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(Accredited by NAAC)

GU/Acad –PG/BoS -Agri/2023/211 Date:18.07.2023

CIRCULAR

The syllabus of **Bachelor of Science (Honours) in Agriculture** Programme governed under OC-64A is attached.

The Dean/ Vice-Deans of the School of Biological Sciences and Biotechnology are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2023.07.18 16:52:53 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Agriculture (Honours) Programme..

Copy to:

1. The Dean, School of Biological Sciences and Biotechnology, Goa University.
1. The Vice-Deans, School of Biological Sciences and Biotechnology, Goa University
2. The Chairperson, Board of Studies in Agriculture.
3. The Controller of Examinations, Goa University.
4. The Assistant Registrar, UG Examinations, Goa University.
5. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: AHDS 353
Title of the Course: Technology of milk and milk products
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory:
● To know present status of dairy industry in India. Definition and composition of milk.
● To study Physicochemical properties of milk, Microbial quality of raw milk and standards for different market milk.
● To understand factors affecting yield and composition of milk. Physico-chemical and microbial standards for different types of milk.
● To know nutritional importance of milk and its constituents. Reception and processing (Platform test, Chilling, Standardization, Homogenization, Pasteurization, Storage, Marketing) of milk.
● To study classification and composition of milk products (Heat coagulated, Heat and acid coagulated, Evaporated, Fermented Frozen and Fat riched products). Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI).
● To learn international requirement for export of milk and milk products.
● To know preservation of milk and milk products by physical, chemical, biological and herbal preservatives. Utilization of dairy by-product: whey and high acid milk.
● To study packaging of milk and milk products with modern techniques.
Practical:
● To take samples of milk and milk products. Study of platform tests.
● To determine fat by Gerber’s method. Determination of SNF, TS and specific gravity of milk.
● To determine acidity of milk, adulteration in milk and milk products.
● To standardize milk by Pearson’s method.
● To use cream separator for separation of cream.
● To prepare flavored and chocolate milk, Khoa, Basundi and Rabri, Paneer, Channa and Rassogolla.
● To prepare Dahi, Chakka and Shrikhand, Butter, Ghee, Ice-cream, Kulfi, Pedha and Gulabjamun.
● To clean and sanitize dairy equipment’s.</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture no</th><th>Topics</th><th>Hours</th></tr>
<tr><td>1</td><td>Present status of dairy industry in India</td><td>1 hr</td></tr>
<tr><td>2</td><td>Definition of milk, composition of milk of different livestock species</td><td>1 hr</td></tr>
<tr><td>3</td><td>Physico-chemical properties of milk</td><td>1 hr</td></tr>
<tr><td>4</td><td>Factors affecting yield and composition of milk</td><td>1 hr</td></tr>
<tr><td>5</td><td>Microbial quality of raw milk and standards for different market milk</td><td>1 hr</td></tr>
<tr><td>6</td><td>Nutritional importance of milk and its constituents</td><td>1 hr</td></tr>
<tr><td>7</td><td>Reception, standardization and homogenization of milk</td><td>1 hr</td></tr>
<tr><td>8</td><td>Pasteurization of milk and its methods</td><td>1 hr</td></tr>
</table></td></tr>
</table>

	9	Chilling, storage and marketing of milk	1 hr
	10&11	Classification and composition of Indigenous milk products	2 hrs
	12	Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI)	1 hr
	13	International requirements for export of milk and milk products	1 hr
	14	Preservation of milk and milk products by physical, chemical, biological and herbal preservatives	1 hr
	15	Utilization of dairy by-products like whey and high acid milk	1 hr
	16	Packaging of milk and milk products with modern techniques	1 hr

Practical

Practical no	Topics	Hours
1	Study of platform tests and sampling of milk and milk products	3 hrs
2	Determination of fat by Gerber's method	3 hrs
3	Determination SNF, TS, specific gravity and acidity of milk	3 hrs
4	Determination of adulteration in milk and milk products	3 hrs
5	Standardization of milk by Pearson's method	3 hrs
6	Study of cream separator and separation of cream	3 hrs
7	Preparation of flavoured and chocolate milk	3 hrs
8	Preparation of Khoa, Basundiand Rabri	3 hrs
9	Preparation of Paneer,Channa andRassogolla	3 hrs
10	Preparation of Dahi, Chakka and Shrikhand	3 hrs
11	Preparation of Butter	3 hrs
12	Preparation of Ghee	3 hrs
13	Preparation of Ice-cream and Kulfi	3 hrs
14	Preparation of Pedha and Gulabjamun	3 hrs
15	Study of cleaning and sanitization of dairy equipment's.	3 hrs
16	Visit to milk processing plant.	3 hrs

Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, industry visits, study tours
References/ Readings:	1. A. L. Winton and K.B. Winton, Milk and Milk Products. Jodhapur: Agrobios, 1993. 2. J. G. Davis, Milk Testing. Jodhapur: Agrobios, 2007. 3. V. B. Singh, Chemistry of Milk and Milk Products. Muzaffarnagar: Asian Publishers, 1965. 4. H. A. Gupta, Dairying in India. Ludhiana: Kalyani Publisher, 1997. 5. S. De, Outlines of Dairy Technology. New Delhi: Oxford University Press, 2000.
Course Outcomes:	At the end of the course, students will be able to 1. Learn about dairy industry. 2. Explain properties of milk. 3. Learn processing of milk to various products. 4. Packing of milk and milk products.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: AHDS 364
Title of the Course: Sheep Goat and Poultry Production
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory
● To understand the importance of sheep, goat and poultry production in national economy.
● To learn the common terminologies used in sheep, goat and poultry production.
● To study the important Indian and Exotic breeds of sheep, goat and poultry
● To know the breeding seasons, mating systems, rearing methods and housing systems of sheep and goat.
● To understand the digestive system, digestion and absorption of nutrients in fowl.
● To identify the principles and practices of sheep and goat feeding, flushing of ewes and does.
● To learn the care and management of pregnant ewes and does, lambs/kids and rams / bucks.
● To study the methods of rearing, feeding and management of chicks, pullets, layers and broilers.
● To know the importance, composition and utilization of sheep and goat milk.
● To understand the marketing of sheep and goat.
● To know the selection, incubation, hatching of eggs and brooding in poultry
● To study the preservation, grading, marketing of eggs and its economics
● To know the diseases of sheep goat and poultry
● To understand vaccination and health cover in sheep, goat and poultry
Practical
● To Study the body parts of sheep, goat and poultry
● To Study the differences between sheep and goat
● To learn the Identification marking in sheep, goat and poultry.
● To know the management practices in sheep and goat viz. clipping, spraying, dusting, deworming, docking and ringing. Debeaking etc.
● To understand the feeding habits and nutrients requirement for different classes of sheep and goat
● To learn the computation of ration for different classes of poultry
● To understand the shearing of sheep and grading of wool
● To study the judging and culling of sheep and goat
● To understand the preparation of animals for slaughter and different methods of slaughter
● To study the different meat cuts, dressing percentage, meat bone ratio and edible and non-edible offal’s
● To know the candling of eggs
● To study of various farm records maintained at sheep and goat farm.
● To know the preparation of viable bank proposal
● To understand the vaccination of sheep, goat and poultry
● Visit to sheep, goat and poultry farm</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture no</th><th>Topic</th><th>Hours</th></tr>
<tr><td>1</td><td>Importance of sheep, goat and poultry production in national economy</td><td>1 hour</td></tr>
</table>
</td></tr>
</table>

2	Common terminologies used in sheep, goat and poultry production	1 hour
3	Classification and study of Indigenous and exotic sheep breeds	1 hour
4	Classification and study of Indigenous and exotic goat breeds	1 hour
5	Classification and study of Indigenous and exotic poultry breeds	1 hour
6	Breeding seasons, mating systems, rearing methods and housing systems of sheep and goat	1 hour
7	Digestive system and digestion absorption of nutrients in fowl	1 hour
8	Principles and practices of sheep and goat feeding, flushing of ewes and does.	1 hour
9	Care and management of pregnant ewes/does, lambs/kids and rams/ bucks	1 hour
10	Methods of rearing, feeding and management of chicks, pullets, layers and broilers	1 hour
11	Importance, composition and utilization of sheep and goat milk	1 hour
12	Marketing of sheep and goat	1 hour
13	Selection of eggs, incubation, hatching and brooding in poultry	1 hour
14	Preservation, grading, marketing of eggs and its economics	1 hour
15	Study of diseases of sheep, goat and poultry	1 hour
16	Vaccination and health cover in sheep, goat and poultry	1 hour

Practical

Practical no	Topic	Hours
1	Study of body parts of sheep, goat and poultry	3 hours
2	Study of differences between sheep and goat	3 hours
3	Identification marking in sheep, goat and poultry	3 hours
4	Management practices in sheep and goat viz. clipping, spraying, dusting, deworming, docking and ringing etc.	3 hours
5	Management practices in poultry viz. debeaking	3 hours
6	Feeding habits and Nutrients requirement for different classes of sheep and goat	3 hours
7	Computation of ration for different classes of poultry	3 hours
8	Shearing of sheep and grading of wool	3 hours
9	Judging and culling of sheep and goat	3 hours
10	Preparation of animals for slaughter and different methods of slaughter	3 hours
11	Study of different meat cuts, dressing percentage, meat bone ratio and edible and non-edible offal's	3 hours
12	Candling of eggs	3 hours
13	Study of various farm records maintained at sheep and goat farm.	3 hours
14	Preparation of viable bank proposal	3 hours
15	Vaccination of sheep, goat and poultry	3 hours

	16	Visit to sheep, goat and poultry farm	3 hours
Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, industry visits, study tours		
References/ Readings:	1. C. L. Arora and R. C. Garg, Sheep Production and Breeding. New Delhi: Studium Press, 1998. 2. S. K. Kaushish, Sheep Production in Tropics and subtropics. New Delhi: Scientific Publishers, 2001 3. C. Devendra and G. B. Mcleroy. Goat and Sheep Production in the Tropics. New York: Longman Publishers, 1983. 4. P. Jagdish, Goat, Sheep and Pig Production and management. New Delhi: Kalyani Publishers, 2018. 5. S. Harbans and Moore, E. N, Livestock and poultry Production. New Delhi, 1968. 6. G. C. Banergee, A Textbook of Animal Husbandry. New Delhi: Oxford and IBH Publishers, 1999.		
Course Outcomes:	At the end of the course, students will be able to 1. Get knowledge on the management techniques in rearing of sheep, goat and poultry. 2. Learn about the care and management eggs. 3. How to be an entrepreneur for self-sustainability. 4. How to be employer to employ youth in goatery and allied industries.		

Name of the Programme: B. Sc. (Hons.) Agriculture
Course No. ELE AGRO 3510
Title of the Course: Weed Management (Elective)
Number of Credits: 3 (2+1), 2 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory
● To study definition of weeds, characteristics and their harmful and beneficial effects on ecosystem.
● To learn classification, reproduction and dissemination of weeds.
● To study Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use.
● To understand mode of action and selectivity of herbicides.
● To learn concept of Allelopathy and its application for weed management.
● To study Bio-herbicides and their application in agriculture.
● To learn concept of herbicide mixture and its utility in agriculture.
● To study Herbicide compatibility with agro-chemicals and their application.
● To understand Integration of herbicides with non-chemical methods of weed management.
● To study Herbicide resistance and its management.
Practical
● To learn techniques of weed preservation.
● To identify various weeds and study of losses cause by it.
● To study Biology of important weeds.
● To study herbicide formulations and herbicide mixture.
● To study herbicide compatibility with other Agrochemicals and fertilizers.
● To study methods of herbicide application
● To learn Herbicides application equipment’s and their calibration.
● To study calculations of herbicide doses, weed control efficiency and weed index.</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture No</th><th>Topic</th><th>Hour</th></tr>
<tr><td>1-2</td><td>Introduction and importance of weeds</td><td>2 hour</td></tr>
<tr><td>3-4</td><td>Characteristics of weeds</td><td>2 hour</td></tr>
<tr><td>5-6</td><td>Harmful and beneficial effects of weeds on ecosystem</td><td>2 hour</td></tr>
<tr><td>7-8</td><td>Classification of weeds, Shift of weed flora</td><td>2 hour</td></tr>
<tr><td>9-10</td><td>Reproduction and dissemination of weeds</td><td>2 hour</td></tr>
<tr><td>11</td><td>Classification of herbicides</td><td>1 hour</td></tr>
<tr><td>12-13</td><td>Concept of adjuvant and surfactants</td><td>2 hour</td></tr>
<tr><td>14</td><td>Herbicide formulation and their use</td><td>1 hour</td></tr>
<tr><td>15-16</td><td>Introduction to mode of action of herbicides</td><td>2 hour</td></tr>
<tr><td>17</td><td>Introduction to herbicide selectivity</td><td>1 hour</td></tr>
<tr><td>18-19</td><td>Allelopathy and its application in weed management</td><td>2 hour</td></tr>
<tr><td>20-21</td><td>Bio herbicides and their application in Agriculture</td><td>2 hour</td></tr>
<tr><td>22-23</td><td>Concept of herbicide mixture and its utility in Agriculture</td><td>2 hour</td></tr>
<tr><td>24-25</td><td>Herbicide compatibility with Agrochemicals</td><td>2 hour</td></tr>
<tr><td>26</td><td>Herbicide compatibility with fertilizers</td><td>1 hour</td></tr>
</table></td></tr>
</table>

	27-28	Integration of herbicides with non-chemical methods of weed management	2 hour
	29-30	Herbicide resistance and its management	2 hour
	Practical		
	1-2	Identification of weeds	6 hours
	3	Techniques of weed preservation	3 hours
	4	Study of losses caused by weeds	3 hours
	5-6	Biology of important weeds	6 hours
	7	Study of herbicide formulation and herbicide mixtures	3 hours
	8	Study of herbicide in relation to Agrochemicals	3 hours
	9	Phyto-toxicity symptoms on crops and its measurement	3 hours
	10	Methods of herbicide application	3 hours
	11-12	Herbicides application equipments and their calibration	6 hours
	13	Calculation of herbicide dose	3 hours
	14	Computation of different weed indices	3 hours
	15	Visit to weed management experiments	3 hours
Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, expert lecture, field visits and study tours.		
References/ Readings:	1. O. P. Gupta, Weed management Principles and Practices. Jodhpur: Agrobios, 2007. 2. O. P. Gupta, Modern Weed Management, Jodhpur: Agrobios, 2018. 3. V. S. Rao, Principles of Weed Science. New Delhi: CBS Publishers & Distributors, 2018. 4. T. K. Das, Weed Science: Basics and Applications. New Delhi: Jain Brothers, 2008.		
Course Outcomes:	At the end of the course, students will be able to Understand 1. Concept of weed, their characteristics, reproduction and dispersal behavior. 2. Concept of Herbicide its different types with advantages and disadvantages. 3. Different methods of weed management		

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: ELE AGM 361
Title of the Course: System Stimulation and Agro-advisory
Number of Credits: 3 (2+1), 2 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>To impart the knowledge about crop models, weather forecasting and Use of crop simulation model for preparation of Agro-advisory.
Theory
● To study System Approach and System boundaries for representing soil-plant-atmospheric continuum
● To learn Crop models, concepts & techniques, types of crop models, data requirements, and relational diagrams.
● To study Elementary crop growth models; calibration, validation, verification and sensitivity analysis.
● To study Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.
● To learn Weather forecasting, types, methods, tools & techniques.
● To study ITK used for weather forecast.
● To learn concept of herbicide mixture and its utility in agriculture.
● To study Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.
Practical
● To study preparation of crop weather calendars.
● To learn Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.
● To study of crop-weather models using different statistical techniques.
● To study of forewarning models for insect pest and disease and crop-weather –pest - disease calendar.
● To Study of Simulation with limitations of water and nutrient management options
● To learn use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture No</th><th>Topic</th><th>Hour</th></tr>
<tr><td>1-2</td><td>System Approach for representing soil-plant-atmospheric continuum</td><td>2 Hours</td></tr>
<tr><td>3</td><td>System boundaries for representing soil-plant-atmospheric continuum</td><td>1 Hour</td></tr>
<tr><td>4-5</td><td>Crop models, concepts and techniques</td><td>2 Hours</td></tr>
<tr><td>6-7</td><td>Types of models, data requirements, relational diagrams</td><td>2 hours</td></tr>
<tr><td>8-9</td><td>Evaluation of crop responses to weather elements</td><td>2 hours</td></tr>
<tr><td>10-11</td><td>Elementary crop growth models –calibration and validation</td><td>2 hours</td></tr>
<tr><td>12-13</td><td>Elementary crop growth models -verification and sensitivity analysis</td><td>2 hours</td></tr>
<tr><td>14</td><td>Potential and achievable crop production- concept</td><td>1 hour</td></tr>
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	15	Modelling techniques for potential and achievable crop production estimation	1 hour
	16-17	Crop production in moisture and nutrients limited conditions	2 hours
	18	Components of soil water and nutrient balance	1 hour
	19-20	Weather forecasting, its types, methods and tools	2 hours
	21	Techniques of weather forecasting and its verification	1 hour
	22	Value added weather forecast	1 hour
	23-24	ITK for weather forecast and its validity	2 hours
	25	Aerospace science and weather forecast	1 hour
	26	Crop-Weather Calendar, Crop-Weather-Pest-Disease Calendar and forewarning model	1 hour
	27	Crop weather diagram	1 hour
	28-29	Remote sensing- its application in agriculture	2 hours
	30	Preparation of agro-advisory bulletin based on weather forecast	1 hour
	31	Use of crop simulation model for preparation of Agro-advisory	1 hour
	32	Agro-advisory , its effective dissemination	1 hour
	Practical		
	1	Preparation of crop weather calendars	3 hours
	2-3	Preparation of agro-advisories based on weather forecast using various approaches	6 hours
	4	Preparation of AAS based on weather forecast using synoptic charts	3 hours
	5-6	Study of crop-weather models using different statistical teqniques	6 hours
	7	Study of simulation models for crop-growth (DSSAT)	3 hours
	8-9	Study of forewarning models for insect pest and disease	6 hours
	10	Study of crop-weather –pest - disease calendar	3 hours
	11	Study of Simulation with limitations of water and nutrient management options	3 hours
	12	Sensitivity analysis of varying weather and crop management practices	3 hours
	13-14	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast	6 hours
	15-16	Feedback from farmers about agro-advisory.	6 hours
Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, expert lecture, field visits and study tours		
References/ Readings:	1. O. P. Bishnoi, Applied Agro climatology. Jaipur: Oxford Book Company, 2010. 2. D. D.Sahoo and R.M. Solanki, Remote Sensing Techniques in Agriculture. Jodhpur: Agrobios (india), 2008. 3. M. C. Varshneya and P. B. Pillai, Text book of Agril. Meteorology. New Delhi: ICAR, 2003. 4. D. Wallach, Working with Dynamic crop models, Evaluation, Analysis, Parametrization and Applications. U.K.: Elsevier Oxford, 2006.		
Course Outcomes:	At the end of the course, students will be able to Understand 1. Concept of crop models, techniques, types of models and data requirements. 2. Modelling techniques for potential and achievable crop production estimation.		

	3. ITK used for weather forecast. 4. Remote sensing- its application in agriculture 5. Use of crop simulation model for preparation of Agro-advisory

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: ENTO 354
Title of the Course: Pests of Crops and Stored Grain and their Management
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory
To understand the General account on nature and type of damage by different arthropods pests: Scientific name, order, family, host range, distribution, biology, nature of damage and management of insect pests of Cereals, Pulses, Fibre crops.
To understand the Stored grain pest and their management
Practical
To study the identification, Nature of damage and symptoms, biology and integrated management of pests of major crops
To study the identification, Nature of damage and symptoms, biology and integrated management of stored grain pests</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture no</th><th>Topic</th><th>Hours</th></tr>
<tr><td></td><td>Distribution, biology, nature of damage and management of insect pests of crops</td><td></td></tr>
<tr><td>1</td><td>Rice - Paddy stem borer, green leaf hopper, Brown plant hopper, White backed plant hopper, Gall midge, Paddy grasshopper, blue beetle, Caseworm, Armyworm, Gundhi bug, Hispa, Leaf folder</td><td>1 hour</td></tr>
<tr><td>2</td><td>Sorghum – Shoot fly, Stem borer, Aphids, Delphacids, Grasshopper, Earhead midge, Earhead caterpillars</td><td>1 hour</td></tr>
<tr><td>3</td><td>Maize – Shoot fly, Stem borer, Armyworm, Cob earworm
Bajra – Shoot fly, Blister beetle
Wheat – Stem borer, Aphids, Termites,
Minor millets</td><td>1 hour</td></tr>
<tr><td>4</td><td>Pigeon pea – Pod borer, Plume moth, Pod fly, Spotted pod borer, Leaf webber, Mites</td><td>1 hour</td></tr>
<tr><td>5</td><td>Chickpea – Gram pod borer, Aphids, Cutworm
Mung and Urdbean – Aphids, Leaf eating caterpillar, Semilooper, Pod borer
Cowpea and Pea – Aphids, Blue butterfly, Pod borer</td><td>1 hour</td></tr>
<tr><td>6</td><td>Groundnut – Leaf miner, Hairy caterpillar, Tobacco leaf eating caterpillar, Aphids, Thrips, White grub, Pod sucking bug</td><td>1 hour</td></tr>
<tr><td>7</td><td>Castor – Semilooper, Capsule borer, Jassids, Tobacco leaf eating caterpillar
Sunflower – Capitulum borer, Hairy caterpillar, Jassids, Thrips, Whitefly, Stem borer</td><td>1 hour</td></tr>
<tr><td>8</td><td>Safflower – Aphids, Capitulum borer, Guzia weevil
Mustard – Aphids, Sawfly, Leaf webber
Linseed – Gall fly</td><td>1 hour</td></tr>
<tr><td>9</td><td>Soybean – Stem fly, Girdle beetle, Leaf miner, Tobacco leaf eating caterpillar, Whitefly, Semilooper, Gram pod borer
Sesamum – Til hawk moth, Gall fly, leaf eating caterpillar</td><td>1 hour</td></tr>
</table></td></tr>
</table>

	Niger – Semilooper, Gram pod borer	
10-11	Cotton – Aphids, Jassids, Thrips, Whitefly, Mealy bugs, Spotted bollworm, American bollworm, Pink bollworm, Tobacco leaf eating caterpillar, Leaf folder, Semilooper, Red cotton bug, Dusky cotton bug, Grey weevil Sunhemp and Mesta – Sunhemp hairy caterpillar	2 hours
12	Sugarcane – Early shoot borer, Internode borer, Top shoot borer, Whitefly, Pyrilla, Woolly aphids, Mealy bug, Scale insect, Termites, White grub	1 hour
13	**Non-insect pests of above crops –** Crabs, Snails and Slugs, millepedes, Mites, Rats and squirrels	1 hour
14-15	**Stored grain pests - -** Biology and damage of Primary and Secondary pests Primary store grain pests- Internal feeders - Rice weevil, lesser grain borer, pulse beetle and Angoumois grain moth External feeders - khapra beetle, Indian meal moth Secondary store grain pests – Rust red flour beetle, Saw toothed grain beetle, long headed beetle Primary and Secondary store grain pests - Rice moth	2 hour
16	Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management	1 hour
17	Preventive and curative methods of stored grain pests	1 hour
18	Storage structure and methods of grain storage and fundamental principles of grain store management	1 hour

Practical

Practical no	**Topic**	**Hours**
1	Pests of Rice	3 hours
2	Pests of Sorghum	3 hours
3	Pests of Maize, Bajra, Wheat and Miner millets	3 hours
4	Pests of Pigeon pea	3 hours
5	Pests of Chickpea, Mung bean, Urd bean, Cowpea and Pea	3 hours
6	Pests of Groundnut	3 hours
7	Pests of Castor and Sunflower	3 hours
8	Pests of Safflower, Mustard, Linseed	3 hours
9	Pests of Soybean, Sesamum and Niger	3 hours
10 & 11	Pests of Cotton, Sunhemp and Mesta	3 hours
12	Pests of Sugarcane	3 hours
13	Non insect pests of field crops	3 hours
14 & 15	Store grain pests	3 hours
16	Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management	3 hours
17	Preventive and curative methods of stored grain pests	3 hours
18	Storage structure and methods of grain storage and fundamental principles of grain store management	3 hours

Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, field visits, study tours
References/ Readings:	1. A. S. Atwal and G.S. Dhaliwal, Agricultural Pests of South Asia and their Management. New Delhi: Kalyani Publishers, 2018.

	2. B. V. David and V.V. Ramamurthy, Elements of Economic Entomology. New Delhi: Brillion Publishing, 2017. 3. L. P. Pedigo, Entomology and Pest Management. United states: Waveland press INC ,2014
Course Outcomes:	At the end of the course, students will be able to 1. Identify different pests of major crops 2. know the life cycle of pests and know their susceptible stages 3. know about host plants of pests 4. know about integrated pest management of major crops 5. Identify non insect pest and their management 6. identify stored grain pest and manage them.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: PATH 354
Title of the Course: Diseases of Field and Horticultural Crops and their Management- I
Number of Credits: 3(2+1), 2 Theory and 1 Practical
Effective from AY: 2019-20

Pre-requisites for the Course:	Nil
Course Objectives:	**Theory**: Includes symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: ● To study diseases of Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro; ● To study diseases of Maize: stalk rots, downy mildew, leaf spots; ● To study diseases of Sorghum: smuts, grain mold and anthracnose, ● To study diseases of Bajra: downy mildew and ergot; ● To study diseases of Finger millet: Blast and leaf spot ● To study diseases of Groundnut: early and late leaf spots, wilt. ● To study diseases of Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; ● To study diseases of Pigeonpea: Phytophthora blight, wilt and sterility mosaic; ● To study diseases of Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; ● To study diseases of Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: ● To study diseases of Guava: wilt and anthracnose; ● To study diseases of Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; ● To study diseases of Papaya: foot rot, leaf curl and mosaic, ● To study diseases of Pomegranate: bacterial blight; Cruciferous vegetables: ● To study diseases of vegetables: Alternaria leaf spot and black rot; ● To study diseases of Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; ● To study diseases of Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; ● To study diseases of Okra: Yellow Vein Mosaic; ● To study diseases of Beans: anthracnose and bacterial blight; ● To study diseases of Ginger: soft rot; Colocasia: Phytophthora blight; ● To study diseases of Coconut: wilt and bud rot; ● To study diseases of Tea: blister blight; ● To study diseases of Coffee: rust **Practical:** ● To identify the diseases of field crops, horticultural crops and vegetables. ● To learn histopathology of diseases. ● To visit fields to see incidence of diseases in crops and identify/diagnose. ● To collect disease specimens and preserve in herbarium ● To submit well mounted disease specimens.
Content:	**Theory**

Lecture no	Topic	Hours
	Study: Symptoms, etiology, disease cycle and management of major diseases of following crops	
	Field crops	
1,2,3	Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro;	3 hours
4, 5	Maize: stalk rots, downy mildew, leaf spots;	2 hours
6, 7	Sorghum: smuts, grain mold and anthracnose	2 hours
8	Bajra: downy mildew and ergot;	1 hour
9	Finger millet: Blast and leaf spot	1 hour
	Oilseed	
10	Groundnut: early and late leaf spots, wilt.	1 hour
	Pulses	
11, 12, 13	Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic;	3 hours
14	Pigeon pea: Phytophthora blight, wilt and sterility mosaic;	1 hour
	Cash crop	
15	Castor: *Phytophthora* blight;	1 hour
16	Tobacco: black shank, black root rot and mosaic.	1 hour
	Horticultural Crops	
17	Guava: wilt and anthracnose;	1 hour
18, 19	Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;	2 hours
20, 21	Papaya: foot rot, leaf curl and mosaic,	2 hours
22, 23	Pomegranate: bacterial blight;	2 hours
	Cruciferous vegetables:	
24. 25	Crucifers: Alternaria leaf spot and black rot;	2 hours
26, 27	Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic;	2 hours
28, 29	Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight;	2hours
	Plantation crops	
30, 31, 32	Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust	3hours

Practical

Practical no	Topics	Hours
1	Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro	3 hrs

	2	Maize: stalk rots, downy mildew, leaf spots, Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot	3 hrs
	3	Finger millet: Blast and leaf spot, Groundnut: early and late leaf spots, wilt	3 hrs
	4	Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic, Pigeonpea: Phytophthora blight, wilt and sterility mosaic	3 hrs
	5	Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic	3 hrs
	6	Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic	3 hrs
	7	Guava: wilt and anthracnose; Papaya: foot rot, leaf curl and mosaic, Papaya ring spot	3 hrs
	8	Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top	3 hrs
	9	Pomegranate: bacterial blight, wilt	3 hrs
	10	Cruciferous vegetables: Alternaria leaf spot and black rot	3 hrs
	11	Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic	3 hrs
	12	Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight	3 hrs
	13	Okra: Yellow Vein Mosaic, Beans: anthracnose and bacterial blight	3 hrs
	14	Ginger: soft rot; Colocasia: Phytophthora blight	3 hrs
	15	Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust	3 hrs
	16	Field visit for the diagnosis of field problems	3 hrs
Pedagogy:	Lectures, practical, disease specimen collection and preservation, interactive learning, presentations, home assignments, industry visits, study tours.		
References/ Readings:	1. G. N. Agrios, Plant Pathology. USA: Acad. Press, 2010. 2. L. R. Verma and R. C. Sharma, Diseases of Horticultural Crops fruits. New Delhi: Indus Publishing company, 1999. 3. V. N. Pathak, Diseases of fruit crops. New Delhi: Oxford & IBH publication, 1986. 4. R. S.Singh, Diseases of fruit crops. New Delhi: Oxford & IBH publication, 1986. 5. S. A. Naqvi, Diseases of Fruits and vegetables Springer Science & Business Media (2007) 6. P. Chowdappa an P. Sharma, Diseases of Plantation Crops. New Delhi: Indian Phytopathological Society, 2014. 7. ICAR, Diseases of Horticulture Crops and their management. Tamil Nadu: Tamil Nadu Agriculture University, 2017. 8. P. Santha Kumari, Advances in the diseases of Plantation crops & spices. Uttar Pradesh: International Book Distributing Company, 2004. 9. R. S. Mehrotra and A. Aggarwal, Plant Pathology. Uttar Pradesh: Tata Mc Graw Hill Publ. Co. Ltd, 2007.		

	10. S. T. Koike, P. Gladers and A. Paulus, Vegetable Diseases. USA: Academic Press, 2006. 11. R. S. Singh, Diseases of Vegetables crops. New Delhi: Oxford & IBH publication, 1987. 12. R. S. Singh, Plant Diseases. New Delhi: Oxford & IBH. Publications, 2008. 13. G. Rangaswamy and A. Mahadevan. Diseases of Crops Plants in India. New Delhi: PHI learning Pvt. Ltd, 2009. 14. A. Steferud, Diseases of Vegetable crops. New Delhi: Biotech Books, 2005. 15. R. S. Mehrotra and A. Aggarwal, Plant Pathology. Uttar Pradesh: Tata Mc Graw Hill Publ. Co. Ltd, 2007. 16. D. Singh and P. Chodappa, Diseases of Vegetable Crops. Diagnosis and Management, New Delhi: Today and Tomorrow Printers, 2014. 17. H. Singh, House-hold and Kitchen Garden Pests - Principles and Practices. New Delhi: Kalyani Publishers, 1984.
Course Outcomes:	At the end of the course, students will be able to: 1. Study and know about diseases caused by fungi, bacteria, viruses, nematode in plants. 2. Learn etiology of phytopathogens. 3. Learn symptoms and disease appearance in plants and crops. 4. Lean diagnosis of diseases. 5. Preserve the disease specimens. 6. Learn management of diseases using chemicals and various integrated approaches.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: ENTO 232
Title of the Course: Insect Ecology and Integrated Pest Management
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory:
● To impart knowledge to students on Insect ecology and impact of ecosystem on Pest population dynamics
● To impart knowledge to students on Different pest management methods and concept of Integrated pest management
Practical:
● To impart knowledge to students on meteorological observatory / automatic weather reporting station
● To impart knowledge to students on Different type of Ecosystems
● To impart knowledge to students on distribution patterns of insects, sampling techniques for the estimation of insect population and damage, Pest surveillance through light traps, pheromone traps and field incidence.
● To impart knowledge to students on Different pest management methods and concept of Integrated pest management.
● To impart knowledge to students on Calculation of doses/concentrations of insecticides.
● To impart knowledge to students on Identification of common phytophagous mites and their morphological characters
● To impart knowledge to students on Identification of rodents and bird pests and their damage.
● To impart knowledge to students on Vermiculture – visit to vermiculture unit.
● To impart knowledge to students on Biopesticides used in IPM with mass multiplication of NPV and Entomopathogenic fungi.</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture no</th><th>Topics</th><th>Hours</th></tr>
<tr><td>1</td><td>The Definition of Insect Ecology and its scope, Environment and its components.</td><td>1 hr</td></tr>
<tr><td>2</td><td>The Effect of abiotic factors on Pest Population – temperature, moisture and humidity, rainfall, light, atmospheric pressure, air currents and edaphic factors.</td><td>1 hr</td></tr>
<tr><td>3</td><td>The effect of biotic factors on Pest Population– food/ competition and Natural Enemies, Natural and Environmental resistance.</td><td>1 hr</td></tr>
<tr><td>4</td><td>The concepts of balance of life in nature, biotic potential, Causes for outbreak of pests in agro – ecosystem.</td><td>1 hr</td></tr>
<tr><td>5</td><td>Pest surveillance and its types and pest forecasting, Categories of pests.</td><td>1 hr</td></tr>
<tr><td>6</td><td>Natural and Applied pest control. IPM – Introduction, Importance, Scope, Concepts, Principles, tools and limitations of IPM.</td><td>1 hr</td></tr>
<tr><td>7</td><td>Host plant resistance</td><td>1 hr</td></tr>
<tr><td>8</td><td>Cultural methods of pest control</td><td>1 hr</td></tr>
<tr><td>9</td><td>Mechanical methods of Pest control</td><td>1 hr</td></tr>
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10	Physical Methods and Legislative methods of pest control.	1 hr
11	Biological control- parasitoids, predators and transgenic plant, pathogens such as bacterial, fungi and viruses.	1 hr
12	Chemical control – importance, hazards and limitations. Classification of insecticides, Insecticidal toxicity and formulations	1 hr
13	Examples of important insecticide groups - Botanical insecticides – Neem based products. Cyclodienes, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones,	1 hr
14	Examples of important insecticide groups - Thioureaderivaties, Pyridine azomethines, Pyrroles etc, Nematicides, Rodenticides, Acaricides and Fumigants. Insecticides Act 1968-important provisions	1 hr
15	Insecticidal toxicity and formulations	1 hr
16	Application techniques of spray fluids. Phytotoxicity of insecticides.	1hr
17	Symptoms of poisoning, first aid and antidotes.	1hr
18	Recent methods of pest control: Repellents, Antifeedants, hormones, attractants, gamma radiation and genetic control.	1hr

Practical

Practical no	Topics	Hours
1	Visit to meteorological observatory / automatic weather reporting station	3 hrs
2	Study of terrestrial and pond ecosystems of insects.	3 hrs
3	Studies on behaviour of insects and orientation (repellency, stimulation, deterancy).	3 hrs
4	Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage.	3 hrs
5	Pest surveillance through light traps, pheromone traps and field incidence.	3 hrs
6	Practicable IPM practices- Mechanical and Physical methods	3 hrs
7	Practicable IPM practices -Cultural and Biological methods	3 hrs
8	Chemical control – Insecticides and their formulations	3 hrs
9	Pesticide appliances, insecticide application techniques, calibration of plant protection appliances	3 hrs
10	Calculation of doses/concentrations of insecticides	3 hrs
11	Compatibility of pesticides and phytotoxicity of insecticides	3 hrs
12	IPM case studies -Paddy	3 hrs
13	IPM case studies – Sugarcane	3 hrs
14	IPM case studies – Mango/ Citrus/Pomegranate	3 hrs

	15	Identification of common phytophagous mites and their morphological characters	3 hrs
	16	Identification of rodents and bird pests and their damage	3 hrs
	17	Vermiculture – visit to vermiculture unit	3hrs
	18	Biopesticides used in IPM with mass multiplication of NPV and Entomopathogenic fungi.	3hrs
Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, field visits, study tours		
References/ Readings:	1. R.L. Metcalf and W.H Luckman, Introduction to Insect Pest Management. New York: Wiley Inter Science publishing, 1982. 2. G.S. Dhaliwal and R. Arora, Integrated Pest Management: Concepts and Approaches. New Delhi: Kalyani publishers, 2001. 3. L. P. Pedigo, Entomology and Pest Management. New York: Mac Millan publishing company, 1991. 4. G. S. Yazdani and M.L. Agarwal, Elements of Insect Ecology. New Delhi: Naroji publishing New Delhi house, 1979.		
Course Outcomes:	At the end of the course, students will be able to 1. know about effect of abiotic and biotic factors on Pest population. 2. know the different methods of pest management. 3. know about concept of Integrated pest management. 4. know about concept of Pesticide resistance, pest resurgence and pesticide residue. 5. know about Biorational methods of pest management. 6. Know about concept of pesticide formulations and toxicity.		

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: GPB 243
Title of the Course: Principles of Seed Technology
Number of Credits: 3(1+2), 1 Theory and 2 Practical
Effective from AY: 2019-20

Pre-requisites for the Course:	Nil
Course Objectives:	**Theory:** ● To learn seed and seed technology: introduction, definition and importance. ● To study deterioration causes of crop varieties and their control & Maintenance of genetic purity during seed production ● To understand seed quality: definition. characters of good quality seed ● To study different classes of seed. ● To study foundation and certified seed production of important cereals, pulses, oilseeds, fodder crops and vegetable crops ● To know about seed certification, phases of certification, procedure for seed certification, field inspection ● To understand Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds control order 1983. ● To study varietal identification through Grow Out Test and Electrophoresis. Molecular and biochemical test. Detection of genetically modified crops. Transgene contamination in non-GM crops, GM crops and organic seed production. ● To learn seed drying, processing and their steps. Seed testing for quality assessment. ● To study seed treatment, its importance, method of application and seed packing. Seed storage : general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage ● To learn seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. **Practical:** ● To study seed production in major cereals: Wheat, Rice, Sorghum, Bajara and Maize. ● To study seed production in major pulses: Green gram, Black gram, Pigeonpea, Lentil, Gram and Field pea ● To study seed production in major oil Seeds: Soybean, Rapeseed & Mustard ● To study seed production in major vegetable crops: Brinjal, Tomato, Chilli, Okra, Onion, Pumpkin, Bottle gourd, Bitter gourd, Ridge gourd and Sponge gourd ● To learn about seed sampling and testing procedure ● To learn Physical purity test and Seed moisture test ● To learn about Germination test – types of germination, Germination test – different methods of germination ● To study Seed viability test, Seed and seedling vigour test ● To understand Genetic purity test: Grow Out Test, Genetic purity test : Electrophoresis ● To learn Seed certification: Procedure ● To know Field inspection, preparation of field inspection report ● To acquaint with seed production farms of cereal crops, oilseed crops, pulse crop and fibre crops. ● To know about seed testing laboratory and seed processing plants.

Content:

Theory

Lecture No	Topic	Hour
1	Seed and seed technology: introduction, definition and importance	1 hour
2	Deterioration causes of crop varieties and their control & Maintenance of genetic purity during seed production	1 hour
3	Seed quality: definition. Characters of good quality seed	1 hour
4	Different classes of seed.	1 hour
5	Foundation and certified seed production of important cereals (Wheat, Sorghum, Maize, Rice &Bajara)	1 hour
6	Foundation and certified seed production of important pulses (Pigeon Pea, Green Gram, Black Gram & Chick Pea)	1 hour
7	Foundation and certified seed production of important oil seeds (Soybean, Sunflower, Safflower ,Groundnut and Cotton)	1 hour
8	Foundation and certified seed production of important fodder crops (Fodder Sorghum, Lucern, Berseem,)	1 hour
9	Foundation and certified seed production of important vegetable crops (Tomato, Brinjal, Chilli, Onion & Okra)	1 hour
10	Seed certification, phases of certification, procedure for seed certification, field inspection	1 hour
11	Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds control order 1983.	1 hour
12	Varietal identification through Grow Out Test and Electrophoresis. Molecular and biochemical test. Detection of genetically modified crops. Transgene contamination in non-GM crops, GM crops and organic seed production.	1 hour
13	Seed drying, processing and their steps. Seed testing for quality assessment.	1 hour
14&15	Seed treatment, its importance, method of application and seed packing. Seed storage: general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage	2 hours
16	Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing	1 hour

Practical

Practical No,	Title	Hours
1	Seed production in major cereals: Wheat and Rice	3 hours
2	Seed production in: Sorghum and Bajara	3 hours
3	Seed production in : Maize	3 hours
4	Seed production in major pulses: Green gram and Black gram	3 hours
5	Seed production in pulses: Pigeonpea and Lentil	3 hours
6	Seed production in pulses: Gram and Field pea	3 hours
7	Seed production in major oil Seeds: Soybean, Rapeseed & Mustard	3 hours

	8	Seed production in major vegetable crops: Brinjal and Tomato	3 hours
	9	Seed production in vegetable crops: Chilli and Okra.	3 hours
	10	Seed production in vegetable crops: Onion	3 hours
	11	Seed production in: Pumpkin, Bottle gourd	3 hours
	12	Seed production in: Bitter gourd, Ridge gourd, Sponge gourd	3 hours
	13	Seed sampling and testing procedure	3 hours
	14	Physical purity test	3 hours
	15	Seed moisture test	3 hours
	16	Germination test – types of germination	3 hours
	17	Germination test – different methods of germination	3 hours
	18	Seed viability test	3 hours
	19	Seed and seedling vigour test	3 hours
	20	Genetic purity test: Grow Out Test	3 hours
	21	Genetic purity test: Electrophoresis	3 hours
	22	Seed certification: Procedure	3 hours
	23	Field inspection, preparation of field inspection report	3 hours
	24	Visit to seed production farms of cereal crops	3 hours
	25	Visit to seed production farms of oilseed crops	3 hours
	26	Visit to seed production farms of pulse crops	3 hours
	27	Visit to seed production farms of fiber crops	3 hours
	28	Visit to seed testing laboratories	3 hours
	29&30	Visit to seed processing plant	3 hours

Pedagogy:	Lectures, practical, presentations, home assignments, study tours etc.
References/ Readings:	1. R. L. Agrawal, Seed Technology. Oxford and IBH. New Delhi: Publishing Company Ltd, 1980. 2. S. Sen and N. Ghosh., Seed Science and Technology. New Delhi: Kalyani Publication, 2014. 3. P. Singh, Principles of Seed Technology. New Delhi: Kalyani Publication, 2013 4. N. C. Singhal, Seed Science and Technology. New Delhi: Kalyani Publication, 2016. 5. D. Khare and M. Bhale, Seed Technology. Jodhapur, Scientific Publishers, 2000. 6. N, Singh, D.K. Singh, Y.K. Singh and V, Kumar. Vegetable Seed Production. Lucknow, International Book Distribution Company, 2006.
Course Outcomes:	At the end of the course, students will be able to: 1. Learn about quality seed production of cereals, pulses, oilseeds, fodder crops and vegetable crops. 2. Learn about seed certification and field inspection procedure for quality seed production. 3. Learn about seed sampling and procedure of seed sampling and seed testing viz., germination test, seed moisture test, viability test, grow out test etc. 4. Learn about seed drying, processing, seed treatment and seed marketing

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: GPB 232
Title of the Course: Fundamentals of Plant Breeding
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory:
● To know plant breeding methods and their application in breeding (agriculture).
● To study self- incompatibility and male sterility system in plants.
● To study concepts of population genetics.
● To study hybridization techniques in different field, vegetable and horticultural crops.
● To study heterosis breeding and inbreeding depression.
● To study handling of segregating generations by different breeding methods.
● To know about different breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops for development of crop cultivars.
Practical:
● To study germplasm of different crops.
● To learn about floral structure of self-pollinated and cross-pollinated crops.
● To study about emasculation and hybridization techniques in self-pollinated crops.
● To learn about emasculation and hybridization techniques in cross-pollinated crops.
● To learn about emasculation and hybridization techniques in often cross-pollinated crops.
● To learn about different methods of experimentation used in plant breeding and analysis of randomized block design.
● To study prediction performance of double cross hybrids.</td></tr>
<tr><td>Content:</td><td>Theory

<table>
<tr><th>Lecture no</th><th>Topics</th><th>Hours</th></tr>
<tr><td>1</td><td>Definition, history of plant breeding, aims and general objective of plant breeding Land marks of plant breeding, Indian plant breeders, General objectives of plant breeding Major achievements, Future Prospects.</td><td>1 hr</td></tr>
<tr><td>2</td><td>Self-incompatibility- Definition, classification, heteromorphic SI, its features, distyly, tristyly, homomorphic SI, its types i.e. gametophytic SI and sporophytic SI, its features, utilization of self-incompatibility in plant breeding.</td><td>1 hr</td></tr>
<tr><td>3</td><td>Male sterility- Definition, Classification/types, Genetic MS, Thermosensitive Genetic MS, Photosensitive Genetic MS, Transgenic MS, Cytoplasmic MS, Cytoplasmic Genetic MS, Chemical Hybridizing Agents.</td><td>1 hr</td></tr>
<tr><td>4</td><td>Heritability- Definition, types-narrow and broad sense heritability
Components of genetic variation- Classification, definition and features of additive, dominance and epistatic variance, gene action.</td><td>1 hr</td></tr>
<tr><td>5</td><td>Concepts of population genetics- Definition and concept of</td><td>1 hr</td></tr>
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		population genetics, random mating population, gene and genotypic frequency. Hardy-Weinberg law- Law, its validity, factors affecting gene frequency.	
	6	Breeding Methods in self - pollinated crops - List of breeding methods Plant Introduction- Definition, purpose, types i.e. primary and secondary introduction, advantages and disadvantages. Acclimatization- Definition, concept, factors affecting acclimatization.	1 hr
	7	Pure line selection- uses of pure line, merits, demerits, achievements. Mass selection- Definition, genetic basis, main features, positive and negative selection, detailed procedure of development of variety by mass selection, its merits, demerits, achievements.	1 hr
	8	Handling of segregating population through Pedigree method- detailed procedure of pedigree method, its merits, demerits, achievements.	1 hr
	9	Handling of segregating population through Bulk method- Concept of bulk method, short term, long term, its application, procedure of bulk method, its merits, demerits, achievements. Handling of segregating population through Single seed descent method- concept of SSD method, its application, detailed procedure of SSD method, its merits, demerits, achievements.	1 hr
	10	Back cross method- Definition of backcross, its objective, requirements and applications of backcross method, procedure for transfer of dominant gene. Back cross method- procedure for transfer of recessive gene, merits, demerits, achievements of backcross method.	1 hrs
	11	Methods of breeding in cross pollinated crops- list of plant breeding methods for cross pollinated crops. Modes of selection- Recurrent selection, its types and its procedure.	1 hr
	12	Hybridization techniques- Definition, aim and objectives, types of hybridization, steps and procedure of hybridization programme. Wide hybridization- Definition, types, main features, interspecific and intergeneric hybridization, its examples, incompatibility barriers for wide hybridization, techniques for overcoming incompatibility barriers, achievements.	1 hr
	13	Composite and synthetic varieties- Definition, steps for development of composites and synthetics, procedure of developing composites and synthetics, its merits, demerits and achievements.	1 hr
	14	Breeding methods in asexually propagated crops: List of breeding methods for asexually propagated crops. Clonal selection- Definition, features of asexually propagated crops, procedure of clonal selection, its merits and demerits	1 hr

	Hybridization- steps and procedure of hybridization in clonal crops.	
15	Mutation breeding method and its uses – Definition of mutation breeding, conditions in which mutation is rewarding, procedure of mutation breeding for seed and vegetatively propagated crops, applications, its merits, demerits and achievements. Polyploidy in relation to plant breeding- Definition of haploid, monoploid, diploid, polyploid, genome, heteroploidy, annuploidy, euploidy, types of annuploidy its application in crop improvement, types of polyploidy (natural occurring and artificial) and its role in crop improvement, effects of polyploidy, its application in crop improvement and limitation.	1 hr
16	Heterosis- Definition, heterosis and hybrid vigour, effects and estimation of heterosis, genetic basis/theories of heterosis. Inbreeding depression- Definition, effects of inbreeding.	1 hr

Practical

Practical no	Topics	Hours
1	Plant Breeder's kit	3 hrs
2	Study of germplasm of various crops	3 hrs
3	Study of floral structure of self-pollinated crops	3 hrs
4	Study of floral structure of cross pollinated crops	3 hrs
5	Emasculation and hybridization techniques in self-pollinated crops: Green gram, Black gram, Rice, Wheat, Groundnut, Soybean.	3 hrs
6	Emasculation and hybridization techniques in self-pollinated crops: Sesame, Chickpea, Okra, Tomato, Brinjal, Chilli.	3 hrs
7	Emasculation and hybridization techniques in cross pollinated crops: Maize, Bajra, Sunflower, Papaya, Sugarcane.	3 hrs
8	Emasculation and hybridization techniques in often cross pollinated crops: Cotton, Sorghum, Pigeonpea, Safflower.	3 hrs
9	Consequences of inbreeding on genetic structure of resulting populations	3 hrs
10	Study of male sterility system	3 hrs
11	Handing of segregation populations	3 hrs
12	Methods of calculating mean, range, variance, standard deviation, heritability.	3 hrs
13	Designs used in plant breeding experiment.	3 hrs
14	Analysis of Randomized Block Design.	3 hrs
15	To work out the mode of pollination in a given crop and extent of natural out Crossing.	3 hrs
16	Prediction of performance of double cross hybrids	3 hrs

Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, study tours

References/ Readings:	1. B. D. Singh, Plant Breeding Principles and Methods. New Delhi: Kalyani Publication, 2000. 2. P. Sing, Essentials of Plant Breeding. New Delhi: Kalyani Publication, 2006. 3. J. R. Sharma, Principles and Practices Plant Breeding. New Delhi: McGraw Hill Publishing Company Limited, 1994. 4. V. L. Chopra, Plant Breeding Theory and Practices, New Delhi: Oxford and IBH Publishing Company, 1989. 5. R. C. Choudhary, Introduction to Plant Breeding. New Delhi: Oxford and IBH. Publishing Company, 2008. 6. H. K. Choudhary, Elementary Principles of Plant Breeding. New Delhi: Oxford and IBH Publishing Company, 1971.
Course Outcomes:	At the end of the course, students will be able to: 1. Learn about mode of pollination in different field crops, vegetable crops and horticultural crops. 2. Learn different breeding methods of self -pollinated crops. 3. Learn different breeding methods of cross -pollinated crops. 4. Learn about development of varieties in self-pollinated, cross pollinated and vegetatively propagated crops by different breeding methods. 5. Study and know about different design of experimentation used in plant breeding.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: EXTN 123
Title of the Course: Communication Skills & personality development
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2019-20

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory:
● To learn communication Skills, its Meaning and process of communication ; verbal and nonverbal communication
● To study structural and functional grammar
● To understand body languages & to acquire group discussion techniques
● To study listening, note taking & writing skills
● understand time & conflict management
● To maintain field diary and lab record
● To understand indexing, footnote and bibliographic procedures
● To study reading and comprehension of general and technical articles
● To learn precise writing, summarizing, abstracting
● To study individual and group presentations, impromptu presentation, public speaking, oral presentation skills and self-esteem & self confidence
● To learn leadership & team building skills
● To understand organizing seminars and conferences
● To study personality Development & SWOT analysis
Practical:
● To understand listening skills
● To learn note taking skills
● To study oral presentation skills
● To acquire Individual & group presentation skills
● To study writing skills
● To learn field diary maintenance
● To learn laboratory records maintenance
● To acquire indexing and footnote writing skills
● To acquire bibliographic procedures
● To understand precise writing, summarizing & abstracting
● To learn organizing group discussion
● To know impromptu presentation
● To acquire individual & group presentation skills</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture No</th><th>Topic</th><th>Hours</th></tr>
<tr><td>1</td><td>Communication Skills: Meaning and process of communication</td><td>1 hour</td></tr>
<tr><td>2</td><td>Structural and functional grammar verbal and nonverbal communication</td><td>1 hour</td></tr>
<tr><td>3</td><td>Body languages</td><td>1 hour</td></tr>
<tr><td>4</td><td>Group discussion</td><td>1 hour</td></tr>
<tr><td>5</td><td>Listening & Note taking</td><td>1 hour</td></tr>
<tr><td>6</td><td>Time & conflict management</td><td>1 hour</td></tr>
<tr><td>7</td><td>Writing skills</td><td>1 hour</td></tr>
<tr><td>8</td><td>Oral presentation skills</td><td>1 hour</td></tr>
<tr><td>9</td><td>Field diary and lab record</td><td>1 hour</td></tr>
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</table>

	10	Indexing, footnote and bibliographic procedures	1 hour
	11	Reading and comprehension of general and technical articles	1 hour
	12	Precise writing, summarizing, abstracting	1 hour
	13	Individual and group presentations, impromptu presentation, public speaking, self-esteem & self-confidence	1 hour
	14	Leadership & team building skills	1 hour
	15	Organizing seminars and conferences	1 hour
	16	Personality Development & SWOT analysis	1 hour

Practical

Practical No.	Topic	Hours
1	Listening skills	3 hours
2	Note taking skills	3 hours
3	Oral presentation skills	3 hours
4	Individual presentation skills	3 hours
5	Group presentation skills	3 hours
6	Writing skills	3 hours
7	Field diary maintenance	3 hours
8	Laboratory records maintenance	3 hours
9	Indexing	3 hours
10	Footnote writing skills	3 hours
11	Bibliographic procedures	3 hours
12	Precise writing	3 hours
13	Summarizing & abstracting	3 hours
14	Organizing group discussion	3 hours
15	Impromptu presentation	3 hours
16	Individual & group presentation skills	3 hours

Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, expert lecture, study tours
References/ Readings:	1. J. R. Kadam, Communication skills & personality development. New Delhi: Scientific publishers, 2018. 2. Dwivedi, Communication skills for professional & students. Mumbai: Oxford publishers, 2008. 3. S. Kumar *et al.*, Communication skills. New Delhi: Oxford Higher education, 2015. 4. P. C. Sharma, Communication skills & personality development. Mumbai: Nirali Prakashan, 2016. 5. S. Gupta, Personality development & communication skills. New Delhi: Book Enclave publishers, 2023.
Course Outcomes:	At the end of the course, students will be able to: 1. Propel their career aspects with confidence. 2. Allow others & students to understand information more accurately & quickly. 3. Improve student's skills & deeper bonds with others. 4. Improve student's way to operate through life, smoothing their way in relationship with others

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: ECON 353
Title of the Course: Agricultural Marketing, Trade and Prices
Number of Credits: 3 (2+1), 2 Theory and 1 Practical
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil
Course Objectives:	**Theory:** ● To study marketing concepts, components, market structure and market performance. ● To learn Agricultural Marketing, Scope and classification of market. ● To understand difference between Marketing Mix and Market Segmentation and Demand and supply along with the determinants of farm products. ● To learn producer's surplus and Product life cycle. ● To know the cost based and competition-based prices and market promotion. ● To learn the marketing process, marketing functions, physical functions and facilitating functions. ● To study the market functionaries and marketing channels in detail. ● To learn market Integration and marketing efficiency. ● To understand marketing cost-margin, price spread and factors affecting the cost of marketing. ● To know the role of government in agricultural marketing and important features of regulated markets. ● To study the public sector institutions, Warehousing and Food cooperation of India. ● To learn the characteristics of agricultural product prices and cooperative marketing in India. ● To study NAFED, MARKFED and state trading objectives and types. ● To understand the concept of risk in marketing, Speculation and Hedging. ● To study Commission for Agricultural cost and Prices (CACP) , administered prices, minimum support price, procurement price and issue price. ● To learn various concept of trade and theories of absolute and comparative advantage. ● To know present status and prospects of international trade in agri commodities, GATT and WTO ● To learn Agreement on Agriculture (AoA) and its implications on Indian agriculture. ● To study Trade Related Intellectual Property Rights (TRIPS). **Practical:** ● To Plot and study demand and supply curves and calculation of elasticity's. ● To Study relationship between market arrivals and prices of some selected commodities. ● To compute marketable and marketed surplus of important commodities. ● To study price behavior over time for some selected commodities ● To organize visit to a local market and regulated market to study various marketing functions performed by different agencies. ● To identify marketing channels for selected commodity and collection of data regarding marketing costs, margins and price spread. ● To organize visit to market institution NAFED, SWC, CWC and Cooperative marketing society to study their organization and functioning.

	● To know application of principles of comparative advantage of international trade
Content:	**Theory**

Lecture no	Topic	Hours
1	Market and Marketing – Meaning – Definitions – Components of market – Market structure – Meaning – Components – Market conduct – Market performance	1 hour
2	Agricultural Marketing – Meaning – Definition – Scope – Subject matter – Importance of Agricultural Marketing in economic development.	1 hour
3	Classification of markets – On the basis of location, Area of coverage, time span, volume of transaction, nature of transaction, number of commodities, degree of competition, nature of commodities, stage of marketing, extent of public intervention, type of population served, accrual of marketing margins	1 hour
4	Marketing mix and market segmentation,	1 hour
5	Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products,	1 hour
6	Producers surplus- Meaning- Marketable surplus- Marketed surplus-importance- factors influencing marketable surplus- Marketing channels - Definition	1 hour
7	Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC;	1 hour
8	Strategies in different stages of PLC; pricing and promotion strategies:	1 hour
9	Pricing considerations and approaches –cost based and competition based pricing;	1 hour
10	Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits;	1 hour
11	Marketing process and functions: Marketing process-concentration, dispersion and equalization;	1 hour
12	Marketing functions – Meaning -exchange functions – buying and selling;	1 hour
13	Physical functions – storage, transport and processing	1 hour
14	Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);	1 hour
15	Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing;	1 hour
16	Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products;	1 hour
17	Market integration-definition-types of market integration-horizontal, vertical and conglomeration	1 hour
18	Marketing efficiency-meaning-definitions-technical or physical or operational efficiency-pricing or allocative efficiency	1 hour

	19	Marketing cost-margins-price spread-factors affecting the costs of marketing-reasons for higher marketing costs of agricultural commodities- ways of reducing marketing costs for farm products	1 hour
	20	Role of Govt. in agricultural marketing- Remedial measures-Regulated markets-definition-important features of regulated markets, functions, progress and defects	1 hour
	21	Public sector institutions- Warehousing-meaning-warehousing in India - Central Warehousing Corporation(CWC)- working of warehouses -advantages- State Warehousing Corporations (SWC)- Food Corporation of India(FCI)-objectives- functions	1 hour
	22	Characteristics of agricultural product prices-agricultural price stabilization-need for agricultural price policy.	1 hour
	23	Cooperative marketing- meaning-structure- Functions of cooperative marketing societies-.	1 hour
	24	National Agricultural Cooperative Marketing Federation (NAFED) and State Agricultural Cooperative Marketing Federations (MARKFED)- State Trading-objectives-Types of state trading	1 hour
	25	Risk in marketing: Types of risk in marketing;	1 hour
	26	Speculation & hedging; an overview of futures trading;	1 hour
	27	Commission for Agricultural cost and Prices (CACP)-administered prices- minimum support price, procurement price and issue price.	1 hour
	28	Trade: Concept of International Trade and its need, International trade-definition-difference between international and inter-regional trade- free trade vs protection.	1 hour
	29	Theories of absolute and comparative advantage	1 hour
	30	Present status and prospects of international trade in agri-commodities; GATT and WTO;	1 hour
	31	Agreement on Agriculture (AoA) and its implications on Indian agriculture;	1 hour
	32	Trade Related Intellectual Property Rights (TRIPS)	1 hour

Practical:

Practical no	**Topics**	**Hours**
1	Plotting and study of demand and supply curves	3 hours
2	Calculation of elasticities	3 hours
3	Study of relationship between market arrivals and prices of some selected commodities	3 hours
4	Computation of marketable and marketed surplus of important commodities	3 hours
5	Study of price behaviour over time for some selected commodities;	3 hours
6	Visit to a local market to study various marketing functions performed by different agencies	3 hours
7	Visit to regulated market	3 hours

	8	Identification of marketing channels for selected commodity	3 hours
	9	Collection of data regarding marketing costs, margins and price spread	3 hours
	10	Presentation of report in the class	3 hours
	11	Visit to market institution – NAFED to study their organization and functioning.	3 hours
	12	Visit to SWC to study their organization and functioning	3 hours
	13	Visit to CWC to study their organization and functioning	3 hours
	14	Visit to cooperative marketing society to study their organization and functioning	3 hours
	15	Application of principles of comparative advantage of international trade	3 hours
	16	Final practical exam	3 hours

Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, marketing institutions visits, study tours
References/ Readings:	1. S.S. Acharya and N. L. Agarwal, Agricultural Marketing in India. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2006. 2. A.S. Kahlon and D. S. Tyagi, Agricultural Price Policy in India. New Delhi: Allied Publishers Pvt. Ltd.,1983. 3. K. R. Kulkarni, Agricultural Marketing in India. The Co-operators Books Depot, Mumbai: 1964. 4. C.B. Mamoria and R. L. Joshi, Principles and Practices of Marketing in India, Kitab Mahal Allahabad, 1995. 5. C.B. Mamoria, Agricultural Problems in India, Allahabad: Kitab Mahal 1973. 6. S. Reddy, S. P. Raghu Ram., P. Sastry and B. Devi, Agricultural Economics., New Delhi: Oxford & IBH Publishing Company Private Ltd., 2010.
Course Outcomes:	At the end of the course, students will be able to: 1. Learn about the marketing of Agricultural produce. 2. To understand marketing functionaries and trade. 3. Learn the policies of government with agricultural marketing. 4. To understand the different risk management practices.

Name of the Programme: B. Sc. (Hons.) Agriculture
Course Code: ECON 365
Title of the Course: Farm Management, Production and Resource Economics
Number of Credits: 2(1+1), 1 Theory and 1 Practical
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td>Nil</td></tr>
<tr><td>Course Objectives:</td><td>Theory:
To learn farm management and Economic principles applied to farm management, Minimum loss principle and principle of factor substitution.
To understand the principle of product substitution, law of equi-marginal returns, opportunity cost principle and time comparison principle.
To know types of farming and types of farm business.
To learn concept of costs, farm income measures, Gross income, farm business income, family labour income, net farm income, farm investment income and Farm business analysis.
To study farm records and accounts, Farm inventory methods of valuation– net selling price, cost less depreciation, market price, cost method, replacement cost less depreciation and income capitalization methods.
To study balance sheet or net worth statement and income statement or profit and loss statement.
To understand farm planning and budgeting.
To study linear programming its meaning, assumptions, advantages and limitations.
To know the risk and uncertainty in agriculture and agricultural production economics.
To study laws of return, factor-product, factor-factor and product-product relationship.
To learn resource productivity, resource economics and positive and negative externalities in agriculture.
To study the Inefficiency and welfare loss and important issues in economics and management of common property resources of land, water, pasture and forest resources.
Practical:
To learn basic concepts and terms of farm management.
To determine optimum input and output and least cost combination of inputs.
To determine profitable combination of products and application of principle of equi-marginal returns.
To study seven types of costs, farm cost concepts and their computation.
To understand and estimate depreciation by using different methods and learn about farm holding survey.
To learn about farm survey and farm inventory analysis.
To estimate cost of cultivation and farm income measures of major crops.
Analysis and estimation of balance sheet and profit and loss statement.
To prepare farm plans and budget estimation by using different methods.</td></tr>
<tr><td>Content:</td><td>Theory
<table>
<tr><th>Lecture no</th><th>Topic</th><th>Hours</th></tr>
<tr><td>1</td><td>Farm Management – Meaning – Definitions – Scope – Objectives - Relationship with other sciences</td><td>1 hour</td></tr>
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		Farm – Meaning – Definition – its types and characteristics – factors determining size of farms	
	2	Economic principles applied to farm management – Principle of variable proportions – Determination of optimum input and optimum output Minimum loss principle (Cost Principle) - Principle of factor substitution	1 hour
	3	Principle of product substitution - Law of Equi-marginal returns – Opportunity cost principle Principle of comparative advantage – Time comparison principle	1 hour
	4	Types of farming – Specialization, Diversification, Mixed farming, Dry farming and Ranching – factors influencing types of farming Types of farm business organizations – Peasant farming, Co-operative farming, Capitalistic farming, Collective farming and State farming	1 hour
	5	Meaning and concept of cost –types of costs – cost concepts – farm income measures – Gross income, farm business income, family labour income, net farm income & farm investment income Farm business analysis – meaning and concept of farm income and profitability – technical and economic efficiency measures	1 hour
	6	Farm records and accounts – importance – types of farm records needed to maintain on farm Farm inventory – methods of valuation– net selling price, cost less depreciation, market price, cost method, replacement cost less depreciation and income capitalization methods	1 hour
	7	Balance sheet or Networth statement – Assets, liabilities and networth – ratio measures Income statement or profit and loss statement – Receipts, expenses and net income – ratio measures	1 hour
	8	Farm planning – Meaning – Need for farm planning – types of farm plans – simple farm plan and whole farm plan – Characteristics of a good farm plan – basic steps in farm planning	1 hour
	9	Farm budgeting – Meaning – types of farm budgets – Enterprise budgeting – Partial budgeting and whole farm budgeting. Linear programming – Meaning – Assumptions – Advantages and limitations	1 hour
	10	Risk and uncertainty in agriculture – nature and sources of risks – Production and technical risks – Price or marketing risk – Financial risk – methods of reducing risk Agricultural Production Economics – Definition – Nature – Scope and subject matter of Agricultural Production Economics – Objectives of Production Economics – Basic Production Problems	1 hour

11	Law of returns - Law of increasing returns – Law of constant returns – Law of decreasing returns Factor-product relationship – production function and its types – Elasticity of production - Three stages of production function	1 hour
12	Factor-factor relationship – Isoquant and their characteristics – MRTS – Types of factor substitution Iso-cost lines – Characteristics – Methods of determining Least-cost Combination of resources – Expansion path – Isoclines – Ridge lines	1 hour
13	Product-product relationship – Production possibility curve – Marginal rate of product substitution – Types of enterprise relationships – Joint products – Complementary – Supplementary – Competitive and Antagonistic products Iso-revenue line and characteristics – Methods of determining optimum combination of products – Expansion path – Ridge lines	1 hour
14	Resource productivity – Returns to scale Resource economics – Definition, subject matter and scope - Differences between NRE and agricultural economics	1 hour
15	Natural resources classification and characteristics – Resource depletion and causes for the same Positive and negative externalities in agriculture	1 hour
16	Inefficiency and welfare loss, solutions Important issues in economics and management of common property resources of land, water, pasture and forest resources, etc.	1 hour

Practical

Practical no	**Topics**	**Hours**
1	Basic concepts and terms	3 hours
2	Determination of optimum input and output, and least cost combination of inputs	3 hours
3	Determination of profitable combination of products and application of principle of equi-marginal returns	3 hours
4	Seven types of costs and their computation	3 hours
5	Farm cost concepts and their imputation procedure	3 hours
6	Depreciation methods	3 hours
7	Farm holding survey	3 hours
8	Livestock – Farm survey	3 hours
9	Estimation of cost of cultivation and farm income measures of major crops	3 hours
10	Farm inventory analysis	3 hours
11	Farm financial analysis – Preparation and analysis of balance sheet	3 hours
12	Preparation and analysis of profit and loss statement	3 hours
13	Preparation of farm plans	3 hours
14	Preparation of enterprise budget and partial budge	3 hours

	15	Study of farm management aspects related to Agriculture college farm	3 hours
	16	Final Practical Examination	3 hours
Pedagogy:	Lectures, practical, interactive learning, presentations, home assignments, industry visits, study tours		
References/ Readings:	1. Heady and O. Earl, Economics of Agricultural Production and Resource Use. New Delhi: Prentice Hall of India, Private Limited, 1964. 2. J. Wiley, London Introduction to Agricultural Economic Analysis, Bishop, C.E., & Toussant, 1958. 3. S. S. Johl and J. R. Kapur, Fundamentals of Farm Business Management. New Delhi: Kalyani Publishers, . 4. S. Reddy, P. Raghuram, Neelakanta Sastry and T.V. Bhavani Devi I, Agricultural Economics: New Delhi: Oxford and IBH Publishing Company, Private Limited, 2006. 5. Heady, O. Earl and H. R. Jenson, Farm Management Economics, Prentice Hall, New Delhi, 1954. 6. I.J. Singh, Elements of Farm Management Economics. New Delhi: Affiliated East-West press, Private Limited, 1954. 7. P. L. Sankhayan, Introduction to Farm Management. New Delhi: Tata – Mc Graw – Hill Publishing Company Limited, 1983. 8. K., M. John, D. K. Marothia, K. Singh, C. Ramasamy and W. R. Bentley, Natural Resource Economics, Theory and Applications in India. New Delhi: Oxford & IBH Publishing Company Private Limited, 1997. 9. U. Sankar, Environmental Economics, New Delhi: Oxford University Press, 2001. 10. T. Tietenberg, Environmental and Natural Resource Economics, USA: Addison Wesley, 2003.		
Course Outcomes:	At the end of the course, students will be able to: 1. Understand farm management in detail. 2. Learn about the factor efficiency. 3. Estimate cost and profit and obtain more revenue. 4. To gain better understanding of the role of natural resource in the economics.		