: Total Weightage

L: Lectures T: Tutorial P: Practical Cr: Credits

Educational Tours: One educational tour of 2 Credit hours (0+2 NC)

*SGS 101 is Non credit Course

Note: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

**Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)**

Semester 5

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 311	Farming Systems and Sustainable Agriculture	2	1	1	3	20	20	20	20	20	75
2	AGR 312	Principles of Plant Biotechnology	2	0	1	3	20	20	20	20	20	75
3	AGR 313	Crop Pests and stored grain pests and their management	2	1	1	3	20	20	20	20	20	75
4	AGR 314	Fundamentals of Agri Business Management (Including product development, Appraisal and Monitoring)	1	1	1	2	20	20	20	20	20	50
5	AGR 315	Practical crop production I (Cereals, Pulses and Fodder crops)	0	1	4	2	-	-	-	-	100	50
6	AGR 316	Fundamentals of Rural Sociology and Educational Psychology	2	1	0	2	20	20	20	20	20	50
7	AGR 317	Post-harvest management and value addition of fruits and vegetables	2	0	1	3	20	20	20	20	20	75
8	AGR 318	Disease of Horticultural crops and their management	2	1	1	3	20	20	20	20	20	75
9	AGR 319	Breeding of Field / Horticultural crops	2	1	1	3	20	20	20	20	20	75
			15	7	11	24						600

- A: Continuous Assessment: Based on Objective Type & Subjective Type Test
 B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type & Subjective Type Test
 F: Practical Exam: Based on Continuous Assessment and Exam.
 F: Practical Exam: Based on Continuous Assessment and Exam.
 E: Total Weightage
L: Lectures T: Tutorial P: Practical Cr: Credits

Note: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)

Semester 6

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 321	Production Economics & Farm management	1	1	1	2	20	20	20	20	20	50
2	AGR 322	Extension Methodologies for Transfer of Agricultural Technology	2	1	1	3	20	20	20	20	20	75
3		Biochemistry	2	0	1	3	20	20	20	20	20	75
4	AGR 323	Entrepreneurship Development	1	1	1	2	20	20	20	20	20	50
5	AGR 324	Practical crop production II (oil seeds & commercial crops)	0	1	4	2	-	-	-	-	100	50
6	AGR 325	Weed management	2	1	1	3	20	20	20	20	20	75
7	AGR 326	Renewable Energy	1	1	1	2	20	20	20	20	20	50
8	EVS 151	Environmental Science	2	0	1	3	20	20	20	20	20	75
9	AGR 327	Breeding of Field / Horticultural crops	2	1	1	3	20	20	20	20	20	75
10	EVS 103*	Road Safety and Legal Awareness	2	0	0	2	25	25	25	25		50
			15	7	9	24						575

- A: Continuous Assessment: Based on Objective Type & Subjective Type Test
 B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
 C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
 D: End-Term Exam (Final): Based on Objective Type & Subjective Type Test
 F: Practical Exam: Based on Continuous Assessment and Exam.
 F: Practical Exam: Based on Continuous Assessment and Exam.
 E: Total Weightage
L: Lectures T: Tutorial P: Practical Cr: Credits

Educational Tours: One educational tour of 2 Credit hours (0+2 NC)

*EVS 103 is Non Credit Course.

Note: Instead of Subjective type tests, one can follow MCQ type tests on OMR sheets in the End Term Exam.

**Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)**

Rural Agricultural Work Experience (RAWE)- INTERNSHIP

Semester 7

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	F	E
1	AGR 411	Crop Production	0	1	5	5	-	-	-	-	100	125
2	AGR 412	Crop Protection	0	1	4	4	-	-	-	-	100	100
3	AGR 413	Rural Economics	0	1	3	3	-	-	-	-	100	75
4	AGR 414	Extension Programme	0	1	4	4	-	-	-	-	100	100
5	AGR 415	Research Station / KVK / DAATT Centre activities and Attachment to the Agro-based industries	0	1	4	4	-	-	-	-	100	100
			0	5	20	20						500

L: Lectures T: Tutorial P: Practical Cr: Credits

Rural Agricultural Work Experience (RAWE): Under this programme two models are suggested and DAVU could choose any one depending upon need assessment.

Sr.	RAWE Model I	Duration (Week)
1	Orientation	1
2	Village attachment	17
3	Research Station / KVK / DAATT Center activities and attachment to the Agro-based industries	4
4	Project report preparation and examination	2

Sr.	RAWE Model II	Duration (Week)
1	Orientation	1
2	Village attachment	7
3	Agri-clinics / Plant Health Clinics / Experiential learning / Industrial Attachment	14
4	Project report preparation and examination	2

RAWEP Attachment with Agro-based Industries: During RAWEP Programme the students will undergo internship in any one of the following industries / companies / institutes for a period of twelve weeks (the list is only suggestive and need based / location specific industries may be included).

- Seed industries / companies
- Fertilizer industries
- Pesticides industries
- Biotechnological industries (Tissue Culture labs)
- Bio pesticides industries
- Commercial nurseries / landscaping units

- Sericulture units
- Food processing units
- Agricultural finance Institutions / Banks / Credit Societies etc.
- Non – Governmental organizations

Evaluation of RAWEP Programme

Attendance: Minimum attendance for this programme - 85%.

Records: Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them.

Evaluation Procedure: The students shall be evaluated by Course Coordinator as well as by a designated evaluation Committee.

Note: i) The duration of the RAWEP is 24 weeks with a weightage of 24 credits; ii) Whenever facilities are not available for industrial training and / or agri-clinics, the duration of vocational training may be increased to that extent; iii) RAWEP can be implemented either in the VII or VIII semester as per convenience.

Scheme of Courses B.Sc Agriculture (Hons) (Program ID-1)
B.Sc. Agriculture (Hons)

Semester 8

Courses for Experiential Learning	20
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Courses for Experiential Learning: A student has to register minimum of 20 credits with major load in one area of electives and rest from among one / two areas of electives in the eighth semester.

Sr.	Title of the module	Credits
I Crop Production		
1	Seed Production Technology	3(1+2)
2	Remote Sensing GIS and Land use Planning	3(1+2)
3	Integrated Farming System	3(1+2)
4	Water Management (Watershed Micro-irrigation Problematic Water)	4(1+3)
5	Soil Management (conservation Problematic soil, Soil quality)	4(1+3)
II Crop Protection		
1	IPM and IDM (Pest Disease Scouting)	4(2+2)
2	Management of Post-Harvest insect- pests and diseases	3(1+2)
3	Non-insect pests and their Management	3(1+2)
4	Apiculture	2(0+2)
5	Mushroom (cultivation)	2(0+2)
6	Bio-control agencies and bio-pesticide (mass multiplication and uses)	3(1+2)
7	Pesticides and Plant Protection equipment	3(1+2)
8	Disease of Horticultural crops and their management	3(2+1)
III Horticulture		
1	Commercial Vegetable Production	3(1+2)
2	Commercial Floriculture	3(1+2)
3	Commercial Fruit Production	3(1+2)
4	Nursery management of horticultural crops	4 (1+3)
5	Protected cultivation of horticultural crops and Seed production of vegetables and flowers	4(1+3)
6	Processing and value addition of horticultural crops	3(1+2)
IV Post Harvest Technology and Value addition		
1	Post harvest Technology of Horticultural crops	3(1+2)
2	Unit operation for quality value addition processing and development of new products	4(1+3)
3	Post harvest technology of spices, plantation crops, medicinal and aromatic crops	4(1+3)
4	Integrated storage management of fruits, flowers and vegetables	3(1+2)
5	Post harvest handling of cut flowers and dry flowers	3(1+2)
6	Processing of cereals, pulses and oilseed crops including biodiesel	3(1+2)
7	Dairy Products Technology	3(2+1)
V Agri-Business Management		
1	Information & Communication Management	3 (1+2)
2	Management of Agro-based industry	4 (1+3)
3	Marketing Management (Agricultural Import-Export Policy of Govt. of India & Business Laws)	3 (1+2)
4	Financial Management of Agri-Business	4 (1+3)
5	Natural Resources Economics and Management	3 (1+2)

6	Project formulation, Evaluation and Monitoring	3 (1+2)
VI	Social Sciences	
1	Agricultural Journalism	3 (1+2)
2	Visuals and Graphic Communications	3 (1+2)
3	Cyber Extension	2 (1+1)
4	Behavioral Skills	3 (1+2)
5	Livestock, Poultry and Fish Marketing	3 (1+2)
6	Farm Planning and Budgeting	3 (1+2)
7	Government Policies and Programmes Related to Agriculture	3 (1+2)
8	Milk Processing	3(2+1)
VII	Basic Sciences	
1	Molecular Breeding	3 (1+2)
2	Plant tissue culture	4 (1+3)
3	Recombinant DNA Technology	3 (1+2)
4	Bio informatics	3 (1+2)
5	Microbial & Environmental Technology	4 (1+3)
6	Molecular Diagnostics	3(1+2)
VIII	Commercial Agriculture	
1	Commercial floriculture	3 (0+3)
2	Commercial fruit production	3 (0+3)
3	Nursery management of horticultural crops	3 (1+2)
4	Cultivation of commercially important medicinal & aromatic plants	2 (1+1)
5	Commercial spices production	3 (1+2)
6	Production technology of economic forest plants	3 (1+2)
7	Commercial seed production technologies	3 (1+2)

SYLLABUS

1. AGRONOMY

Paper Code	Course Title	L	T	P	Cr
AGR 111	Principles of Agronomy and Agricultural Meteorology	2	1	1	3

Meaning and scope of Agronomy: National and International Agricultural Research Institutes in India, Agro-climatic zones of India and Punjab. Tillage, crops stand establishment, Planting geometry and its effect on growth and yield cropping systems, Harvesting. Seed bed preparation. Characteristics of good seed beds. Methods of sowing and their suitability under different conditions. Seedling practices in relation to kind of seed, time of sowing, soil moisture. Tillage-practices for different soil types and crops. Weed characteristics, dissemination, and competition for growth factors and problems caused by them. Common methods of weed control and losses. Green manuring- advantages, limitations, green manure crops

Agricultural meteorology: Weather and climate, micro-climate, weather elements, Earths' atmosphere, Composition and structure, solar radiation, Nature, properties, depletion, solar constant and energy balance, Atmospheric, temperature, factors affecting, horizontal and vertical distribution, variations and global warming, Air Pressure variations; Wind: factors affecting, cyclones and anticyclones and general circulation, Atmospheric humidity, vapour pressure and saturation, Process of condensation, formation of dew, fog, mist, snow, rain and hail; Formation and classification of clouds, Introduction to monsoon, Basics of weather forecasting.

Practical: Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments and introduction of remote sensing. Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of intercultivation implements and practice; Practice of methods of fertilizer applications; Participation in ongoing field operations. Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts.

Suggested Readings:-

Reddy S.R., Principles of Crop Husbandry, Kalyani Publishers, Ludhiana, 2009.

Handbook of Agriculture, I.C.A.R. Publications, New Delhi, 2008.

Weeds of North India I.C.A.R. Publications, New Delhi, 2008.

Package of Practices for Rabi and kharif crops, P.A.U. Publications Ludhiana, Corresponding year.

Mavi, H.S., Introduction to Agrometeorology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1994.

Ahrens, C.D., Meteorology Today, Thomson Learning Inc. USA, 2003.

Critchfield, H. J., General Climatology, Prentice Hall of India Pvt Ltd., New Delhi. 2002.

Paper Code	Course Title	L	T	P	Cr
AGR 117	Introductory Agriculture (Ancient, Heritage, Agriculture, Scenario and gender equity in Agriculture)	1	0	0	1

Art, Science and business of crop production, Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in

Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture, balance sheet, liabilities; Assets and Contrasting trends (DATA), Agrl. growth, contrasting food chains, Diversity in physiography, Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Economic ecology, dry and irrigation agriculture, Farming Systems approach, value addition, requirements in new technology; Women in Agriculture: multifaceted roles and tasks, work stress factors, Nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology; Empowerment of women; Group dynamics for farm women, rural women; The nucleus of Agricultural Extension and Training.

Suggested Readings

- Agarwal RL. 1995. Seed Technology. Oxford & IBH.
 Dahiya BS & Rai KN. 1997. Seed Technology. Kalyani Ludhiana.
 Govardhan V. 2000. Remote Sensing and Water Management in Command Areas: Agroecological Prospectives. IBDC.
 ICAR. 2006. Hand Book of Agriculture. ICAR. New Delhi
 Narasaiah ML. 2004. World Trade Organization and Agriculture. Sonali Publ.
 Palaniappan SP & Annadurai K. 2006. Organic Farming - Theory and Practice. Scientific Publ.
 Sen S & Ghosh N. 1999. Seed Science and Technology. Kalyani.
 Tarafdar JC, Tripathi KP & Mahesh Kumar 2007. Organic Agriculture. Scientific Publ.

Paper Code	Course Title	L	T	P	Cr
AGR 211	Field Crops-I (Kharif)	2	1	1	3

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif crops.

Cereals – rice, maize, sorghum, pearl millet and minor millets;

Pulses : pigeonpea, mungbean and urdbean;

Oilseeds: groundnut, sesame and soybean;

Fibre crops: cotton, jute and sunhemp; and

Forage crops: sorghum, maize, cowpea, cluster bean and napier.

Practical: Rice nursery preparation and transplanting/seed bed preparation and sowing of Kharif crops; Calculations on seed rate; Sowing of soybean, pigeonpea, mungbean, maize, groundnut, and cotton; Effect of seed size on germination and seedling vigour of soybean/groundnut; Effect of sowing depth on germination of soybean; Identification of weeds in rice, maize and soybean fields and study of weed control experiments in these crops; Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum and millets; Study of yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Study of crop varieties and important agronomic experiments; Study of forage experiments.

Suggested Readings:-

- Reddy S.R., Principles of Crop Husbandry, Kalyani Publishers, Ludhiana, 2009.
 Handbook of Agriculture, I.C.A.R. Publications, New Delhi, 2008.
 Weeds of North India I.C.A.R. Publications, New Delhi, 2008.
 Package of Practices for kharif crops, P.A.U. Publications Ludhiana, Corresponding year.

Paper Code	Course Title	L	T	P	Cr
AGR 325	Weed management	2	1	1	3

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination;

Weed biology and ecology, crop weed association, crop weed competition and allelopathy Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

Practical: Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, Bermuda grass, Parthenium and Cynodon; Economics of weed control practices; Tours and visits of problem areas.

Suggested Readings:

- Aldrich, R.J., Kramer, R.J. 1997. Principles in Weed Management. Panima publ.
 Ashton, F.M and Crafts, A.S. 1981. Mode of Action of Herbicides (2nd Ed). Wiley Inter Science.
 Gupta, O.P. 2007. Weed Management – Principles and Practices. Agrobios
 Mandal, R. C, 1990. Weed, Weedicides and Weed Control – Principles and Practices. Agro – Botanical Publ.
 Rao, V.S. 2000. Principles of Weed Science. Oxford & IBH
 Subramanian, S. Ali, A.M and Kumar, R.J. 1997. All About Weed Control. Kalyani
 Zimdahl RL. 1999. Fundamentals of Weed Science (2nd Ed). Academic Press.

Paper Code	Course Title	L	T	P	Cr
AGR 122	Water management including micro irrigation	2	1	1	3

Irrigation: definition and objectives, water resources and irrigation development in India; Soil plant water relationships; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage.

Practical: Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow

method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, biocarbonates, Ca⁺⁺ and Mg⁺⁺ in irrigation water (quality parameters)

Suggested Readings:

Iraeslon, Irrigation Principles, John Willey & Sons New Delhi 1996.

Gandhi R T., Gupta, P.C., Joseph, A.P. and Rage, N. I, Handbook of Irrigation Water Management.

Mickael, A.M., Irrigation Theory and Practices.

Paper Code	Course Title	L	T	P	Cr
AGR 221	Field crops-II (Rabi)	2	1	1	3

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops; Cereals: wheat, barley; Pulses: chickpea, lentil, peas, french bean; Oilseeds: rapeseed and mustard, sunflower, safflower and linseed; Sugar crops: sugarcane and sugarbeet, Medicinal and aromatic crops such as mentha, lemon grass, citronella, palma rosa, isabgol and posta; Commercial crops: potato and tobacco, Forage crops: berseem, lucerne and oat.

Practical: Seed bed preparation and sowing of wheat, sugarcane and sunflower; Calculations on seed rate; Top dressing of nitrogen in wheat and study of fertilizer experiments on wheat and mustard; Identification of weeds in wheat and grain legumes, application of herbicide and study of weed control experiments; Morphological characteristics of wheat, sugarcane, chickpea and mustard; Yield contributing characters of wheat; Yield and quality analysis of sugarcane; Crop distribution in the state and the region; Important agronomic experiments of rabi crops and visit to research stations related to rabi crops.

Suggested Readings:-

Reddy S.R., Principles of Crop Husbandry, Kalyani Publishers, Ludhiana, 2009.

Handbook of Agriculture, I.C.A.R. Publications, New Delhi, 2008.

Weeds of North India I.C.A.R. Publications, New Delhi, 2008.

Package of Practices for Rabi crops, P.A.U. Publications Ludhiana, Corresponding year.

Paper Code	Course Title	L	T	P	Cr
AGR 311	Farming Systems and Sustainable Agriculture	2	1	1	3

Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservators of natural resources, LEIA & HEIA; Irrigation problems, waste lands and their development; Organic farming: definition, principles and components; Farming systems: definition, principles and components, IFS models for wetland, irrigated dryland and dryland situations.

Practical: Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryland situations; Study of existing farming systems in nearby villages;

Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Visit to poultry and dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Study of degraded lands.

Paper Code	Course Title	L	T	P	Cr
AGR 315	Practical crop production I (Cereals, Pulses and Fodder crops)	0	1	4	2

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Paper Code	Course Title	L	T	P	Cr
AGR 324	Practical crop production II (oil seeds & commercial crops)	0	1	4	2

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect-pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Paper Code	Course Title	L	T	P	Cr
AGR 217	Organic Farming	2	1	1	3

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

Practical: Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post-harvest management.

Suggested Readings:

- Sharma, A.K. 2005. Biofertilizers for Sustainable Agriculture. Agrobios (India), Jodhpur.
 Alexander, M. 1961. Introduction to Soil Microbiology John Wiley & Sons, Inc., New York
 Kannaiyan S. Kumar, K & Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ.
 Gaur, A.C. 2006. Biofertilizers in Sustainable Agriculture. ICAR, New Delhi.

GENETICS AND PLANT BREEDING

Paper Code	Course Title	L	T	P	Cr
AGR 112	Principles of Genetics	2	0	1	3

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristic features; Methods of inducing mutations and C I B technique. Gene expression and differential gene activation; Lac operon and Fine structure of Gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and differences between them; DNA and its structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas; Structural chromosomal aberrations.

Practical: Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of meiosis; Preparation of micro slides and identification of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

Suggested Readings:

- Gupta, P.K. Genetics, Rastogi Publication Meerut, 2008.
Singh, B.D., Fundamentals of Genetics ,Kalyani Publishers, Ludhiana, 2006.
Gardner, E.J., Principles of Genetics, John Wiley and Sons, New York, 1991.
Singh, P., Genetics, Kalyani Publishers Ludhiana, 2000.

Paper Code	Course Title	L	T	P	Cr
AGR 123	Principles of Seed Technology	2	1	1	3

Introduction to Seed Production, Importance of Seed Production, Seed policy, Seed demand forecasting and planning for certified, foundation and breeder seed production, Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed, Different classes of seed, Production of nucleus & breeder's seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production, Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); Foundation and certified seed production of rice (varieties & hybrids); Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetics and composites); Foundation and certified seed production of cotton and sunflower (varieties and hybrids); Foundation and certified seed production of castor (varieties and hybrids); Foundation and certified seed production of tomato and brinjal (varieties and hybrids); Foundation and certified seed production of chillies and bhendi (varieties and hybrids); Foundation and certified seed production of onion, bottle gourd and ridge gourd (varieties and hybrids); Seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow-Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

Practical: Seed sampling principles and procedures; Physical Purity analysis of Field and Horticultural crops; Germination analysis of Field and Horticultural crops; Moisture tests of Field and Horticultural crops; Viability test of Field and Horticultural crops; Seed health test of Field and Horticultural crops; Vigour tests of Field and Horticultural crops; Seed dormancy and breaking methods; Grow out tests and electrophoresis for varietal identification; Visit to Seed production plots of Maize, Sunflower, Bajra, Rice, Sorghum, Cotton, Chillies and Vegetables. (Add or delete crops of the region); Visit to Seed processing plants; Visit to Seed testing laboratories; Visit to Grow out testing farms; Visit to Hybrid Seed Production farms; Varietal identification in seed production plots; Planting ratios, isolation distance, roguing etc

Suggested Readings:

Vishunavat, K., Seed health testing- principal and protocol, Kalyani Publishers, New Delhi, 2009.

Sen Subir, and Ghosh N, Seed science and technology-, Kalyani Publishers, New Delhi, 2009.

Singh, B.D., Plant Breeding, Kalyani Publishers, New Delhi, 2009.

Paper Code	Course Title	L	T	P	Cr
AGR 212	Principles of Plant Breeding	2	1	1	3

Classification of plants, Botanical description, Floral biology, Emasculation and Pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantation crops etc. Aims and objectives of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apomixis and their classification; Significance in plant breeding; Modes of pollination, genetic consequences, differences between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johansson's pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method and various modified methods; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, inbreeding depression, various theories of Heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; Population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding for vegetatively propagated crops; Clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization, significance in crop improvement.

Practical: Botanical description and floral biology; Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant Breeder's kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incompatibility in field plots; Rice and Sorghum; Maize and Wheat; Bajra and ragi; Sugarcane and coconut; Groundnut, Castor, Safflower and Sesamum; Redgram, Bengalgram and Greengram; Soybean and blackgram; Chillies, Brinjal and Tomato; Bendi, Onion, Bottle gourd and Ridge gourd; Cotton and Mesta; Jute and Sunhemp

Suggested Readings :

Allard, R.W., Principles of Plant Breeding, John Wiley & Sons, New York, 1999.

Singh, B.D., Plant Breeding, Kalyani Publishers, New Delhi, 2009.

Poehlman, J.N. and Borthakur, D.N, Breeding Asian Field Crops, Oxford and IBH Pub. Co., New Delhi, 2000.

Singh, P., Essentials of plant breeding, Kalyani Publishers, New Delhi, 2009.

Paper Code	Course Title	L	T	P	Cr
AGR 312	Principles of Plant Biotechnology	2	0	1	3

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement: Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures, Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements; Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering;

Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement.

Practical: Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoresis techniques.

Suggested Readings :

Allard, R.W ., Principles of Plant Breeding, John Wiley & Sons, New York, 1999.
 Singh, B.D., Plant Breeding, Kalyani Publishers. New Delhi, 2009.
 Poehlman, J.N. and Borthakur, D.N, Breeding Asian Field Crops, Oxford and IBH Pub. Co., New Delhi, 2000.
 Singh, P., Essentials of plant breeding, Kalyani Publishers. New Delhi, 2009.

Paper Code	Course Title	L	T	P	Cr
AGR 227	Breeding of Field / Horticultural crops	2	1	1	3

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra, ragi); Pulses (redgram, greengram, blackgram, soybean); Oilseeds (Groundnut, sesame, sunflower, safflower, castor, mustard) etc. Fibers (Cotton, kenaf, roselle, jute) etc. Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, galardia, gerbera & marigold); Fruit crops (aonla, guava, mango, custard apple, banana, papaya); Major breeding procedures for development of hybrids / varieties of various crops; Plant Genetic Resources their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; Genetic basis of adaptability to unfavourable environments; Definition of biometrics, assessment of variability i.e., additive, dominance and epistasis and their differentiation; Genotype x Environment interaction and influence on yield/performance, IPR and its related issues.

Practical: Emasculation and Hybridization techniques; Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods; Handling of segregating generations, back cross methods; Field lay out of experiments; Field trials, maintenance of records and registers; Estimation of Heterosis and inbreeding depression; Estimation of Heritability, GCA and SCA; Estimation of variability parameters; Parentage of released varieties/hybrids; Problems on Hardy, Weinberg Law; Study of quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow out test plots; Visit to various research stations; Visit to other institutions

Suggested Readings :

Allard, R.W., Principles of Plant Breeding, John Wiley & Sons, New York, 1999.
 Poehlman, J.N. and Borthakur, D.N., Breeding Asian Field Crops, Oxford and IBH Pub. Co., New Delhi, 2000.
 Singh, B.D., Plant Breeding, Kalyani Publishers. New Delhi, 2009.
 Singh, P., Essentials of plant breeding, Kalyani Publishers. New Delhi, 2009.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Paper Code	<u>Course Title</u>	L	T	P	Cr
AGR 113	Introduction to Soil Science	2	1	1	3

Soil: Pedological and edaphological concepts, Origin of the earth, Earth’s crust; Composition: Rocks and minerals Weathering, Soil formation factors and processes Components of soils; Soil profile, Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil compaction, Soil Colour, Elementary knowledge of soil classification and soils of India; Soil water, Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, Drainage, Methods of determination of soil moisture Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth; Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, Adsorption of ions, Ion exchange, CEC & AEC Factors influencing ion exchange and its Significance. Soil organic matter, Composition, Decomposability, Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

Practical: Determination of bulk density and particle density, Aggregate analysis, Soil strength, Soil moisture determination, Soil moisture constants – Field capacity Infiltration rate, water holding capacity, soil texture and mechanical analysis – Soil temperature. Analytical chemistry – Basic concepts, techniques and calculations – Collection and processing of soil for analysis – Organic carbon, pH, EC, soluble cations and anions – Study of a soil profile – Identification of rocks and minerals.

Suggested Readings:

Brady, N.C. and Weil, R.R., The nature and Properties of Soil: 13th edn., Pearson education Pte. Ltd. New Delhi, 2002.
 Oswal, M.C., Soil Physics, Oxford & IBH publishing Co.Pvt. Ltd. New Delhi, 1994.
 Biswas, T.D., and Mukherjee, S.K., Text book of soil science, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997.

Paper Code	<u>Course Title</u>	L	T	P	Cr
AGR 222	Manures, Fertilizers and Agrochemicals	2	1	1	3

Introduction – Raw materials – Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermicomposting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges. Fertilizers – classifications, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, diammonium phosphate,

ammonium poly phosphate), potassic and complex fertilizers their fate and reactions in the soil, Secondary and micronutrients fertilizers, Amendments. Fertilizer Control Order, Fertilizer storage; Biofertilizers and their advantage, Organic chemistry as prelude to agro chemicals, diverse types of agrochemicals, Botanical insecticides (Neem), Pyrethrum, Synthetic pyrethroids. Synthetic organic insecticides, Major classes, Properties and uses of some important insecticides under each class. Herbicides – Major classes – Properties and uses of 2, 4-D, atrazine, glyphosate, butachlor benthocarb; Fungicides – Major classes – Properties and uses of carbendazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act, Plant growth regulators.

Practical: Total nitrogen and phosphorus in manures / composts – Ammoniacal and nitrate nitrogen – Water soluble P₂O₅, potassium, calcium, sulphur and zinc contents of fertilizers COD in organic wastes – Adulteration in fertilizer. Argentimetric and iodometric titrations – their use in the analysis of lindane metasystox, endosulfan, Malathion, copper and sulphur fungicides – Compatibility of fertilizers with pesticides.

Suggested Readings:

Basak, R.K., Fertilizers, Kalyani Publishers, Ludhiana, 2007.
 Brady, N.C. and Weil, R.R., The nature and Properties of Soil: 13th edn., Pearson education Pte. Ltd. New Delhi, 2002.
 Russal, E.W., Soil conditions and plant growth, Longman publishers, London, 1961.
 Ruth and Turk, J., Fundamentals of soil sciences, J. Wiley & Sons, Inc., London, 1943.

Paper Code	Course Title	L	T	P	Cr
AGR 127	Soil Chemistry, Soil Fertility and Nutrient Management	2	1	1	3

Soil as a source of plant nutrients. Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities. Problem soils – acid, salt affected and calcareous soils, characteristics, nutrient availabilities. Reclamation – mechanical, chemical and biological methods. Fertilizer and insecticides and their effect on soil water and air. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture. Soil fertility – Different approaches for soil fertility evaluation. Methods, Soil testing – Chemical methods. critical levels of different nutrients in soil. Plant analysis – DRIS methods, critical levels in plants. Rapid tissue tests. Indicator plants. Biological method of soil fertility evaluation. Soil test based fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Practical: Principles of analytical Instruments and their calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, and Zn in oils, pH, EC, soluble cations and anions in soil water extracts. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

Suggested Readings:

Brady, N.C. and Weil, R.R., The nature and Properties of Soil: 13th edn., Pearson education Pte. Ltd. New Delhi, 2002.
 Oswal, M.C., Soil Physics, Oxford & IBH publishing Co.Pvt. Ltd. New Delhi, 1994.
 Biswas, T.D., and Mukherjee, S.K., Text book of soil science, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997.

ENTOMOLOGY

Paper Code	<u>Course Title</u>	L	T	P	Cr
AGR 213	Insect Morphology and Systematics	2	1	1	3

History of Entomology in India. Factors for insects abundance. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts and legs. Wing venation, modifications and wing coupling apparatus. Structure male and female genitalia. Sensory organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system in insects. Types of reproduction in insects. 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. Orthoptera, Acrididae. Dictyoptera, Mantidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae, Hemiptera, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae Lepidoptera, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera, Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae.

Practical: Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus Types of insect larvae and pupae; Dissection of digestive system in insects (Grassopher); Dissection of male and female reproductive systems in insects (Grassopher); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importances.

Suggested Readings:

Srivastva, K.P., Text book of Applied Entomology. Kalyani Publishers, Ludhiana, 2009.

Atwal, A.S., and Dhaliwal, G.S Agricultural pest of south Asia and their management, Kalyani Publishers, Ludhiana, 2005.

Dhaliwal, G.S., and Kukal, S.S., Essentials of Environment Science, Kalyani Publishers, Ludhiana, 2005.

Paper Code	<u>Course Title</u>	L	T	P	Cr
AGR 223	Insect Ecology & Integrated pest management including beneficial insects	2	1	1	3

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests. IPM; Introduction, importance, concepts principles and tools of IPM-Host plant resistance, Cultural, Mechanical, Physical, Legislative, Biological (parasites, predators &

transgenic plant pathogens such as bacteria, fungi and viruses) methods of control. Chemical control – importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Study of important insecticides. Botanical insecticides – neem based products, Cyclodiens, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazimes, Thiourea derivatives, pyridine azomethines, pyrroles, etc. Nematicides, Rodenticides, Acaricides and fumigants. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968 – Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers, their importance. Non insect pests – mites, nematology, rodents and birds. Vermiculture

Practical: Visit to meteorological observatory / automatic weather reporting station; Study of terrestrial and pond ecosystems of insects; Studies on behaviour of insects and orientation (repellency, stimulation, deterancy); Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; Pest surveillance through light traps, pheromone traps and field incidence; Practicable IPM practices, Mechanical and physical methods; Practicable IPM practices, Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/concentrations of insecticides; Compatibility of pesticides and Phytotoxicity of insecticides; IPM case studies; Identification of common phytophagous mites and their morphological characters; Identification of common plant parasitic nematodes and their morphological characters; Identification of rodents and bird pests and their damage; Identification of earthworms in vermiculture – visit to vermiculture unit; Other beneficial insects – Pollinators, weed killers and scavengers

Suggested Readings:

Mani, M.S., General Entomology, Oxford & I.B.H. Pub. New Delhi, 1973.
 David, B.V. and Ananthkrishnan, T.N., General and applied Entomology Second Edition, Tata Mcgraw Hill, New Delhi, 2006.
 Atwal, A.S. and Dhariwal G.S., Agricultural pests of India and South-East Asia, Kalyani Publishers, Ludhiana, 2007.
 Nayar, K.K., Ananthkrishnan, T.N., and David, V.B. General and applied entomology, Tata McGraw-Hill, 1976.

Paper Code	Course Title	L	T	P	Cr
AGR 313	Crop Pests and stored grain pests and their management	2	1	1	3

Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (*Eleusine coracana*), wheat, sugarcane, cotton, mesta, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, brinjal, bhendi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, colacasia, moringa, amaranthus, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, betelvine, onion, coriander, garlic, curry leaf, pepper, ginger and ornamental plants.

Practical: Identification of pests, their damage symptoms and management of rice, sorghum, maize, wheat, sugarcane, cotton, pulses, Solanaceous and Malvaceous vegetables, cruciferous and cucurbitaceous vegetables, chilli, mango, carbon, citrus and sapota.

AGRICULTURAL ECONOMICS

Paper Code	Course Title	L	T	P	Cr
AGR 124	Principles of Agril. Economics	2	0	0	2

Economics: Meaning, Definition, Subject matter, Divisions of Economics, Importance of Economics; Agricultural Economics: Meaning, Definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare. Wants: Meaning, Characteristics, Classifications of Wants, Importance. Theory of consumption: Law of Diminishing Marginal utility, Meaning, Definition, Assumption, Limitations, Importance. Consumer's surplus: Meaning, Definition, Importance. Demand: Meaning, Definition, Kinds of Demand, Demand schedule, Demand Curve, Law of Demand, Extension and Contraction Vs Increase and Decrease in Demand. Elasticity of Demand: Types of Elasticity of Demand, Degrees of price elasticity of Demand, Methods of Measuring Elasticity, Factors influencing elasticity of Demand, Importance of Elasticity of Demand. Welfare Economics: Meaning, Pareto's optimality. National Income: Concepts, Measurement. Public Finance: Meaning, Principles. Public Resource: Meaning, Services Tax, Meaning, Classification of Taxes: Cannons of Taxation, Public expenditure: Meaning, Principles. Inflation: Meaning, Definition, Kinds of inflation

Suggested Readings:

Lekhi, R.K. and Singh, J., Agricultural Economics-, Kalyani publishers, Ludhiana, 2007.
 Black. J.D., Introduction of Economics for Agriculture, Fromount Pierre National Press, 1955.
 Nanavati, M.B. and J. J. Anjaria, The Indian Rural Problem. The Indian Society of Agricultural Economics, Bombay, 1944.
 Memoria, C.B. and B.B. , Agricultural Problems in India, Kitab Mahal ,Allahabad, 2007.

Paper Code	Course Title	L	T	P	Cr
AEC 211	Agricultural Finance and Co-operation	1	1	1	2

Agricultural finance: nature and scope. Time value of money, Compounding and Discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's 5C's and 7 P's of credit, repayment plans. History of financing agriculture in India. Commercial banks, nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, Asian Development Bank, World Bank, Insurance and Credit Guarantee Corporation of India. Assessment of crop losses, determination of compensation. Crop insurance, advantages and limitations in application, estimation of crop yields. Agricultural cooperation: philosophy and principles. History of Indian cooperative Movement, pre-independence and post-independence periods, cooperation in different plan periods, cooperative credit structure: PACS, FSCS. Reorganisation of cooperative credit structure in Andhra Pradesh and single window system. Successful cooperative systems in Gujarat, Maharastra. Punjab etc.

Practical: Factors governing use of Capital and identification of credit needs; Time value of money, Compounding and discounting; Tools of financial management, Balance sheet, Income statement and cash flow analysis; Estimations of credit needs and determining unit costs; Preparations and analysis of loan proposals; Types of repayment loans; Study of financial institutions: PACS, DCCB, Apex Banks, RRBs, CBs, NABARD.

Paper Code	Course Title	L	T	P	Cr
AEC 221	Agricultural marketing, Trade and Prices	2	0	1	3

Agricultural Marketing: Concepts and Definition, Scope and subject matter, Market and Marketing: Meaning, Definitions, Components of a market, Classification. Market structure, Conduct, performance. Marketing structure, Market functionaries or agencies, Producer's surplus: Meaning, Types of producers surplus, marketable surplus. Marketed surplus, importance, Factors affecting Marketable surplus. Marketing channels: Meaning, Definition, Channels for different products. Market integration, Meaning, Definition, Types of Market Integration. Marketing efficiency: Meaning, Definition, Marketing costs, Margins and price spread, Factors affecting the cost of marketing, Reasons for higher marketing costs of farm commodities, Ways of reducing marketing costs. Theories of International Trade: Domestic Trade, Free trade, International Trade, GATT, WTO, Implications of AOA. Market access, Domestic support, Export subsidies, EXIM-Policy & Ministerial conferences. Cooperative Marketing. State Trading. Ware Housing Corporation; Central and State, Objectives, Functions, Advantages. Food Corporation of India: Objectives and Functions. Quality Control, Agricultural Products, AGMARK. Price Characteristics of agricultural product process, Meaning, Need for Agricultural Price Policy. Risk in Marketing: Meaning and importance, Types of Risk in Marketing. Speculations and Hedging, Futures trading, Contract farming.

Practical: Identification of marketing channels; Study of Rythu Bazars, Regulated markets; Study of unregulated markets; Study of livestock markets; Price spread analysis; Visit to market institutions, NAFED; Study of SWC, CWC and STC; Analysis of information of daily prices; Marketed and marketable surplus of different commodities.

Paper Code	Course Title	L	T	P	Cr
AGR 321	Production Economics & Farm management	1	1	1	2

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. Production Functions: Meaning, Definition, Types. Laws of returns: Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor relationship. Product relationship. Types of enterprise relationships. Returns to scale: Meaning, Definition, Importance. Farm Management. Economic principles applied to the Organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting. Linear programming: Assumptions, Advantages and Limitations of Linear programming.

Practical: Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

Suggested Readings:

Tandon, P.K. and Dhandyal, S.P., Principles and methods of farm management Kalyani publishers, Ludhiana, 2007.
 Joshi.S.S.& Kapur,T.R., Fundamentals of farm business management, Kalyani publishers, Ludhiana, 2005.
 Economics of farm management in india, Govt. of India, 2007
 Bond H. and Cunnighum, Farm Management, John Wiley and Sons Inc, New York, 1921.
 Lekhi, R.K. and Singh, J., Agricultural Economics-, Kalyani publishers, Ludhiana, 2007.

Paper Code	Course Title	L	T	P	Cr
AGR 314	Fundamentals of Agri Business Management (Including product development, Appraisal and Monitoring)	1	1	1	2

Agribusiness: Meaning, Definition, Structure of Agribusiness, (Input, Farm, Product Sectors). Importance of Agribusiness in the Indian Economy, Agricultural Policy. Agribusiness Management, Distinctive features, Importance of Good Management, Definitions of Management. Management Functions, Planning, Meaning, Definition, Types of Plans (Purpose or Mission, Goals or Objectives, Strategies, Polices, Procedures, rules, programmes, Budget) characteristics of sound plan, Steps in planning, Organisation, Staffing, Directing, Motivation, Ordering, Leading, Supervision, Communication, control. Capital Management. Financial Management of Agribusiness: Importance of Financial Statements, Balance sheet, Profit and Loss Statement, Analysis of Financial statements. Agro-based Industries: Importance and Need, Classification of Industries, Types of Agro-based Industries, Institutional arrangement, Procedure to set up agro-based industries, Constraints in establishing agro-based industries. Marketing Management: Meaning, Definitions, Marketing Mix, 4Ps of Marketing. Mix, Market segmentation, Methods of Market, Product life cycle. Pricing policy, Meaning, pricing method. Prices at various stages of Marketing. Project, definitions, project cycle, Identification, Formulation, Appraisal, Implementation, Monitoring and evaluation, Appraisal and Evaluation techniques, NPW, BCR, IRR, N/K ratio, sensitivity analysis, characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries, agro-industries etc.

Practical: Study of input markets: seed, fertilizers, pesticides. Study of output markets, grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions cooperatives commercial banks, RRBs, Agribusiness Finance Limited, NABARD; Preparations of projects, Feasibility reports; Project appraisal techniques; Case study of agro-based industries.

AGRICULTURAL ENGINEERING

Paper Code	Course Title	L	T	P	Cr
AGR 114	Fundamentals of soil water conservation and engineering	2	1	1	3

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields. Levelling – levelling equipment, terminology, methods of calculation of reduced levels, types of levelling, contouring. Irrigation, classification of projects, flow irrigation and lift irrigation. Water source, Water lifting devices – pumps (shallow and deep well), capacity, power calculations. Irrigation water measurement – weirs, flumes and orifices and methods of water measurement and instruments. Water conveyance systems, open channel and underground pipeline. Irrigation methods – drip and sprinkle irrigation systems. Soil and water conservation – soil erosion, types and engineering control measures.

Practical: Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading; Differential leveling; Profile leveling; Contour survey – grid method; Plotting of contours; Study of centrifugal pumping system and irrigation water measuring devices; Study of different components of sprinkler irrigation systems; Study of different components of drip and sprinkle irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures.

Suggested Readings :

Nakra, C.P., Farm machines and equipment, Dhanpat Rai Publishing Company, New Delhi, 2009.

Srivastava, A.C. and Primlari, R., Elements of Farm Machinery, Oxford & IBH Publishing Company, New Delhi, 2008.

Jain, S.C. and Rai, C.R., Farm Tractor-maintenance and repair, Standard Publishing Distributers, New Delhi, 2008.

Paper Code	Course Title	L	T	P	Cr
AGR 214	Farm power and machinery	1	1	1	2

Farm power in India: sources, I.C engines, working principles, two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Tractors, Types, Selection of tractor and cost of tractor power. Tillage implements: Primary and Secondary tillage implements, Implements for intercultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Equipment for land development and soil conservation.

Practical: Study of different components of I.C. Engine; Study of working of four stroke engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration, alignment and operation of mower. Study of different inter cultivation equipment

in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of dusters; Study of paddy transplanters.

Suggested Readings :

Nakra, C.P ., Farm machines and equipment, Dhanpat Rai Publishing Company, New Delhi, 2009.

Srivastava, A.C. and Primlari, R., Elements of Farm Machinery, Oxford & IBH Publishing Company, New Delhi, 2008.

Jain, S.C. and Rai, C.R., Farm Tractor-maintenance and repair, Standard Publishing Distributers, New Delhi, 2008.

Paper Code	Course Title	L	T	P	Cr
AGR 224	Protected cultivation and Post harvest Technology	1	1	1	2

Green house technology, Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics. Threshing, threshers for different crops, parts, terminology, care and maintenance. Winnowing, manual and power operated winnowers, care and maintenance. Groundnut decorticators, hand operated and power operated decorticators, principles of working, care and maintenance. Maize shellers & castor shellers. Drying, grain drying, types of drying, types of dryers. Storage, grain storage, types of storage structures. Fruits and vegetables cleaning, machinery for cleaning of fruits and vegetables, care and maintenance. Grading, methods of grading, equipment for grading of fruits and vegetables, care and maintenance. Size reduction. Equipment for size reduction care and maintenance. Evaporation, Principle, types of evaporators, quality standards – FAQ, ASTA, FPO, FDA.

Practical: Study of different types of greenhouses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial greenhouses; Study of threshers, their components, operation and adjustments; Winnowers, their components, operation and adjustments; Study of different components of groundnut decorticator; Study of maize shellers; Study of castor shellers; Study of improved grain storage structure; Study of dryers; Study of cleaners & graders.

Paper Code	Course Title	L	T	P	Cr
AGR 326	Renewable Energy	1	1	1	2

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders. Solar energy, Solar flat plate and focussing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications / Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar pumping systems. Wind energy, Types of wind mills, Constructional details & application of wind mills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, its production & uses.

Practical: Constructional details of KVIC & Janatha type biogas plants; Constructional details of Deen Bandu type biogas plants; Field visit to biogas plants; Constructional details of different types of gasifiers; Testing of gasifiers; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; To study and find the performance of a solar dryers; Study and working of solar photovoltaic pumping system; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Study and performance evaluation of solar street light; To study the performance of different types of wind mills; Field visit to wind mills; To study the processing of Bio-diesel production from Jatropha.

PLANT PATHOLOGY

Paper Code	Course Title	L	T	P	Cr
AGR 115	Plant Pathogens and Principles of Plant Pathology	3	0	1	4

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual of Systematic Bacteriology. General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions and sub-divisions. Introduction: Definition and objectives of Plant Pathology. History of Plant Pathology. Terms and concepts in Plant Pathology. Survival and Dispersal of Plant Pathogens. Phenomenon of infection – pre-penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants – Structural and Bio-chemical (pre and post-infection). Plant disease epidemiology. Plant Disease Forecasting – Remote sensing – General principles of plant diseases management – Importance, general Principles – Avoidance, exclusion, protection – Plant Quarantine and Inspection – Quarantine Rules and Regulations. Cultural methods – Rougeing, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR. Physical Methods – Heat and Chemical methods – Methods of application of fungicides. Host plant resistance – Application of biotechnology in plant disease management –Development of disease resistant transgenic plants through gene cloning. Integrated plant disease management (IDM) – Concept, advantages and importance.

Practical: Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for fungi and bacteria; Isolation techniques, preservation of disease samples; Study of Pythium, Phytophthora and Albugo; Study of Sclerospora, Peronosclerospora, Pseudoperonospora, Peronospora, Plasmopara and Bremia; Study of genera Mucor and Rhizopus. Study of Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemiliea; Study of Sphacelotheca, Ustilago and Tolyposporium; Study of Agaricus, Pleurotus and Ganoderma; Study of Septoria, Colletotrichum, Pestalotiopsis and Pyricularia; Study of Aspergillus, Penicillium, Trichoderma, and Fusarium; Study of Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium; Demonstration of Koch's postulates; Study of different groups of fungicides and antibiotics; Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Chestnut compound; Methods of application of fungicides – seed, soil and foliar; Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; Bio-control of plant pathogens – dual culture technique, seed treatment. Visit to quarantine station and remote sensing laboratory.

Suggested Readings:

Agrios, G.N.1998, Plant Pathology, 3rd Edition Academic Press, New York.
 Alexopolus, C.J. and Mims, 1989, Introductory Mycology, Willey Eastern Ltd., New Delhi.
 Alice, D., C.Jayalakshmi and K.Sethuraman 2007. Hand Book on Introductory Plant Pathology, A.E. Publication, Coimbatore.

CHattopadhyay, S.G.1998. Principles and Procedure of Plant Protection – Oxford and IBH publications, New Delhi.

Dasgupta, M.K.1988. Principles of Plant Pathology, Allied Publishers Pvt.Ltd. Banagalore

Maramorach, K. 1998. Plant Diseases of Viral, Viroid, Mycoplasma and uncertain Etiology, Oxford and IBM publications, New Delhi.

Mehrotra, R.S. 1990. An Introductions to Mycology, Willey Eastern Ltd., New Delhi.

Narayanasamy, P.1997. Plant Pathogens and Detections and Diseases Control Oxford and IBH Publishing Co. Ltd, New Delhi.

Nene, Y.L. and Thapliyal, P.N.1998. Fungicides in plant diseases control. Oxford and IBH publishing Co.Ltd, New Delhi.

Prakasam, V., T.Raguchander, and K. Prabakar, 2006. Applied Plant Pathology, A.E. Publications, Coimbatore.

Vidyasekaran, P.1993, Principles of Plant Pathology, CBS publishers and Distributors, New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGR 225	Diseases of Field Crops and their management	2	1	1	3

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, tobacco, groundnut, sesamum, sunflower, cotton, redgram, bengalgram, blackgram, greengram, tea, soybean.

Practical: Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Presentation of disease samples survey and collection of Diseases of rice, sorghum; Diseases of wheat, bajra & maize; Diseases of sugarcane, turmeric & tobacco; Diseases of groundnut, castor & sunflower; Diseases of sesamum & cotton; Diseases of redgram, greengram, blackgram, bengalgram & beans; Field visits at appropriate time during the semester

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

Suggested Readings:

Gupta VK &.Sharma SK. 2000. Diseases of Fruit Crops. Kalyani Publ.,New Delhi.

Pathak VN. 1980. Diseases of Fruit Crops. Oxford & IBH, New Delhi.

Singh RS. 2000. Diseases of Fruit Crops. Oxford & IBH, New Delhi.

Walker JC. 2004. Diseases of Vegetable Crops. TTPP, India.

Package of Practices for Vegetable Crops, P.A.U. Publications Ludhiana, Corresponding year.

Paper Code	Course Title	L	T	P	Cr
AGR 121	Introductory Nematology	1	1	1	2

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods

(crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non-fumigants). Resistant varieties. IDM.

Practical: Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb's decanting – sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes; Preparation of temporary and permanent mounts; Method of preparation of perineal patterns for identification of species of Meloidogyne; Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomatology – Meloidogyne, Pratylenchus; Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, and Helicotylenchus. Experimental techniques used in pathogenicity studies with root knot nematode.

Suggested Readings:

Agrios, G.N.1998, Plant Pathology, 3rd Edition Academic Press, New York.
Alexopolus, C.J. and Mims, 1989, Introductory Mycology, Willey Eastern Ltd., New Delhi.
Alice, D., C.Jayalakshmi and K.Sethuraman 2007. Hand Book on Introductory Plant Pathology, A.E. Publication, Coimbatore.

HORTICULTURE

Paper Code	Course Title	L	T	P	Cr
AGR 116	Production technology of fruit crops	2	1	1	3

Definition and importance of horticulture. Divisions of horticulture. Climatic zones of horticulture crops. Area and production of different fruit crops. Selection of site, fencing, and wind break, planting systems, high density planting, planning and establishment. Propagation methods and use of rootstocks. Methods of training and pruning. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits – mango, banana, citrus, grape, guava, sapota, apple, litchi. Papaya, Minor fruits – pineapple, annonaceous fruits, pomegranate, ber, fig, phalsa, jack, pear, plum, peaches and cherry.

Practical: Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Plant propagation, seed propagation, scarification, and stratification; Propagation by cuttings (soft wood, hard wood and semi-hardwood) layering (simple layering, Air layering, stooping in guava); Layout and planting systems (Traditional system and high density planting methods); Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; Description and identification of varieties of mango, guava, grape, papaya, apple and sapota; Description and identification of varieties of banana, citrus, (lime lemon, sweet orange, mandarin, grape fruit) pomegranate, ber, pear and cherries; Irrigation methods in fruit crops including drip – Micro irrigation methods of establishment of orchard; Methods of Fertilizer application methods in fruit crops including fertigation technology; Visit to local commercial orchards; Preparation of growth regulators, powder, solution and lanolin paste for propagation; Application of growth regulators for improving fruit set, fruit size, quality, delaying ripening and hastening ripening.

BOOKS

Singh, R., Fruits, National Book Trust of India, New Delhi, 1969.

Hayes, W.B., Fruit growing in India, Kitabistan, Allahabad, 1945.

Lal, G., Siddappa, S. And Tandon, G.L., Preservation of fruits and vegetables, Indian Council of Agricultural Research, New Delhi, 2009.

Paper Code	Course Title	L	T	P	Cr
AGR 215	Production Technology of Vegetables & Flowers	2	1	1	3

Importance of Olericulture, vegetable gardens, vegetable classification. Origin, area, production, varieties, package of practices for fruit vegetables –, tomato, brinjal, chillies, and okera; Cucurbitaceous vegetables cucumber, ridge gourd, ash gourd, snake gourd, bottle gourd, bitter gourd and melons, Cole crops – cabbage, cauliflower and knol-khol. Bulb crops – Onion and garlic. Beans and peas – French beans, cluster beans, dolichos beans, peas and cowpea. Tuber crops – potato, sweet potato, tapioca, colocasia, yams; Root crops – carrot, radish, turnip and beet root; Leafy vegetables – amaranthus, palak, gogu; Perennial vegetables – drumstick, coccinia and curry leaf. Importance of ornamental gardens. Planning of ornamental gardens. Types and styles of ornamental gardens. Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens. Package of practices for rose, jasmine, chrysanthemum, crossandra, marigold and tuberose.

Practical: 1 Planning and layout of kitchen garden; 2 Identification of important vegetable seeds and plants; Raising of vegetable nurseries; Identification of ornamental plants (trees ,shrubs,climbers,house plants,palms etc..) and development of garden features; Transplanting of vegetable seedlings in main field; Layout of lawns and maintenance; Seed extraction in tomato and brinjal; Depotting, repotting and maintenance of house plants; Visit to commercial vegetable farms; Training and pruning of rose (standards, hybrid ‘T’ roses scented roses) and chrysanthemum (pinching and disbudding); Planning and layout of gardens and garden designs for public and private areas; Intercultural operations in vegetable plots; Seed production in vegetable crops; Harvesting indices of different vegetable crops; Grading and packing of vegetables; Prolonging the shelf life of cut flowers.

Suggested Readings:

Dhaliwal M.S., Handbook of vegetable crops, Kalyani Publishers, Ludhiana, 2008.
 Das , P.C., Vegetable crops of India, Kalyani Publishers, Ludhiana, 1993.
 Chauhan, D.V., Vegetable production in India, S. Ram Prasad and Sons, Agra, 1993
 Package of Practices for Vegetable crops, P.A.U. Publications Ludhiana, Corresponding year.

Paper Code	Course Title	L	T	P	Cr
AGR 226	Production technology of spices, Aromatics Medicinal and Plantation crops	2	1	1	3

Importance and cultivation technology of Spices – ginger, turmeric, pepper, cardamom, coriander, cumin, fenugreek; Aromatic crops – lemon grass, citronella, palmarose, vetiver, geranium, dawana; Plantation crops – coconut, arecanut, betelvine, cashew, cocoa, coffee, oilpalm; Medicinal plants – diascoria, rauwolfia, opium, ocimum, perwinkle, aloe, guggul, belladonna, nuxvomica, Solanum khasiamum , aonla,senna, plantago, stevia,coleus and Acorus.

Practical: Botanical description and identification of aromatic plants; Identification of varieties in spices and plantation crops; Identification of medicinal plants; Propagation techniques in aromatic and spice crops; Selection of mother palm, and seed nuts in coconut and oil palm; Study of identification of aromatic plants; Distillation procedures for aromatic crops; Propagation methods in plantation crops; Propagation and planting methods in turmeric; Propagation and planting techniques in ginger; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Training methods in betelvine; Rejuvenation practices in cashewnut; Products – byproducts of spices and plantation crops; Procedures for oleoresin extraction; Visit to local commercial plantations. Aromatic & medicinal plant nurseries and seed spices field.

Suggested Readings :

Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemam, Oxford University Press.
 Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
 Chattopadhyaya, P.K.2001. A text book on Pomology (Fundamentals of fruit growing) Kalyani Publication, New Delhi.
 Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
 Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre,1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi.
 George Acquaaah, 2002, Horticulture-principles and practices. Prentice– Hall of India Pvt. Ltd., New Delhi.

Hartman, H.T. and Kester, D.E. 1986. Plant propagation – Principles and Practices – Prentice Hall of India Ltd., New Delhi.

Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.

Rajan, S. and B.L. Markose. 2007. Propagation of horticultural crops. New India Publishing, New Delhi.

Singh, N.P. 2005. Basic concepts of fruit science. International Book Distributing Co., Lucknow.

Surendra Prasad and U. Kumar. 1999. Principles of horticulture, Agro-botanica, Bikaner, India.

Paper Code	Course Title	L	T	P	Cr
AGR 317	Post harvest management and value addition of fruits and vegetables	2	0	1	3

Importance of post-harvest technology in horticultural crops. Maturity indices, harvesting and post-harvest handling of fruits and vegetables. Maturity and ripening process. Factors affecting ripening of fruits, and vegetables. Pre harvest factors affecting quality on post-harvest shelf life of fruits and vegetables. Factors responsible for deterioration of harvested fruits and vegetables. Chemicals used for hastening and delaying ripening of fruits and vegetables. Methods of storage – precooling, prestorage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structures. Various methods of packing, packaging materials and transport. Packing technology for export. Fabrication of types of containers, cushioning material, vacuum packing, poly shrink packing, specific packing for export of mango, banana, grapes kinnow, sweet orange, and mandarin etc. Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, chemicals and fermentation. Unit layout – selection of site and precautions for hygienic conditions of the unit. Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials Spoilage of canned products, biochemical, enzymatic and microbial spoilage. Preservatives, Colours permitted and prohibited in India.

Practical: Practice in judging the maturity of various fruits and vegetables. Conservation of zero energy cool chambers for on farm storage. 3& 4. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic and content in fruits and vegetables. Packing methods and types of packing and importance of ventilation. Pre cooling packing methods for export or international trade. Methods of prolonging storage life. Effect of ethylene on ripening of banana, sapota, mango, sapota. Identification of equipment and machinery used is preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles sauces and ketchup. Visit to local processing units. Visit to local market yards and cold storage units. Visit to local market and packing industries.

AGRICULTURAL EXTENSION

Paper Code	Course Title	L	T	P	Cr
AGR 125	Dimensions of Agril. Extension	1	1	1	2

Education – Meaning, Definition, Types – Formal, Informal and Non-formal education and their Characteristics. Extension Education and Agricultural Extension – Meaning, Definition, Concepts, Objectives and Principles. Rural development – Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development. Developmental programmes of pre-independence era – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme. Development programmes of Post-independence era, Firka Development, Etawah – Pilot project and Nilokheri Experiment. Community Development Programme – Meaning, Definition, Concepts, Philosophy, Principles, Objectives, Differences between Community Development and Extension Education, National Extension service. Panchayat Raj system – Meaning of Democratic – Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system, Powers, Functions and Organizational setup. Agricultural Development Programmes with reference to year of start, objectives & salient features – Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC. Social Justice and Poverty alleviation programmes – Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Prime Minsiter Employment Yojana (CMEY). New trends in extension, privatization. Women Development programmes – Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samridhi Yojana (MSY). Reorganized extension system (T&V System) – Salient features, Fort night Meetings, Monthly workshops, Linkages, Merits and Demerits, Emergence of Broad Based Extension (BBE).

Practical: Visits to a village and kisan mandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (ZPP). Visit and study the District Rural Development Agency (DRDA). Participation in monthly workshops of Training and Visit (T & V) System. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities. Organizing PRA techniques in a village to identify the agricultural problems. Visit to villages.

Suggested Readings:

- Mondal, S. and Ray G.L., A Text book of Rural Development. Kalyani Publishers, Chennai, 2007.
- Dharma, O.P. and Bhatnagar, O.P., Education and Commnication for Development. Oxford, IBH, New Delhi, 2003.
- Desai, A.R., Rural Sociology in India. Popular Prakashan, Bombay, 2003.
- Samanta, R.B., Agricultural Extension in Changing World perspective. UDH Publishing, New Delhi, 1991.
- Ray G.L., Extension Communication and Management, Kalyani Publishers, Chennai, 2007.

Paper Code	Course Title	L	T	P	Cr
AGR 316	Fundamentals of Rural Sociology and Educational Psychology	2	1	0	2

Extension Education and Agricultural Extension – Meaning, Definition, Scope and Importance. Sociology and Rural Sociology, Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies. Social Groups – Meaning, Definition, Classification, Factors considered in formation and organization of groups, Motivation in group formation and Role of Social groups in Agricultural Extension. Social Stratification – Meaning, Definition, Functions, Basis for stratification, Forms of Social stratification – Characteristics and – Differences between Class & Caste System. Cultural concepts – Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions – Meaning, Definition and their Role in Agricultural Extension. Social Values and Attitudes – Meaning, Definition, Types and Role of Social Values and Attitudes in Agricultural Extension. Social Institutions -Meaning, Definition, Major institutions in Rural society, Functions and their Role in Agricultural Extension. Social Organizations – Meaning, Definition, Types of organizations and Role of Social organizations in Agricultural Extension. Social Control – Meaning, Definition, Need of social control and Means of Social control. Social change – Meaning, Definition, Nature of Social change, Dimensions of social change and factors of social change. Leadership – Meaning, Definition, Classification, Roles of a leader, Different methods of Selection of Professional and Lay leaders. Training of Leaders – Meaning, Definition, Methods of training, Advantages and Limitations in use of local leaders in Agricultural Extension. Psychology and Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence – Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Personality – Meaning, Definition, Types, Factors influencing the Personality and Role of personality in Agricultural Extension. Teaching – Learning process – Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics. Principles of learning and their implication for teaching.

Paper Code	Course Title	L	T	P	Cr
AGR 322	Extension Methodologies for Transfer of Agricultural Technology	2	1	1	3

Communication – Meaning, Definition, Models, Elements and their Characteristics, Types and Barriers in communication. Extension Programme Planning – Meaning, Definitions of Planning, Programme, Project, Importance, Principles and Steps in Programme Development Process, Monitoring and Evaluation of Extension Programmes. Extension Teaching methods – Meaning, Definition, Functions and Classification. Individual contact methods – Farm and Home visit, Result Demonstration, Field trials – Meaning, Objectives, Steps, Merits and Demerits. Group contact methods – Group discussion, Method demonstration, Field Trips – Meaning, Objectives, Steps, Merits and Demerits. Small group discussion techniques – Lecture, Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference. Mass contact Methods – Campaign, Exhibition, Kisan Mela, Radio & Television – Meaning, Importance, Steps, Merits & Demerits. Factors influencing in selection of Extension Teaching Methods and Combination (Media Mix) of Teaching

methods. Innovative Information sources – Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers, Consultancy clinics. Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations. Diffusion and Adoption of Innovations – Meaning, Definition, Models of adoption Process, Innovation – Decision Process – Elements, Adopter categories and their characteristics, Factors influencing adoption process. Capacity building of Extension Personnel and Farmers – Meaning, Definition, Types of training, Training to farmers, farm women and Rural youth – FTC and KVK.

Practical: Simulated exercises on communication. Identifying the Problems, Fixing the Priorities and selecting a most important problem for preparation of a project. Developing a project based on identified problems in a selected village. Organization of Group discussion and Method demonstration. Visit to KVK / FTC. Planning and Writing of scripts for Radio and Television. Audio Visual aids – Meaning, Importance and Classification. Selection, Planning, Preparation, Evaluation and Presentation of visual aids. Planning & Preparation of visual aids – Charts, Posters, Over Head Projector, (OHP) Transparencies, Power Point Slides. Planning and Preparation of Agricultural Information materials – Leaflet, Folder, Pamphlet, News Stories, Success Stories. Handling of Public Address Equipment (PAE) System, Still camera, Video Camera and Liquid Crystal Display (LCD) Projector.

Paper Code	Course Title	L	T	P	Cr
AGR 323	Entrepreneurship Development	1	1	1	2

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to agriculture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics of Indian agricultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

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

BIOCHEMISTRY/PHYSIOLOGY MICROBIOLOGY/ ENVIRONMENTAL SCIENCES

Paper Code	Course Title	L	T	P	Cr
	Biochemistry	2	0	1	3

Biochemistry – Introduction and importance. Plant cell, cell wall and its role in livestock, food and paper industries. Bio-molecules – Structure, properties & applications: Amino acids, peptides and proteins – Plant proteins and their quality. Enzymes – Factors affecting the activity, classification, Immobilisation and other industrial applications. Lipids – Acyl lipids, Their industrial application in soaps, detergents, paints, Varnishes, lubricants, adhesives, plastics, nylon, Bio-diesel, Biodegradable plastics etc. Carbohydrates; Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. General reactions of amino acid degradation. Biosynthesis – carbohydrates, Lipids, Proteins and Nucleic acids. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

Practical: Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose & starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

Suggested Readings:

- Nelson, D.L. and Cox, M.M., Principles of biochemistry, Macmillan Publishers, New York, 1993.
 Goodwin, T.W., and Mercer, E.I., Introduction to plant biochemistry, Pergamon Press, Oxford, 1983.
 Buchanan B. B., Gruissen, W., and R.L. Jones R.L., Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA, 2000.

Paper Code	Course Title	L	T	P	Cr
AGR 218	Crop Physiology	2	0	1	3

Introduction, Importance in Agriculture. Seed Physiology, Seed structures, Morphological, physiological and biochemical changes during seed development, Physiological maturity – Morphological and physiological changes associated with physiological maturity in crop, Harvestable maturity, Seed viability and vigour, Factors affecting seed viability and vigour. Methods of testing seed viability and vigour, Germination, Utilization of seed reserves during seed germination, Morphological, physiological and biochemical changes during seed germination, Factors affecting seed germination. Growth and Development, Definition, Determinate and Indeterminate growth, Monocarpic and Polycarpic species with examples. Measurement of growth, Growth analysis Growth characteristics, Definitions and mathematical formulae. Crop Water Relations, Physiological importance of water to plants, Water potential and its components, measurement of water status in plants. Transpiration, significance, Transpiration in relation to crop productivity, Water Use Efficiency, WUE in

C₃, C₄ and CAM plants, Factors affecting WUE. Photosynthesis, Energy synthesis, Significance of C₃, C₄ and CAM pathway, Relationship of Photosynthesis and crop productivity, Translocation of assimilates, Phloem loading, apoplastic and symplastic transport of assimilates, Source and sink concept, Photorespiration, Factors affecting Photosynthesis and productivity, Methods of measuring photosynthesis, Photosynthetic efficiency, Dry matter partitioning, Harvest index of crops. Respiration and its significance, Brief account of Growth respiration and maintenance respiration, Alternate respiration – Salt respiration – wound respiration – measurement of respiration. Nutriophysiology – Definition – Mengel’s classification of plant nutrients – Physiology of nutrient uptake – Functions of plant nutrients – Deficiency and toxicity symptoms of plant nutrients – Foliar nutrition – Hydroponics. Introduction of Photoperiodism and Vernalisation in relation to crop productivity – Photoperiodism Plant Growth Regulators – Occurrence – Biosynthesis – Mode of action of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators, Commercial application of plant growth regulators in agriculture. Senescence and abscission – Definition – Classification – Theories of mechanism and control of senescence – Physiological and biochemical changes and their significance. Post-Harvest Physiology – Seed dormancy – Definition – types of seed dormancy – Advantages and disadvantages of seed dormancy – Causes and remedial measures for breaking seed dormancy, Optimum conditions of seed storage – Factors influencing seed storage (ISTA standards). Fruit ripening – Metamorphic changes – Climateric and non-climateric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, Polaris, paclobuterozole).

Practical: Preparation of solutions; Growth analysis: Calculation of growth parameters; Methods of measuring water status in roots, stems and leaves; Measurement of water potential by Chardakov’s method; Measurement of absorption spectrum of chloroplastic pigments and fluorescence; Measurement of leaf area by various methods; Stomatal frequency and index – Respirometer – Measurement of respirometer; Leaf anatomy of C₃ and C₄ plants; Transpiration of measurement; Imbibition of seed; Optimum conditions for seed germination; Breaking seed dormancy; (a) Chemical method (b) Mechanical method; Yield analysis; Seed viability and vigour tests; Effect of ethylene on regulation of stomata.

Paper Code	Course Title	L	T	P	Cr
AGR 126	Agricultural Microbiology	2	0	1	3

History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, Protection against infections, Applied areas of Microbiology Metabolism in bacteria: ATP generation, chemoautotrophy, photo autotrophy, respiration, fermentation. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles: viroids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting. Microbiology of Water. Microbiology of food: microbial spoilage and principles of food preservation. Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases, Biodegradation, Biogas production, Biodegradable plastics, Plant – Microbe interactions.

Practical: General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory: Practice of Aseptic methods: I - Evaluation of aseptic technique

with Nutrient broth tubes. II- Evaluation of aseptic technique with a Nutrient agar plate. Methods of Sterilization and Preparation of media I- Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stab; II- Sterilization of glassware by Dry heating; III - Sterilization of nutrient broth by Filtration. Plating methods for Isolation and Purification of bacteria I - Isolation of bacteria by Streak plate method. II - Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method. III - Checking of purity of a bacterial culture by Streak plating method. Identification of bacteria by staining methods and Biochemical tests: I- Morphological examination of bacteria by Simple and Differential staining. II – Different biochemical tests for identification of bacterial culture; Enumeration of bacteria: I - Enumeration of bacteria by Stain slide method. II- Enumeration of bacteria by most probable number method. III - Enumeration of bacteria by Pour plate method and Spread plate method.

Suggested Readings :

Dubey, R.C., and Maheshwari, D.K., A text book of Microbiology, S. Chand & Company Ltd, New Delhi, 2010.

Darralyn M., David S.and Phillip A., Introduction to microbiology. Black Well Publication Ltd. USA, 2001.

Salle, A.J., Fundamentals Principles of bacteriology. MacGraw Hill, Inc., 1974.

Paper Code	Course Title	L	T	P	Cr
EVS 151	Environmental Science	2	0	1	3

Scope and importance of environmental studies. Natural resources: Renewable and renewable resources. Forest, Water, Food, energy and land resources. Ecosystems: Definition, concept, structure and functions. Producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem. Types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards and industrial wastes. Disaster management, Floods, earthquakes, cyclones and landslides. Social issues and the environment, unsustainable to sustainable development. The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection. Act and Forest Conservation Act. Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.

Practical: Collection, processing and storage of effluent samples; Determination of Bio-Chemical oxygen demand (BOD) in effluent sample; Determination of chemical oxygen demand (COD) in effluent sample; Estimation of dissolved oxygen in effluent samples; Determination of sound level by using sound level meter; Estimation of respirable and non respirable dust in the air by using portable dust sampler; Determination of total dissolved solids (TDS) in effluent samples; Estimation of species abundance of plants; Estimation of nitrate contamination in ground water; Analysis of temporary and total hardness of water sample by titration; Estimation of pesticide contamination in Agro-Ecosystem; Visit to Social Service Organisation / Environmental Education Centre; Crop adaptation to environmental variables, soils conditions; Study of transpiration and water balance in plants; Visit to a local polluted site. Observations and remedial measures; Assessment of chlorophyll content of fresh water / sea water ecosystem.

STATISTICS AND COMPUTER APPLICATION

Paper Code	Course Title	L	T	P	Cr
ECO 151	Statistics	3	0	0	3

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

Practical: Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped and Grouped data; Computation of Mode for Un-Grouped and Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; SND test for Means, Single Sample; SND test for Means , Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r' and its testing; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

Suggested Readings:

Panse, V.G., Shaw, F.J., and Sukhatme, P.V., Statistical methods for agricultural workers, Indian Council of Agricultural Research, 1967.

Fisher, R.A., Statistical methods for research workers(14th Edition), Hafner Press, UK, 1975.

Singh, S., Singh, T.P., Babsal, M.L., and Kumar R., Statistical Method for Research workers Kalyani Publishers, Ludhiana, 2004.

Paper Code	Course Title	L	T	P	Cr
CSA 155	Introduction to computer application	1	0	0	1

Introduction to Computers, Anatomy of Computers, Input and Output Devices. Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines. Operating System – DOS and WINDOWS. Disk Operating System (DOS): Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. WINDOWS: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date,

starting and shutting down of WINDOWS. Anatomy of a WINDOW, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars. Applications – MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and Saving a spreadsheet with MSEXCEL. Use of in-built Statistical and other functions and writing expressions. Use of Data Analysis Tools, Correlation and Regression, t-test for two-samples and ANOVA with One-way Classification. Creating Graphs. MS Power Point: Features of Power Point Package. MSACCESS: Concept of Database, Units of database, creating database; Principles of Programming: Flow Charts and Algorithms, illustration through examples. Internet: World Wide Web (WWW), Concepts, Web Browsing and Electronic Mail

Suggested Readings :

Singh, G. and Singh, R. , PC Software And Programming, Kalyani Publishers, Ludhiana, 2002.
 Basandra , G., Computer Today, Galgotia Publications New Delhi, 2009.
 Sinha P.K. ,Computer Fundamentals, BPB Publications Bombay, 2009.

Paper Code	Course Title	L	T	P	Cr
CSA 156	Introduction to computer application Lab	0	0	2	1

Practical: Study of Computer Components; Booting of Computer and its Shut Down; Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; WINDOWS Explorer, Creating Folders, COPY and PASTE functions; MSWORD: Creating a Document, Saving and Editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text; MSWORD, Creating a Table, Merging of Cells, Column and Row width; MSEXCEL: Creating a Spreadsheet, Alignment of rows, columns and cells using Format tool bar; MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, STDEV; MSEXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression; MSEXCEL: Creating Graphs and Saving with & without data; MSACCESS: Creating Database, Structuring with different types of fields; MS Power Point: Preparation of slides on Power Point; Transforming the data of WORD, EXCEL and ACCESS to other formats; Internet Browsing: Browsing a Web Page and Creating of E-Mail ID

ANIMAL PRODUCTION

Paper Code	Course Title	L	T	P	Cr
AGR 216	Livestock Production and Management	2	0	1	3

Place of livestock in the national economy, different livestock development programmes of Govt. of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting fertility in livestock, reproductive behaviour like oestrus, parturition, farrowing etc. Milk secretion, milking of animals and factors affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals and other classes and types of animals, housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care, breeding, feeding and production records. Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine.

Practical: Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Hatching, housing and management of poultry; Visit to livestock farms and Economics of livestock production.

Suggested Readings:-

Singh, H., Handbook of Animal Husbandry, I.C.A.R. Publications, New Delhi, 2005.
Eigan, W.M., and Paul, R., Dairy cattle feed, Johan Willey & Sons, New York, 2005.
Kumar, A., Animal Husbandry, Discovery Publishing House, New Delhi, 2006.

NON CREDIT COURSES

Paper Code	Course Title	L	T	P	Cr
ENG 153	Comprehension and Communication Skills in English	3	3	0	2

Comprehension: Text for comprehension, Current English for Colleges, By N. Krishnaswamy & T.Sriraman, Macmillan India Limited, Madras, 1995; War Minus shooting The sporting spirit George Orwell (a) Reading Comprehension (b) Vocabulary – Synonyms – Antonyms – Often confused words and (c) Two exercises to help the students in the enrichment of vocabulary based on TOEFL and GRE and other competitive examinations. A Dilemma – A layman looks at science Raymond B. Fosdick (a) Reading Comprehension (b) Vocabulary – Homonyms and Homophones (c) Exercises on Figurative Language & Idiomatic Language (E.g.: dust and ashes, doorstep of doom, boundaries of knowledge, Apple of one’s eye, in a fix etc). 5&6 You and Your English – Spoken English and Broken English G.B.Shaw (a) Reading Comprehension (b) Language study, Functional Grammar, Agreement of verb with subject. Written Skills: Mechanics of good letter, Effective business correspondence, Personal Correspondence, Preparation of Curriculum vitae and Job applications. The Style, Importance of professional writing –Choice of words and Phrases, precision, conciseness clichés, redundancy, jargon, foreign words, Precise writing and synopsis writing. Interviews, Types of interviews, purpose, different settings, as interviewer, interviewee, physical makeup and manners, appearance, poise, speech, self-reliance, Evaluation process, Review or feedback.

Paper Code	Course Title	L	T	P	Cr
ENG 154	Comprehension and Communication Skills in English Laboratory	0	0	2	1

Practical: Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature) Practical: listening to at least two tape, recorded conversations aimed at testing the listening comprehension of students; Communication: Spoken English, oral communication, importance stress and intonation. Practical: Spoken English practice by using audiovisual aids, the essentials of good conversations, oral exercises in conversation practice (At the Doctor, at the Restaurant, at the Market Yard); Oral Presentation of Reports: Seminars and conferences, features of oral presentation, regulating speech, physical appearance, body language posture, eye contact, voice, audience, preparation of visual aids. Practical: One presentation by individual on the given topic related to agriculture like W.T.O, Developing new technologies in Agriculture, Bio fertilizers etc.; Evaluation of a Presentation: evaluation sheet, other strategies to be considered for evaluating a presentation, Practical: Mock evaluation of a presentation; Dyadic communication, face to face conversation, Telephonic conversation, rate of speech, clarity of voice, speaking and listening politeness, telephone etiquette, Practical: Practice of Telephonic conversation; Reading skills, using Dictionary, reading dialogues, rapid reading, intensive reading, improving reading skills; Meetings: purpose, procedure participation, chairmanship, physical arrangements, recording minutes of meeting; Practice of Presentation by using power point and LCD projector; Conducting Mock interviews – testing initiative, team spirit, leadership, intellectual ability – potential for development, memory, motivation, objectives, aptitude etc., Group Discussions and Debates on current topics; Review or Feed Back; Practical examination.

DAV UNIVERSITY, JALANDHAR

Paper Code	Course Title	L	T	P	Cr
MTH170	Basic Mathematics	2	0	0	0

Review of trigonometric functions, sum and product formulae for trigonometric functions, trigonometric equations and inverse trigonometric functions. Complex numbers, quadric equations, permutations and combinations, mathematical induction, binomial theorem, sequences and series. Matrices, operation of matrices, determinants, singular and non-singular matrices. Ad joint and inverse of matrix. Co-ordinate Geometry: Rectangular co-ordinate system, straight lines. Circles, parabola, ellipse and hyperbola their equations in standard form. Condition for tangency. Three dimensional space. Differential calculus: real functions and their graphs, limits and continuity. Derivative of function, product and quotient rule. Chain rule implicit and logarithmic differentiation. The 2nd and 3rd derivative, parametric, increasing and decreasing functions. Maxima and minima. Mean value theorem, tangents and normals.

Integral calculus: Integral as anti-derivatives integration as substitution, by partial fractions and by parts. Definite integral: the definition of integral of real valued function of real variable as limit of sum motivated by the determination of area. Functional theorem of integral calculus, properties of definite integral. Areas of boundary regions. Differential equations: Formation and methods of solving first order first degree diff. equations.

Paper Code	Course Title	L	T	P	Cr
BOT 155	General Botany	2	0	1	0

Classification of Plant kingdom. General outline of life history of Angiosperms. Morphology of Root, Stem and Leaf. Seed structure of Gram and Maize. Seed Germination. Structure of Flower, Floral formula and Floral Diagram. Inflorescence- different types. Pollination- Types and Agencies.

Fruit – Types, Dispersal of Fruit and Seed. Anatomy- Tissue types. Difference between Monocot and Dicot Root, Stem, Leaf. Families- General characters of Solanaceae, Malvaceae, Cruciferae, Graminae, Compositae.

Practical

Form and function of Root, Stem & Leaf and modifications.

Different types of inflorescence.

Representative of families included in theory.

Suggested Readings :

Dutta, C., Text Book of Botany , Oxford University Press- India, 2000.

Bhatia K.N., and Widge, R., Introduction of Botany , Truman Publishers, Jalandhar, 2010.

Vidyarthi, S., Text Book of Botany, S. Chand and Company, New Delhi, 2002.

Paper Code	Course Title	L	T	P	Cr
BOT 155	General Botany	2	0	1	0

Introduction to Zoology, description of typical animal cell, difference between plant and animal cell. Zoological nomenclature and principles of classification. General survey of animal kingdom up to phylum in in-vertebrates and up to class in vertebrates. Economic significance and importance of Amoeba, Entamoeba, Sycon, Plasmodium, Fasciola, Tapeworm, Ascaris, Hirudo, Pharitema, Grasshopper, Locust, Silkworm, Beetle, Red cotton, Honey bee, Bug, Mosquito, Rohu, Frog, Snake, Owl, Woodpecker, Hoopoe, Parrot, Horse , Sheep, Rat, Mongoose and Monkey. Animals of economic importance in Agriculture. Comparison of Digestive and Reproductive system of Horse, Ox and Sheep. Physiology of Respiration Composition of Blood and its function Reproduction, Locomotion in Animals Structure of skin and Heat Regulation General account of Aves.

Practical

Animal cell, cell division, tissue,
General survey and collection of fauna of local area
Smear of human blood
Skelton parts of ox, goat, and horse.

NSS/NCC / Physical Education

1(0+1)

NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: Introduction to NCC, defense services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training – rifle bayonet, light machine gun, sten machine carbine. Introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self-defense, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defense, leadership and NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules regulations of important games, skill development in any one of the games, football, hockey, cricket, volleyball, badminton, throw ball, tennis. Participation in one of the indoor games, badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events, long jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-to-day activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience.

Note: Warming up and conditioning exercises are compulsory before the commencement of each class.