

**PDM UNIVERSITY**  
**FACULTY OF AGRICULTURE**

**COURSE CATALOGUE AND SYLLABI**

**B.Sc. (Hons.) AGRICULTURE PROGRAMME**



**PDM University, Bahadurgarh, Haryana - 124507**

## Course Catalogue for B. Sc. (Hons.) Agriculture, 4-Year Programme

Subject Code	Course Title	Credits	Faculty/ Department
<b>I Semester</b>			
AGRI1101	Agriculture Heritage and Introductory Agriculture	3 (2+1)	Agriculture
AGRI1102	Fundamentals of Soil Science	3 (2+1)	Agriculture
AGRI1103	Fundamentals of Genetics	3 (2+1)	Agriculture
AGRI1104	Fundamentals of Crop Physiology	3 (2+1)	Agriculture
AGRI1105	Elements of Plant Bio-chemistry	3 (2+1)	Agriculture
MATH0109	Elementary Mathematics (Students from Bio. stream)	3 (2+1)	Mathematics
BIOL0107	Introductory Biology (Students from Maths stream)	3 (2+1)	Life Science
ENGL0106	Comprehension & Communication Skills in English	2 (2+0)	English
COAP0101	Introduction to Computer Applications	3 (2+1)	Com. Science
LANF0101	Foreign Language - I (French)	2 (2+0)	Tr. & Placement
LANG0102	Foreign Language - I (German)	2 (2+0)	Tr. & Placement
LANS0103	Foreign Language - I (Spanish)	2 (2+0)	Tr. & Placement
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>28 (20+8)</b>	
<b>II Semester</b>			
AGRI1106	Agriculture Meteorology and Climate Change	3 (2+1)	Agriculture
AGRI1107	Principles of Agronomy	3 (2+1)	Agriculture
AGRI1108	Soil Chemistry, Soil Fertility and Nutrient Management	3 (2+1)	Agriculture
AGRI1109	Principles of Plant Bio-technology	3 (2+1)	Agriculture
AGRI1110	Production Technology of Fruit and Plantation Crops	3 (2+1)	Agriculture
AGRI1111	Principles of Seed Technology	3 (2+1)	Agriculture
AGRI1112	Fundamentals of Soil and Water Conservation Engineering	2 (1+1)	Agriculture
AGRI1113	Rural Sociology & Educational Psychology	2 (2+0)	Soc. Sci./Psych.
COMM0102	Fundamentals of Agricultural Economics	2 (2+0)	Com.& Mgmt.
LANF0104	Foreign Language - II (French)	2 (2+0)	Tr. & Placement
LANG0105	Foreign Language - II (German)	2 (2+0)	Tr. & Placement
LANS0106	Foreign Language - II (Spanish)	2 (2+0)	Tr. & Placement
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>26 (19+7)</b>	

<b>III Semester</b>			
AGRI2101	Crop Production Technology - I ( <i>Kharif</i> Crops)	3 (2+1)	Agriculture
AGRI2102	Principles of Plant Breeding	3 (2+1)	Agriculture
AGRI2103	Introduction to Forestry and Agro-forestry	2 (1+1)	Agriculture
AGRI2104	Production Technology of Vegetables and Spices	3 (2+1)	Agriculture
AGRI2105	Manures and Fertilizer Management	3 (2+1)	Agriculture
AGRI2106	Plant Pathogens and Principles of Plant Pathology	3 (2+1)	Agriculture
AGRI2107	Irrigation Water Management	3 (2+1)	Agriculture
AGRI2108	Agricultural Microbiology	2 (1+1)	Agriculture
MATH0111	Introductory Statistics	2 (2+0)	Mathematics
COMM0101	Agricultural Finance and Cooperation	3 (2+1)	Com.& Mgmt.
VALU0121	NCC	2 (0+2)	
VALU0122	NSS	2 (0+2)	
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>27 (18+9)</b>	
<b>IV Semester</b>			
AGRI2109	Crop Production Technology - II ( <i>Rabi</i> Crops)	3 (2+1)	Agriculture
AGRI2110	Insect Morphology and Systematics	3 (2+1)	Agriculture
AGRI2111	Production Technology of Flowers, Medicinal and Aromatic Plants, Ornamental Crops and Landscaping	3 (2+1)	Agriculture
AGRI2112	Weed Management	3 (2+1)	Agriculture
AGRI2113	Introductory Nematology	2 (1+1)	Agriculture
AGRI2114	Problematic Soils and their Management	2 (2+0)	Agriculture
AGRI2115	Agricultural Waste Management	2 (1+1)	Agri./Life Sci.
AGRI2116	Dimensions of Agricultural Extension	2 (2+0)	Social Science
AGRI2117	Power Engineering, Farm Machinery & Renewable Energy	3 (2+1)	Agri./Engg.
COMM0103	Agricultural Marketing Trade & Prices	2 (2+0)	Com. & Mgmt.
ENGL0208	Communication Skill and Personality Development	2 (1+1)	English
VALU0129	NCC	2 (0+2)	
VALU0130	NSS	2 (0+2)	
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>27 (19+8)</b>	

<b>V Semester</b>			
AGRI3101	Practical Crop Production - I ( <i>Kharif</i> crops)	4 (0+4)	Agriculture
AGRI3102	Crop Improvement - I ( <i>Kharif</i> Crops)	3 (2+1)	Agriculture
AGRI3103	Diseases of <i>Kharif</i> Field Crops and Horticultural Crops and their Management	3 (2+1)	Agriculture
AGRI3104	Farming System & Sustainable Agriculture	3 (2+1)	Agriculture
AGRI3105	Principles of Organic Farming	2 (1+1)	Agriculture
AGRI3106	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	Agriculture
AGRI3107	Insect Ecology, IPM & Beneficial Insects	3 (2+1)	Agriculture
AGRI3108	Livestock and Poultry Management	3 (2+1)	Agriculture
AGRI3109	Environmental Studies	2 (2+0)	Agriculture
COMM0104	Entrepreneurship Development in Agri-Business	2 (1+1)	Com.& Mgmt.
VALU0137	NCC	2 (0+2)	
VALU0138	NSS	2 (0+2)	
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>27 (15+12)</b>	
<b>VI Semester</b>			
AGRI3110	Practical Crop Production - II ( <i>Rabi</i> crops)	4 (0+4)	Agriculture
AGRI3111	Rainfed Agriculture & Watershed Management	3 (2+1)	Agriculture
AGRI3112	Crop Improvement - II ( <i>Rabi</i> crops)	3 (2+1)	Agriculture
AGRI3113	Protected Cultivation and Secondary Agriculture	3 (2+1)	Agriculture
AGRI3114	Diseases of <i>Rabi</i> Field crops and Horticultural Crops and their Management	3 (2+1)	Agriculture
AGRI3115	Pest of Crops and Stored Grain and their Management	3 (2+1)	Agriculture
AGRI3116	Geoinformatics and Nano-technology for Precision Farming	3 (2+1)	Agriculture
COAP0102	Agriculture Informatics	2 (1+1)	Agriculture
COMM0105	Farm Management, Production & Resource Economics	2 (1+1)	Com.& Mgmt.
VALU0145	NCC	2 (0+2)	
VALU0146	NSS	2 (0+2)	
Academic mentorship		1 (1+0) NC	
<b>Total</b>		<b>26(14 + 12)</b>	

VII Semester			
RAWE4101	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)		
S. No.	Activities	No. of weeks	Credit Hr.
1	General Orientation & On Campus Training by Different Faculties	1	
2	Village Attachment/Unit Attachment in University/ College/ KVK/ Research Station	10	
3	Agro-Industrial Attachment	6	
4	Project Report Preparation, Presentation and Evaluation	1	
<b>Total weeks for RAWE &amp; AIA</b>		<b>18</b>	<b>20</b>

VIII Semester (Experiential Learning Programme/ Hands on Training (HOT))			
Subject Code	Title of the Module	Credit	Faculty
AGRI4201	Seed Production and Technology	10 (0+10)	Agriculture
AGRI4202	Mushroom Cultivation	10 (0+10)	Agriculture
AGRI4203	Soil, Plant , Water and Fertilizer Testing Services	10 (0+10)	Agriculture
AGRI4204	Beekeeping	10 (0+10)	Agriculture
AGRI4205	Commercial Vegetable Production	10 (0+10)	Agriculture
AGRI4206	Organic Production Technology	10 (0+10)	Agriculture
AGRI4207	Bioagents and Biofertilizer Production	10 (0+10)	Agriculture

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

S.No.	Module	Credit	Faculty
1	Module-I	10 (0+10)	Agriculture
2	Module-II	10 (0+10)	Agriculture
<b>Total</b>		<b>20 (0+20)</b>	

N.B: Bio = Biology, Com. Science = Computer Science, Com & Mgmt = Commerce & Management, Soc. Sci = Social Science, Psych = Psychology, Engg = Engineering, Agri = Agriculture, Life Sci = Life Science, IPM = Integrated Pest Management, Tr. & Placement = Training & Placement, PHM = Post-harvest Management, NCC = National Cadet Corps, NSS = National Service Scheme

## I Semester

Course No	Course Title	Credits	Faculty/ Department
AGRI 1101	Agriculture Heritage and Introductory Agriculture	3 (2+1)	Agriculture

### Theory

Introduction of Indian agricultural heritage, status of farmers in society. Management of natural resources in ancient, medieval & pre-modern India and its relevance in modern day sustainable agriculture. Agriculture development through vrikshayurveda and traditional knowledge. Description of Indian agriculture by foreigners, green revolution and its impact and concerns, vision for the future. Chronological agricultural technology development in India. Indian agriculture- scope and resources. Crop plants and their significance as source of food, feed, fuel and raw material for various industries. Crop seasons and classification of crops according to seasons. Soils and their formation, classification, physico-chemical properties. Manures and fertilizers. Irrigation and drainage and their importance in agriculture, land development and its use. Acquaintance with important crops- rice, wheat, sorghum, maize, millets groundnuts, rapeseed and mustard, pulses, cotton, tobacco, berseem, potato, sugarcane, buckwheat and amaranthus. Acquaintance with horticultural crops such as - cabbage, cauliflower, onion, garlic, cucurbits, root crops, peas, tomato, brinjal, banana, apple, mango, litchi, citrus, guava. Study of main breeds of animals such as cows, buffaloes, goats, sheep and poultry. Characteristics of milch cattles, poultry, piggery and fishery. Role of women in agriculture, group dynamics for farm and rural women, farming system approach and the nucleus of agriculture extension and training. Types of agriculture implements, tillage, water lifting devices, equipment used for agrochemicals, interculture, harvesting, threshing and picking implements for different agro-ecological and socio-economic situations.

### Practical

Identification of important crops and their seeds, fertilizers and agricultural chemicals. Acquaintance with soil minerals and rocks. Acquaintance with agricultural implements. Visits to agriculture museum at NASC Complex. Acquaintance with various meteorology laboratory equipment and visit to meteorological observatory, acquaintance with irrigation resources and instruments.

AGRI1102	Fundamentals of Soil Science	3 (2+1)	Agriculture
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### Theory

Soil: Pedological and edaphological concepts. Origin of the earth, earth's crust, composition, soil forming rocks and minerals. Weathering, soil formation factors and processes. Soil profile, components of soil. Soil physical properties: Soil-texture, structure, density and porosity, soil colour, consistency and plasticity. Elementary knowledge of soil taxonomy classification and soils of India. Soil water, forms, hygroscopic, capillary and gravitational. Soil moisture constants: Hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, PF scale, energy concepts, soil moisture measurement methods, saturated and unsaturated water movement. Elementary idea of Infiltration, percolation, permeability, drainage, runoff and its role in crop production. Soil temperature, soil air, and its role on plant growth. Soil reaction: pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Soil colloids: Properties, nature, types and significance. Layer silicate clays: Constitution and properties. Sources of charges,

Ion exchange, CEC & AEC, factors influencing ion exchange and its significance. Soil organic matter, sources of soil organic matter, decomposition of organic matter, formation of humus, fractionation of organic matter, C: N ratio. Soil biology, biomass, soil organisms and their beneficial and harmful roles.

**Practical**

Study of soil forming rocks and minerals. Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Estimation of organic matter content of soil. Determination of soil CEC, soluble cations and anions.

<b>AGRI1103</b>	<b>Fundamentals of Genetics</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Ultra structure of cell and cell organelles and their functions. Mitosis and meiosis, their significance and differences between them. Mendel’s laws of inheritance and exceptions to the laws, types of gene interaction, multiple alleles, pleiotropism, penetrance and expressivity. Law of population equilibrium, 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 / B technique. Linkage, types of linkage and estimation of linkage. Crossing over and factors affecting it, mechanism of crossing over and cytological proof of crossing over. 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. Gene expression and differential gene activation, lac operon and fine structure of gene. Numerical chromosomal aberrations (polyploidy) and structural chromosomal aberrations. Evolution of different crop species like cotton, wheat, tobacco, triticale and brassicas.

**Practical**

Study of microscope, preparation of micro slides and identification of various stages of mitosis. 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. Interaction of factors: Epistatic factors, supplementary factors and duplicate factors, complementary factors, additive factors and inhibitory factors. Linkage: Two point test cross, three point test cross. Hardy Weinberg law of population equilibrium.

<b>AGRI1104</b>	<b>Fundamentals of Crop Physiology</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Introduction to crop physiology and its importance in agriculture. Plant cell: An overview, diffusion and osmosis, absorption of water, transpiration and stomatal physiology. Photosynthesis: Light and dark reactions, C<sub>3</sub>, C<sub>4</sub> and CAM plants. Respiration: Glycolysis, TCA cycle and electron transport chain. Fat metabolism: Fatty acid synthesis and breakdown. Mineral nutrition of plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms. Plant growth regulators: Physiological roles and agricultural uses, physiological aspects of growth and

development of major crops, growth analysis, role of physiological growth parameters in crop productivity.

**Practical**

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, photosynthesis, respiration, measurement of photosynthetic CO<sub>2</sub> assimilation. Separation of photosynthetic pigments through paper chromatography. Tissue test for mineral nutrients. Estimation of relative water content.

<b>AGRI1105</b>	<b>Elements of Plant Biochemistry</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Biochemistry: Introduction and importance of biochemistry, water, pH and buffer. Carbohydrates: Occurrence and classification. Structure of glucose, fructose, ribose, maltose, lactose, starch and cellulose. Physical and chemical properties of carbohydrates: Isomerism, optical activity, reducing property, reaction with acids and alkalies. Proteins: Classification - functional, solubility. Amino acids: Classification and structure, essential amino acids. Properties of amino acids: Colour reactions, amphoteric nature and isomerism. Structure of proteins: Primary, secondary, tertiary and quaternary. Properties and reactions of proteins. Plant proteins and their quality. Enzymes: Classification, factors affecting the activity, immobilization and other industrial applications. Lipids: Classification, important fatty acids and triglycerides, storage and membrane lipid. Industrial application of acylglycerol in soaps, detergents, soap detergent, biodiesel, biodegradable plastics. Carbohydrate metabolism: Glycolysis and TCA Cycle, Pentose phosphate pathway, respiration-oxidative phosphorylation, electron transport chain and ATP formation: Bioenergetics of glucose and carbohydrate synthesis. Metabolism of lipids: Lipases and phospholipases, fatty acids oxidation and bioenergetics, biosynthesis of fatty acids. Protein metabolism: Proteolytic enzymes and transaminases, metabolism inter-relationship. Chemistry and structure of nucleic acids, nucleosides and nucleotides, protein synthesis and genetic code. Secondary metabolites: Terpenoids, alkaloids, phenolics and their applications in food and pharmaceutical industries.

**Practical**

Preparation of standard solutions and buffers. Determination of pH. Qualitative tests for carbohydrates, lipid, amino acids and proteins. Identification of plant pigments by paper chromatography. Identification of lipids through thin layer chromatography. Assay of enzyme and effect of pH, temperature and substrate concentration. Demonstration of column chromatography. Extraction of oil from oil seeds. Quantitative determination of carbohydrates (sugars), proteins and phenols. Extraction of nucleic acids.

<b>MATH0109</b>	<b>Elementary Mathematics</b>	<b>3 (2+1)</b>	<b>Mathematics</b>
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**Theory + Tutorial**

Introduction to coordinate plane, distance between two points, section formula, area of triangle and quadrilateral. Equation of straight line, circle, parabola, ellipse, functions, limits, continuity. Differentiation, tangent and normal, maxima and minima, integration, definite integration, area under curves, determinations. Matrices: addition, multiplication, transpose. Solution of lines equations using cramer's rule.



<b>BIOL0107</b>	<b>Introductory Biology</b>	<b>3 (2+1)</b>	<b>Life Science</b>
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### **Theory**

Introduction to the living world, diversity and characteristics of life. Binomial nomenclature and classification of animals from protozoa to mammals. Structure of cell, cell division, vertebrate physiology and economic importance. Diversity of plants, classification, brief study of algae, fungi, bryophytes, pteridophytes, gymnosperm and angiosperm. Morphology of root, stem, leaf, their modifications, inflorescence, flower and fruit, seed germination. Systematics: Brassicaceae, Fabaceae, Asteraceae and Poaceae. Cell, tissues and internal structure of angiosperms.

### **Practical**

Morphology of flowering plants: Root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues and cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants: Brassicaceae, Fabaceae and Poaceae. Study of type animals of major phyla.

<b>ENGL0106</b>	<b>Comprehension &amp; Communication Skills in English</b>	<b>2 (2+0)</b>	<b>English</b>
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### **Theory**

The Pointed Vision: An Anthology of Short Stories by Usha Bande and Krishan Gopal. Vocabulary: Antonyms, synonyms, homophones, homonyms, often confused words. Exercises to help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, prepositions, verb, subject-verb agreement, transformation, synthesis. Direct and indirect narration. Written skills: Paragraph writing, precis writing, report writing and proposal writing. The Style: Importance of professional writing. Preparation of curriculum vitae and job applications. Synopsis writing. Interviews: Kinds, importance and process.

### **Practical**

Listening comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral communication: Phonetics, stress and intonation. Conversation practice. Conversation: rate of speech, clarity of voice, speaking and listening, politeness. Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock interview: Testing initiative, team spirit: leadership, intellectual ability. Group discussions.

<b>COAP0101</b>	<b>Introduction to Computer Applications</b>	<b>3 (2+1)</b>	<b>Comp.Science</b>
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### **Theory**

Historical evolution of computers, computer system concepts, capabilities and limitations. Types of computer: Analog, digital, hybrid, general purpose, special purpose, micro, mini, mainframe, super. Generations of computers. Type of PCs: Desktop, Laptop, Palmtop etc. their characteristics. Computer security. Basic components of computer system: CPU, input/output and memory, their functions and characteristics. Memory: RAM, ROM, EPROM, PROM and other type of memory, keyboard, mouse, digitizing tablets, scanners, digital cameras, MICR, OCR, OMR, bar code reader, voice recognition, light pen, touch screen, input/output devices. Monitors: Analog, digital and characteristics-size, resolution, video standard-VGA, SVGA, XGA etc. Printers: Dot matrix, inkjet, laser, line printer, plotter, sound card and speakers. Various storage devices: Magnetic tape, magnetic disk, cartridge tape, hard disk device, floppy disk, optical disk-CD, VCD, CD-R, CD-RW, DVD, zip drive. MS-Windows: Introduction to MS-windows, concept of GUI, desktop and its elements, windows explorer, control panel, accessories, running application under MS

windows, advantages and limitation of windows. Various versions of windows like (Win 95, 98, Win ME, 2000 XP). Hardware requirement for Windows XP, Basic concept of MS word processor, MS excel, MS power point, features of word processing packages, MS excel packages, power point package. Internet: World Wide Web (WWW), concept, web browsing and electronic mail, concept of networking.

### Practical

Study of computer components, booting of computer and its shut down. Practicing windows operating system, use of mouse and keyboard, title bar, start menu, minimum, maximum and close buttons, scroll bars, menus and tool bars. Setting time and date, starting and shutting down of Window, windows explorer, creating file and folders, copy and paste functions. MS-word: Introduction to MS word, creating a document, saving and editing, word proofing tools - using spelling checker, working with grammar checker, using thesaurus, working with auto text feature in word, using auto correct feature, word count, text formatting, document formatting (page formatting), alignment of text, creating tables, merging of cells, column and row width and chart in word, working with mail merge, graphics and web pages in word. MS power point: Introduction to MS power point, power point slide creation, slide show, editing, animation, adding a picture, adding graphics, formatting, customizing, printing and other inbuilt additional function. MS excel: Introduction to MS excel, creating a spread sheet, editing and saving. Working with toolbars, formatting, formulas, data management, graphs and chart, macros, goal seek pivot table, financial functions and other inbuilt additional function. Data analysis using inbuilt tool packs, correlation and regression. Internet Browsing: Browsing a web page and creating of E-mail ID.

	<b>Foreign Language - I</b>	<b>2 (2+0)</b>	<b>Tr. &amp; Placement</b>
<b>LANF0101</b>	<b>French</b>		
<b>LANG0102</b>	<b>German</b>		
<b>LANS0103</b>	<b>Spanish</b>		

### Theory

Basic communication: Oral and written skills of understanding, expressing and exchanging information / interacting people. Basic phonetics: Pronounce words, say sentences, questions and give orders using the right accent and intonation; express surprise, doubt, fear, displeasure and all positive or negative feelings using the right intonation; use ‘liaison’ and ‘enchainment’; distinguish voiced and unvoiced consonants; distinguish between vowel sounds. Basic grammar & formation of sentences: Nouns - gender and number; articles - definite and indefinite, partitive, articles contracted; pronouns - personal, relative; verbs - conjugation of regular and irregular verbs (affirmative and negative) in the following tenses (indicative mood) - present, present continuous, simple future, immediate future, recent past, simple past, past continuous; verbs - the imperative mood; adjectives - numeric, qualitative, possessive, demonstrative, interrogative - gender and number; adverbs - simple adverbs of time, place, quantity; prepositions - simple prepositions (place, time); interrogation - interrogative words, interrogative phrases, inversion.

## II Semester

<b>AGRI1106</b>	<b>Agriculture Meteorology and Climate change</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

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

### Practical

Visit of agrometeorological observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of radiation intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET. Computation of daily, weekly, monthly and annual weather data. Preparation of weather charts and diagrams. Computation of agrometeorological indices. Study of synoptic charts for weather forecasting.

<b>AGRI1107</b>	<b>Principles of Agronomy</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

Agronomy: Definition, history and its relation with other sciences. Classification of crops: Agronomic, seasonal, life span, botanical, seed size, root depth and water requirement etc. Seeds and sowing. Tillage and its objectives, soil tilth and its optimum requirement for important crops, water resources, soil plant water relationship, water retention, crop water requirement, water use efficiency. Irrigation: Scheduling criteria and methods, quality of irrigation water, water logging, drainage. Agronomic principles involved in crop production. Crop growth, yield and factors affecting them. Crop density and geometry, plant ideotypes, adaptation and distribution of crops. Crop management technologies in problematic areas, harvesting and post-harvest operation. Soil fertility, productivity and their maintenance. Time and method of application of manures and fertilizers. Crop rotation and its principles, cropping pattern(s), cropping systems and farming systems.

### **Practical**

Study of tillage implements. Practice of ploughing and puddling. Study of seeding equipments. Different methods of sowing. Study of intercultivation implements and practice. Participation in ongoing field operations. Identification of crops, weeds and their seeds. Seed testing for purity, germination and moisture of various crop seeds. Calculation of seed rate of different crops. Preparation of seedarium. Practice of methods of fertilizer applications. Identification of fertilizers and manures, nutrient content of different fertilizers and manures. Computing fertilizer and manurial requirement of various field crops. Study of yield contributing characters and yield estimation of different field crops.

<b>AGRI1108</b>	<b>Soil Chemistry, Soil fertility and Nutrient Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Soil as a source of plant nutrients. Essential and beneficial nutrient elements, criteria of essentiality, available forms, mechanism of nutrient transport to plants, functions and deficiency symptoms in plants, factors affecting nutrients availability to plants. Remediation /amelioration of deficiencies and toxicities. Microbiological transformations of C, N and S in soils. Problem soils: acid, salt affected and calcareous and their characteristics, nutrients availability and reclamation (mechanical, chemical and biological). 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 and productivity evaluation. Soil testing methods: 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 and calculation of nutrient through different fertiliers. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K. Source, method and scheduling of nutrients (macro & micro) for different soils and crops grown under rainfed and irrigated conditions.

### **Practical**

Analytical chemistry - Basic concepts, techniques and calculations. Principles of spectrophotometer, flame photometer and atomic absorption spectrophotometer. Estimation of available N, P, K, S, and Zn in soils. Determination of quality parameters of irrigation water. Determination of Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

<b>AGRI1109</b>	<b>Principles of Plant Biotechnology</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Concepts of plant biotechnology. History of plant tissue culture and plant. 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, scope and importance in crop improvement. Restriction enzymes. Blotting techniques. Vectors for gene transfer. Gene cloning, direct and indirect method of gene transfer. Transgenic plants and their applications. DNA finger printing. DNA based markers: RFLP, AFLP, RAPD, SSR and DNA Probes. Mapping QTL - future prospects. Marker assisted selection and its application in crop improvement. Biosafety rules and regulations: Rules related to GM crops-research, development, field trials, and commercial cultivation.

**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 (GUS assay/antibiotic resistance techniques). Demonstration of gelelectrophoresis techniques.

<b>AGRI1110</b>	<b>Production Technology of Fruit and Plantation Crops</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Importance, introduction and scope of horticulture. Classification of fruits according to climate. Selection of site, planning, establishment and layout of orchard. Propagation methods of fruit crops. Methods of training and pruning in fruit crops. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning, intercultural operation, harvesting, yield and plant protection measures including physiological disorders - mango, banana, citrus, grape, guava, sapota, apple, papaya, pineapple, pomegranate, ber, jack, aonla, bael, date palm. Plantation crops: Coconut, areca nut, cashew, oil palm and tea.

**Practical**

Identification of fruit and plantation crops. Study of horticultural tools and implements and their uses. Plant propagation methods, by seeds, cuttings (soft wood, hard wood and semi hardwood), budding and grafting, layering (simple layering, Air layering,). Layout and planting systems. Methods of pruning and training of important fruit crops. Irrigation methods in fruit crops including drip - micro irrigation methods for establishment of orchard. Methods of fertilizer application in fruit crops. Visit to local commercial orchards with in state. Preparation of growth regulator solutions for propagation. Application of growth regulators for improving fruit set, fruit size and quality.

<b>AGRI1111</b>	<b>Principles of Seed Technology</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Seed and seed technology: Introduction, definition and importance. Deterioration causes of crop varieties and their control. Maintenance of genetic purity during seed production. Seed quality: Definition, characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, varietal identification through grow-out test and electrophoresis, molecular and biochemical test. Detection of genetically modified crops, transgene contamination in non-GM crops, GM crops and organic seed production. Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage: General principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: Structure and organization, sales generation

activities, promotional media. Factors affecting seed marketing, role of WTO and OECD in seed marketing.

**Practical**

Seed production in major cereals. Seed production in major pulses. Seed production in major oilseeds. Seed production in vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, field inspection, preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

<b>AGRI1112</b>	<b>Fundamentals of Soil and Water Conservation Engineering</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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**Theory**

Introduction to soil and water conservation, causes, types and agents of soil erosion. Water erosion: Its type, mechanics and factors affecting it. Gully erosion: Process of gully development, its classification and control measures. Soil loss estimation by universal loss soil equation. Erosion control measures: Agronomical measures, contour farming, strip cropping and mulching. Introduction to contour and graded bund, bench terracing and area lost in bench terrace. Grassed water ways and their design. Wind erosion: Mechanics of wind erosion, types of soil movement, factors affecting it and its control measures. Water harvesting and its techniques.

**Practical**

General status of soil conservation in India. Calculation of erosion index. Numericals on soil loss estimation. Design of shelter belt. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

<b>AGRI1113</b>	<b>Rural Sociology &amp; Educational Psychology</b>	<b>2 (2+0)</b>	<b>Soc.Sci./ Psych.</b>
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**Theory**

Rural sociology: Concepts and scope of sociology and rural sociology. Importance of rural sociology in Agricultural Extension. Indian rural sociology and characteristics, differences between rural and urban society. Social Groups, motivation in group formation. Social stratification, forms. Differences between class and caste system. Cultural concepts, rituals customs and traditions. Social value and attitudes, social institutions, their functions and forms. Social organizations: Types and roles. Social change: Dimension and factors, planned change and rural transformation. Educational Psychology: Scope and importance of educational psychology in agriculture extension. Intelligence types and factors. Personality: Types and factors affecting. Learning process: Theories of learning-classical, operant and cognitive.

<b>COMM0102</b>	<b>Fundamentals of Agricultural Economics</b>	<b>2 (2+0)</b>	<b>Com.&amp; Mgmt.</b>
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**Theory**

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis, micro and macroeconomics, positive and normative analysis. Nature of economic theory: Rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: Meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: Meaning, law of demand, demand schedule and demand

curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: Concept and measurement of price elasticity, income elasticity and cross elasticity. Production: Process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Market structure: Meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition, short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, malthusian and optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: Meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: Meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

	<b>Foreign Language - II</b>	<b>2 (2+0)</b>	<b>Tr. &amp; Placement</b>
<b>LANF0104</b>	<b>French</b>		
<b>LANG0105</b>	<b>German</b>		
<b>LANS0106</b>	<b>Spanish</b>		

### **Theory**

Moderate communication: Describe in detail people, relationships, events, places, cultures of countries; compare people, relationships, events, places, cultures and the changes that they have undergone; apply for a job; exchange personal and professional information; express opinion on people, places, events encountered in one's personal life and on press articles, television programmes, multimedia, films, and books; argue, justify and substantiate a point of view; describe hypothetical or imaginary situations; express plans, dreams, aspirations of the future; paragraph writing; professional communication. Moderate phonetics: Pronounce words, say sentences, questions and give orders using the right accent and intonation; express surprise, doubt, fear, displeasure and all positive or negative feelings using the right intonation; use 'liaison' and 'enchainment'; distinguish voiced and unvoiced consonants; distinguish between vowel sounds. Moderate grammar: Pronouns - relative (don't), possessive, indefinite, demonstrative and the use of double pronouns; verbs - conjugation of regular and irregular verbs (affirmative and negative) in the following tenses (indicative mood) - past perfect, future perfect; verbs - the subjunctive mood (past and present); verbs - conditional (past and present) and gerund forms; adverbs of time, place, quantity and indefinite adverbs; direct/indirect speech; comparative and superlative structures; active/passive structures; multiple clause sentences - independent clauses joined by co-ordinating conjunctions, dependant clause (subordinate clause); phrases to express cause, consequence, and objective.

### III Semester

<b>AGRI2101</b>	<b>Crop Production Technology - I (<i>Kharif</i> Crops)</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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#### **Theory**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *kharif* crops. Cereals: Rice, maize, sorghum and pearl millet. Pulses: Pigeonpea, mungbean and urdbean. Oilseeds: Groundnut, and soybean. Fibre crops: Cotton and Jute. Forage crops: Sorghum, cowpea, cluster bean and napier.

#### **Practical**

Rice nursery preparation, transplanting of rice. Sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton. Effect of seed size on germination and seedling vigour of *kharif* season crops. Effect of sowing depth on germination of *kharif* crops. Identification of weeds in *kharif* season crops. Top dressing and foliar feeding of nutrients. Study of yield contributing characters and yield calculation of *kharif* season crops. Study of crop varieties and important agronomic experiments at experimental farm. Study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

<b>AGRI2102</b>	<b>Principles of Plant Breeding</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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#### **Theory**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects. Domestication, acclimatization, introduction. Centre of origin/diversity. Genetics in relation to plant breeding, modes of reproduction and apomixes, self - incompatibility and male sterility- genetic consequences, cultivar options. Genetic basis and breeding methods in self-pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population, multiline concept. Concepts of population genetics and Hardy-Weinberg Law, component of genetic variation. Heritability and genetic advance. Genetic basis and methods of breeding cross pollinated crops, modes of selection. Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Breeding methods in asexually propagated crops, clonal selection and hybridization. Wide hybridization and pre-breeding. Polyploidy in relation to plant breeding, mutation breeding-methods and uses. Breeding for important biotic and abiotic stresses. Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding. Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

#### **Practical**

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



<b>AGRI2103</b>	<b>Introduction to Forestry and Agro-forestry</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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### **Theory**

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

### **Practical**

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

<b>AGRI2104</b>	<b>Production Technology of Vegetables and Spices</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Importance of vegetables and spices in human nutrition and national economy, brief about origin, area, production, climate and soil requirement, improved varieties and cultivation practices such as sowing time, sowing, nursery raising, transplanting, fertilizer requirements, irrigation, weed management, harvesting, physiological disorders, insect-pests, diseases of important vegetables-potato, tomato, brinjal, cauliflower, cabbage, radish, carrot, okra, onion, garlic, musk melon, water melon, bottle gourd, bitter gourd and sponge gourd, and spices - cumin, hot pepper, fenugreek and coriander and herbal spices.

### **Practical**

Identification of vegetable & spice crops and their seeds. Raising of nursery of vegetables & spices. Direct seed sowing and transplanting. Study of morphological characters of different vegetables and spices. Fertilizers applications. Vegetables and spices seed extraction. Harvesting and preparation for market. Economics of vegetables and spices cultivation.

<b>AGRI2105</b>	<b>Manures and Fertilizer Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Soil organic matter, composition, decomposability, C:N ratio. Manures: Bulky and concentrated. Composts: Different methods, mechanical compost plants, vermicomposting, green manures, oil cakes. Sewage and sludge: Biogas plant slurry, plant and animal refuges. Fertilizers: Classifications, chemistry of manufacturing and properties of major nitrogenous (ammonia, urea, ammonium sulphate, 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. Slow release N fertilizers: Urea-formaldehyde, IBDU, CDU. Controlled release fertilizers and reaction in soil, nitrification inhibitors - criteria and advantages. Mixed fertilizers and amendments: Advantages and disadvantages over straight fertilizers, compatibility of fertilizers. Secondary and micronutrients fertilizers: Different sources of these nutrients and their contents, conditions leading to their deficiency. Fertilizer control order (FCO): Its importance and regulations, specifications and fertilizer storage standards of important fertilizers. Biofertilizers and their advantage.

### Practical

Determination of total nitrogen and phosphorus and potassium in manures. Determination of Ammoniacal and nitrate nitrogen in fertilizers. Determination of biuret in urea. Determination of water soluble P<sub>2</sub>O<sub>5</sub> in fertilizer. Determination of potassium, calcium, sulphur and zinc contents in fertilizers. Determination of moisture in fertilizers. Determination of Adulteration in fertilizer. Compatibility of fertilizers with pesticides. COD in organic wastes. Problems on formulations of fertilizer mixtures, unit values. Methods of inoculation of biofertilizers in seed.

<b>AGRI2106</b>	<b>Plant Pathogens and Principles of Plant Pathology</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

Plant pathogens: 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 subdivisions. 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 - prepenetration, penetration and post penetration. Pathogenesis: Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants: Structural and biochemical (pre and post infection), plant disease epidemiology, plant disease forecasting and 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 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. Fungicides classification, formulations and method of application. Properties and uses of carbendazin, carboxin, captan, tridemorph, copper oxychloride. Adsorption and persistence of fungicides in soils. 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 the species of genera *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Peronosclerospora*, *Pseudoperonospora*, *Peronospora*, *Plasmopara* and *Bremia*. Study the sp. of genera *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Oidium*, *Oidiopsis*, *Ovulariopsis*, *Erysiphe*, *Phyllactinia*, *Uncinula* and *Podosphaera*. Study the sp. of genera *Puccinia* (different stages), *Uromyces*, *Hemilia*, *Sphacelotheca*, *Ustilago*,

*Tolyposporium*, *Agaricus*, *Pleurotus* and *Ganoderma*. Study the species of genera *Septoria*, *Colletotrichum*, *Pestalotiopsis*, *Pyricularia*; *Trichoderma*, *Fusarium*, *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.

<b>AGRI2107</b>	<b>Irrigation Water Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Importance and role of water in crop production; irrigation: definition, source of irrigation, water resources and irrigation development in India and Haryana. Forms of soil moisture and their importance in crop production. Soil plant water relationship. Energy concept of plant water relations, components of water potentials. Method of soil moisture estimation, evapotranspiration, crop water requirement and effective rainfall. Scheduling and methods of irrigation. Irrigation efficiency and water use efficiency and factors affecting them. Conjunctive use of water, irrigation water quality and its management. Water management of various field crops, drainage and methods of drainage, prevention of water losses and adverse effect of water logging. Water stress and its effect on crop growth, irrigation strategies under limited water conditions. Micro/pressure irrigation: Sprinkler, mini sprinklers, micro-sprinkler, drip irrigation and rain gun.

### **Practical**

Determination of bulk density by field method. Determination of soil moisture content by gravimetric, tensiometer, electrical resistance blocks and neutron moisture meter methods. Determination of field capacity by field method. Determination of permanent wilting point. Measurement of irrigation water using different devices. Calculations on irrigation water requirement and irrigation efficiencies (problems). Determination of infiltration rate. Demonstration of border method of irrigation. Demonstration of furrow method of irrigation. Demonstration of check basin and basin method of irrigation. Acquaintance and upkeep of sprinkler and drip irrigation systems. Determination of EC, pH, carbonates bicarbonates and Ca<sup>++</sup> Mg<sup>++</sup> in irrigation water (quality parameters).

<b>AGRI2108</b>	<b>Agricultural Microbiology</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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### **Theory**

Introduction to microorganism, their distribution in nature, historical background and importance in agriculture. Germ theory of disease, protection against infections. Prokaryotic and eukaryotic micro-organisms: their cell structure and functions. Nutritional requirements and genetics of bacteria. Bacteriophages: Structure and properties of bacterial viruses, lytic and lysogenic cycles, viroids, prions. Soil microbiology: Microbial groups in soil, role of micro-organisms in soil fertility and crop production, microbial transformations of carbon, nitrogen, phosphorous and sulphur. Plant-microbe associations: Symbiotics, associative and asymbiotic nitrogen fixation, azolla, mycorrhiza and PGPR. Biodegradation of agricultural chemicals: Insecticides, fungicides and herbicides. Degradation of organic wastes and crop residues including lingo-cellulose. Microbiology of silage production. Rhizosphere and its management. Phyllosphere and its management. Micro-organisms in human welfare: Biofertilizers and biopesticides. Microbiology of water: Marine water, fresh water and potable water. Waste and effluent treatment and recycling,

microbes in composting, microbial biofuel production. Microbiology of food: Role of microbes in fermentation, microbial spoilage and principles of food preservation.

**Practical**

Acquaintance with equipments, glasswares etc. in microbiology laboratory. Acquaintance with microscope. Disinfection and sterilization methods. Preparation of culture media for fungi and bacteria. Isolation of microbes from infected plant parts. Isolation and purification of bacteria by streak plate method. Staining of bacteria: Simple and differential staining. Staining and slide preparation of fungi. Staining of endospore. Enumeration of bacteria present in soil and water. Isolation of *Azotobacter* from soil. Isolation of *Rhizobium* from root nodules of a legume plant.

<b>MATH0111</b>	<b>Introductory Statistics</b>	<b>2 (2+0)</b>	<b>Mathematics</b>
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**Theory**

Introduction to statistics: Definition, limitations and uses. Graphical representation: Frequency distribution, discrete and continuous variables, cumulative frequencies, histogram, frequency polygon, frequency curve and ogives. Measures of central tendency: Arithmetic mean, median and mode for ungrouped and grouped data with merits and demerits. Measures of dispersion: Range, mean deviation from AM, median and mode, variance, standard deviation, coefficient of variation for ungrouped and grouped data. Probability theory: Random experiment, sample space, event, mutually exclusive events. Classical definition of probability. Theorem of addition (for mutually exclusive events) and theorem of multiplication (both without proof). Simple problems based on probability. Correlation: Definition, scatter diagrams, Karl Pearson’s coefficient of correlation and its properties. Linear regression: fitting of linear regression equation of Y on X, estimation of Y for given values of X. Test of significance: Definition of hypothesis, null and alternative hypothesis, test statistics, one sample t-test and two sample Fisher’s t-test. Chi-square test of independence in 2 x 2 contingency table. Analysis of variance: Analysis and variance for one-way classification with equal and unequal number of observations. Sample survey: Population, sample, advantages of sampling over complete enumeration, simple random sampling without replacement, selection procedure for simple random sample using random number tables, estimation of population mean and its standard error.

<b>COMM0101</b>	<b>Agricultural Finance and Cooperation</b>	<b>3 (2+1)</b>	<b>Com.&amp; Mgmt.</b>
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**Theory**

Agricultural finance: Nature and scope. Time value of money: Compounding and discounting. Agricultural credit: Meaning, definition, need, classification and micro finance. Credit analysis: 4R’s, 5C’s and 7P’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. Cooperative credit structure: PACS, DCCB, SCB.

**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 (7 types), preparations and analysis of loan proposals (4R’s) and types of repayment loans.

## IV Semester

<b>AGRI2109</b>	<b>Crop Production Technology - II (<i>Rabi</i> Crops)</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *rabi* crops. Cereals: Wheat and barley. Pulses: Chickpea, lentil, peas. Oilseeds: Rapeseed, mustard and sunflower. Sugar crops: Sugarcane. Forage crops: Berseem, lucerne and oat.

### Practical

Sowing methods of wheat and sugarcane. Identification of weeds in *rabi* season crops. Study of morphological characteristics of *rabi* crops. Study of yield contributing characters of *rabi* season crops. Yield and juice quality analysis of sugarcane. Study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments. Visit to research stations of related crops.

<b>AGRI2110</b>	<b>Insect Morphology and Systematics</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

History of Entomology in India. Factors for insect 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 insect. 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, Tettigoniidae, Gryllidae, Gryllotalpidae, Schizodactylidae); Dictyoptera (Mantidae, Blattidae); Odonata; Isoptera (Termitidae); Thysanoptera (Thripidae); Hemiptera (Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Lophopidae, Lacciferidae); Neuroptera (Chrysopidae); Lepidoptera (Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Pieridae, Danaidae, Papilionidae, Yponomeutidae (Plutellidae), Hesperidae, Sphingidae, Bombycidae); Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Dermestidae, Tenebrionidae, Meloidae, Bostrychidae, Lampyridae); Hymenoptera (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Encyrtidae, Aphelinidae, Eulophidae); Diptera (Cecidomyiidae, Trypetidae, Tachinidae, Agromyzidae, Tephritidae, Syrphidae, Muscidae, Glossinidae, Asilidae, Tabanidae).

### 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 venations, types of wings and wing coupling apparatus. Types of insect larvae and pupae. Dissection of digestive system in insects. Dissection of male and female reproductive systems in insects. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

**Note:** Students should submit at least 75-100 dried well mounted insect specimens representing different orders and families before the practical examination.

<b>AGRI2111</b>	<b>Production Technology of Flowers, Medicinal and Aromatic Plants, Ornamental Crops and Landscaping</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Importance and scope of floriculture, ornamental crops, medicinal and aromatic plants (MAPs) and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Lawn making. Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like asparagus, aloe, costus, cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

### **Practical**

Identification of ornamental plants. Identification of MAPs. Nursery bed preparation and seed sowing. Training and pruning of ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures: Care and maintenance. Intercultural operations in flowers and MAPs. Harvesting and post-harvest handling of cut and loose flowers. Processing of MAPs. Visit to commercial flower/MAP unit.

<b>AGRI2112</b>	<b>Weed Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

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. Integrated weed management. Herbicides: Advantages and limitations of herbicides uses in India. Herbicide classification, formulations, method of application. Properties and uses of 2,4-D, atrazine, glyphosate, butachlor, benthocarb. Adsorption and persistence of herbicides in soils. Introduction to adjuvants and their uses in herbicides. Introduction to selectivity of herbicides, compatibility of herbicides with other agrochemicals. 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 their habitats. Preparation of list of commonly available herbicides, preparation of weed herbarium, calculations on weed control efficiency and weed index. Herbicide label information, computation of herbicide doses. Study of herbicide application equipments and calibrations. Demonstration of method of herbicide application. Study of phytotoxicity symptoms of herbicides in different crops. Biology of nutsedge, bermudagrass *Echinochloa* spp., *Phalaris minor*, *Parthenium* and *Trianthema*; economics of weed control practices. Visits to problem areas.

<b>AGRI2113</b>	<b>Introductory Nematology</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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### **Theory**

Introduction, history, kinds and habitats of nematodes, gross morphology of plant parasitic nematodes. Biology and ecology of plant parasitic nematodes, nature of damage and general symptomatology. Principles and practices of nematode management. Hosts, distribution, biology, symptoms and management of important plant parasitic nematodes viz., *Meloidogyne* spp., *Heterodera avenae*, *Globodera rostochiensis* and *G. pallida*, *Radopholus similis*, *Hirschmanniella oryzae*, *Pratylenchus* spp., *Tylenchulus semipenetrans*, *Rotylenchulus reniformis*, *Anguina tritici*, *Aphelenchoides besseyi*, *Ditylenchus angustus*.

### **Practical**

Collection of soil and plant samples. Extraction of nematodes from soil and plant tissues. Counting and estimation of nematode populations. Killing, fixing and clearing nematodes. Preparation of temporary and permanent mounts. Study of major morphological characteristics. Identification of important plant parasitic nematodes and symptoms caused by them. Methods of nematode management.

<b>AGRI2114</b>	<b>Problematic Soils and their Management</b>	<b>2 (2+0)</b>	<b>Agriculture</b>
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### **Theory**

Soil quality and health. Soil erosion: Types, effects, mechanism and control. Distribution of waste land and problem soils in India, their categorization based on properties. Origin and basic concepts of problem soils, reclamation and management of saline and sodic soils, acid soils, acid sulphate soils, eroded and compacted soils, flooded soils. Soil pollution-behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water - quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species (MPTS), bioremediation through MPTS of soils, land capability and classification, land suitability classification. Problematic soils under different agro-ecosystems.

<b>AGRI2115</b>	<b>Agricultural Waste Management</b>	<b>2 (1+1)</b>	<b>Agri./Life Sci.</b>
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### **Theory**

Introduction to agricultural waste management. Nature and characteristics of agricultural waste and their impact on the environment. Kinds of wastes, classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality. Biological processes of waste management, utilization and recycling of agricultural waste. Potential of recyclable crop residues and its management. *In-situ* management of agriculture waste. Composting and Vermicomposting for bio conservation of biodegradable waste. Biogas technology, agricultural waste and water, air and animal resources. Impacts of waste on human, animal health and environment. Management of bedding and litter, wasted feed, runoff from feed lots and holding areas and waste water from dairy parlors, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

### **Practical**

Collection and preparation agricultural waste sample. Determination of pH, EC, CEC, heavy metals, BOD, COD, TSS, TDS, NH<sub>4</sub>, total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment

operation, maintenance and safety hazards, computer software and models. Survey of different agri-waste from livestock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals. Preparation of compost, vermicomposting, biogas and analysis of compost.

<b>AGRI2116</b>	<b>Dimensions of Agricultural Extension</b>	<b>2 (2+0)</b>	<b>Social Science</b>
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**Theory**

Education: Meaning, definition, types-formal 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: Shriniketan, 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 and 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 Minister Employment Yojana (PMEY). New trends in extension, privatization in extension. 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 and V System): Salient features, fortnight meetings, monthly workshops, linkages, merits and demerits, emergence of broad based extension.

<b>AGRI2117</b>	<b>Power Engineering, Farm Machinery &amp; Renewable Energy</b>	<b>3 (2+1)</b>	<b>Agri./Engg.</b>
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**Theory**

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. Definition of renewable energy, classification of renewable energy sources, contribution of these sources in agricultural sector. Familiarization with biomass sources, their utilization for biofuel (biodiesel, bioethanol etc.) production and their application. Familiarization with biogas production, types of biogas plants, application of biogas. Principles of combustion, pyrolysis and gasification, types of gasifiers, producer gas and its application. Introduction of solar energy, solar thermal and photovoltaic systems and their application. Familiarization with solar energy gadgets: Solar thermal systems (solar cooker, solar water heater, solar drying) and solar photovoltaic systems (solar pond, solar distillation, solar lights, solar fence). Introduction of wind energy, types of wind mills, constructional details and their application.



**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, seed-cum-fertilizer drills, furrow opener, metering mechanism and calibration. Study of maintenance and operation of tractor. Study of 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. Familiarization with renewable energy gadgets. Study of different types of biogas plants. Familiarization with biogas operated appliances. Study of different types of gasifiers and production process of biodiesel. Study of pellet making machine, Familiarization with different solar energy gadgets. Study of solar photovoltaic system and SPV based appliances: Solar light, solar water pump, solar fence, solar refrigerator, solar power plant, Study of solar thermal system based appliances: solar cooker, solar water heater, solar dryers, solar distillation unit and solar pond. Study of different types of wind mills.

<b>COMM0103</b>	<b>Agricultural Marketing Trade &amp; Prices</b>	<b>2 (2+0)</b>	<b>Com. &amp; Mgmt.</b>
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**Theory**

Agricultural marketing: Concepts and definition, scope and subject matter. Market and marketing: Meaning, definitions, dimensions and components of a market classification. Market structure: Conduct, performance, marketing functions, market functionaries or agencies. Producer's surplus: Meaning, types of producers' surplus, marketable surplus. Marketed surplus: importance, factors effecting 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. International trade: GATT, WTO, implications of AOA, market access. Cooperative marketing: Meaning and types. Quality control: Agricultural products, AGMARK, characteristics of agricultural products. Agricultural prices: Meaning, role and types, need for agricultural price policy. Risk in marketing: Meaning and importance, types of risk in marketing, speculations and hedging.

<b>ENGL0208</b>	<b>Communication Skill and Personality Development</b>	<b>2 (1+1)</b>	<b>English</b>
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**Theory**

Communication skills: Meaning and process of communication, verbal and non-verbal communication. Listening and note taking, writing skills, oral presentation skills. Communication barriers, building self-esteem and self-confidence. Know the importance of personality development, dimensions of personality development like attitude, team work, management of conflicts, identify the different personality traits. Reading and comprehension of general and technical articles, 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. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting. Individual and group presentations.

## V Semester

<b>AGRI3101</b>	<b>Practical Crop Production - I (<i>Kharif</i> crops)</b>	<b>4 (0+4)</b>	<b>Agriculture</b>
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### Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

<b>AGRI3102</b>	<b>Crop Improvement - I (<i>Kharif</i> Crops)</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fibres, fodders and cash crops. Vegetable and horticultural crops. Plant genetic resources, its utilization and conservation floral biology, study of genetics of qualitative and quantitative characters. Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional). Seed production technology in self-pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeon pea etc. Ideotype concept and climate resilient crop varieties for future.

### Practical

Emasculation and hybridization techniques in different crop species. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods. Study of field techniques for seed production and hybrid seeds production in *Kharif* crops. Estimation of heterosis, inbreeding depression and heritability. Layout of field experiments. Study of quality characters, donor parents for different characters. Visit to seed production plots. Visit to AICRP plots of different field crops.

<b>AGRI3103</b>	<b>Diseases of <i>Kharif</i> Field Crops and Horticultural Crops and their Management - I</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

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

#### Field crops

Rice: Blast, brown spot, bakanae, bacterial blight, bacterial leaf streak, sheath blight, false smut, khaira and tungro. Maize: Stalk rots, downy mildew, leaf spots. Sorghum: Smuts, grain mold and anthracnose. Bajra: Downy mildew, smut and ergot. Groundnut: Early and late leaf spots (tikka disease), wilt, rust and collar rot. Sesamum: Root rot and phyllody. Clusterbean: Alternaria leaf spot and bacterial blight. Cotton: Anthracnose, vascular wilt, root rot, angular leaf spot, myrothecium leaf spot and CLCuD. Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic. Pigeonpea: Phytophthora blight, wilt and sterility mosaic. Black & Green gram: Cercospora leaf spot and anthracnose, web blight, yellow mosaic and leaf crinkle. Castor: Phytophthora blight and alternaria leaf spot. Tobacco: Black shank, black root rot and mosaic.

#### Horticultural Crops

Guava: Wilt and anthracnose. Banana: Panama wilt, bacterial wilt, sigatoka and bunchy top. Ber: Powdery mildew. Papaya: Foot rot leaf curl and mosaic. Pomegranate: Bacterial blight. Cruciferous vegetables: Alternaria leaf spot and black rot. Brinjal: Phomopsis blight and fruit rot and sclerotinia blight, little leaf disease. Tomato: Damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic. Okra: Yellow vein mosaic. Beans: Anthracnose and bacterial blight. Ginger: Soft rot. Colocasia: Phytophthora blight. Coconut: Wilt and bud rot. Tea: Blister blight, red rust. Coffee: Rust.

### **Practical**

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant disease specimens for Herbarium.

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

<b>AGRI3104</b>	<b>Farming System &amp; Sustainable Agriculture</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

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

### **Practical**

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. Study of profitable utilization of agricultural wastes. Visit to poultry and dairy units to study resource allocation, utilization and economics.

<b>AGRI3105</b>	<b>Principles of Organic Farming</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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### **Theory**

Organic farming, principles and its scope in India. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture. Organic ecosystem and their concepts. Organic nutrient resources and its fortification. Restrictions to nutrient use in organic farming. Choice of crops and varieties in organic farming. Fundamentals of insect, pest, disease and weed management under organic mode of production. Operational structure of NPOP. Certification process and standards of organic farming. Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

**Practical**

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

<b>AGRI3106</b>	<b>PHM and Value Addition of Fruits and Vegetables</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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**Theory**

Importance of fruits and vegetables, extent and possible causes of post-harvest losses. Pre-harvest factors affecting post-harvest quality, maturity, and ripening; changes occurring during ripening. Respiration and factors affecting respiration rate, role of ethylene. Post-harvest diseases and disorders. Heat, chilling and freezing injury. Harvesting and field handling. Storage (ZECC, cold storage, CA, MA and hypobaric). Value addition concept. Principles and methods of preservation. Concepts and standards: Intermediate moisture foodstuffs - Jam, jelly, marmalade, preserve, candy. Fermented and non-fermented beverages (Squash and nectar). Concepts and standards: Tomato products. Concept and methods: Drying/dehydration of fruits and vegetables, osmotic drying. Canning: Concepts and standards, and packaging of products.

**Practical**

Identification of equipments and materials used in post-harvest management. Applications of different types of packaging container for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy, preserve and tomato products, chutney, canned products and preservation of fruits and vegetables. Quality evaluation of products - physico-chemical and sensory. Visit to processing unit/industry.

<b>AGRI3107</b>	<b>Insect Ecology, IPM &amp; Beneficial Insects</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

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 and concept 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, concept, principles. Tools of IPM: Host plant resistance, cultural, mechanical, physical, legislative, biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses). Chemical control: Importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Study of important 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. Adsorption and persistence of insecticides in soils. Recent methods of pest control. Practices, scope and limitations of IPM. Insecticides Act: Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and

antidotes. Beneficial insects (a): 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. Beneficial insects (b): Silk worms, honey bees and lac insects. Important species of pollinators, weed killers and scavengers and their importance. Non insect pests - mites, nematodes, rodents and birds. Vermiculture.

**Practical**

Study of terrestrial and pond ecosystems of insects. 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. Handling, maintenance and upkeep of equipments related to biological control. Identification of important biological agents. Mass rearing techniques of important host insects of parasitoids (one field and one storage Lepidopteran pest). Mass rearing techniques and inundative release of important parasitoids - *Trichogramma* sp./*Camponotus chlorideae*. Mass rearing technique of important predators - Lady bird beetle and green lacewing. Collection and preservation of bio-agents. Mass production of NPV, Bt and *Metarrhizium anisopliae*. Field visit to study the behavior of natural enemies and their collection. Visits of mass production and biological control centers of national repute. Preparation of neem seed kernel extract. 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.

<b>AGRI3108</b>	<b>Livestock and Poultry Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Importance of livestock in the national economy, present status and future prospects of various livestock development programmes in India. Important breeds of cattle, buffalo, sheep, goat and swine. Factors effecting, reproduction in farm animals. Selection and breeding of livestock for higher milk and meat production. Milk secretion, milking of animals and factors affecting milk yield and composition. Feeding and management of calves, growing, heifers and milch animals etc. Housing and rearing systems for different species of livestock. Disease control, health management and animal farm waste management practices. Animal farm records, cost of milk production and economics of viable units of cattle, buffalo, sheep, goat and swine. Classification of poultry and characteristics of important breeds. Methods of rearing, breeding, feeding and management, incubation and hatching, brooding, vaccination and prevention of diseases, preservation of egg and meat, cost of production etc.

**Practical**

Visit to livestock farms. Identification, handling and restraining of animals. Selection, judging and culling of dairy animals. Feeding techniques and ration formulation. Disease control, housing and feeding practices. Economics of livestock production. Incubation hatching, housing and management of poultry.

<b>AGRI3109</b>	<b>Environmental Studies</b>	<b>2 (1+1)</b>	<b>Agriculture</b>
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### **Theory**

Scope and importance of environmental studies and biological chemistry. Natural resources: Renewable and nonrenewable resources, forest, water, food, energy and land. Various environmental cycles viz. carbon, nitrogen and water etc. Ecosystems: Definition, concept, structure and functions, producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem and types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. Global warming and role of plantation forestry in environment protection. 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 - food, balance diet, vitamins and minerals etc. HIV/AIDS - viruses and nucleic acids, modification and propagation. Role of information technology on environment and human health - nutrition/malnutrition in communities.

### **Practical**

Collection, processing and storage of effluent samples. Physical, chemical and biological analysis of soil and water samples. Determination of bio-chemical oxygen demand (BOD) in effluent sample. Determination of chemical oxygen demand (COD) in effluent sample. Estimation of dissolved oxygen in effluent samples. Determination of 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/heavy metal 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.

<b>COMM0104</b>	<b>Entrepreneurship Development in Agri-Business</b>	<b>2 (1+1)</b>	<b>Com.&amp; Mgmt.</b>
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### **Theory**

Concept of entrepreneur, entrepreneurship development, characteristics of entrepreneurs. Assessment of entrepreneurship skills, SWOT Analysis & achievement motivation, entrepreneurial behavior. Government policy and programs and institutions for entrepreneurship development. Entrepreneurial development process. Business leadership skills. Communication skills for entrepreneurship development. Developing organizational skill, developing managerial skills, problem solving skill, achievement motivation, and time management. Supply chain management and total quality management. Project planning formulation and report preparation. Opportunities for entrepreneurship and rural entrepreneurship.

### **Practical**

Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit. Preparation of business plan and proposal writing. Visit to entrepreneurship development institute and entrepreneurs.

## VI Semester

<b>AGRI3110</b>	<b>Practical Crop Production - II (<i>Rabi</i> crops)</b>	<b>4 (0+4)</b>	<b>Agriculture</b>
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### **Practical**

Crop planning, raising field crops in multiple cropping systems. Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

<b>AGRI3111</b>	<b>Rainfed Agriculture &amp; Watershed Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Rainfed agriculture: Introduction, types, history of rainfed agriculture and watershed in India. Problems and prospects of rainfed agriculture in India. Soil and climatic conditions prevalent in rainfed areas. Drought: types, effect of water deficit on physio-morphological characteristics of the plants. Mechanism of crop adaptation under moisture deficit condition. Water harvesting: Importance, its techniques. Efficient utilization of water through soil and crop management practices, management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions. Concept, objective, principles and components of watershed management, factors affecting watershed management.

### **Practical**

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different dry land areas in the country and demarcation of dry land area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapotranspiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices viz. mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

<b>AGRI3112</b>	<b>Crop Improvement - II (<i>Rabi</i> crops)</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### **Theory**

Centers of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fodder crops and cash crops, vegetable and horticultural crops. Plant genetic resources, its utilization and conservation. Floral biology, study of genetics of qualitative and quantitative characters. Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional). Seed production technology in self-pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

### Practical

Emasculation and hybridization techniques in different crop species namely wheat, oat, barley, chickpea, lentil, field pea, rapeseed, mustard, sunflower, potato, berseem, sugarcane, cowpea. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods. Study of field techniques for seed production and hybrid seeds production in rabi crops. Estimation of heterosis, inbreeding depression and heritability. Layout of field experiments. Study of quality characters, study of donor parents for different characters. Visit to seed production plots. Visit to AICRP plots of different field crops.

<b>AGRI3113</b>	<b>Protected Cultivation and Secondary Agriculture</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

Green house technology: Introduction, types of green houses. Plant response to greenhouse environment, planning and design of greenhouses, design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis. Important engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration: Moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

### Practical

Study of different type of greenhouses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of greenhouse equipments. Visit to various post-harvest laboratories. Determination of moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of moisture content of various grains by moisture meter. Field visit to seed processing plant. Determine the rate of air exchange in an active summer/winter cooling system.

<b>AGRI3114</b>	<b>Diseases of <i>Rabi</i> Field crops and Horticultural Crops and their Management - II</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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### Theory

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

#### Field crops

Wheat: Rusts, loose smut, flag smut, karnal bunt, powdery mildew, alternaria blight and tundu. Barley: Covered smut, stripe disease, rust and loose smut. Sugarcane: Red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng. Sunflower: Sclerotinia stem rot, Rhizopus leaf rot and Alternaria blight. Rapeseed & mustard: Alternaria blight, white rust, downy mildew, club root and sclerotinia stem rot. Gram: wilt, root rot, grey mould and ascochyta blight. Lentil: Rust and wilt; Pea: Powdery mildew, downy mildew, and rust. Berseem: Stem rot, powdery mildew and root rot.

#### Horticultural crops

Mango: Anthracnose, malformation, bacterial blight and powdery mildew. Citrus: Canker and gummosis. Grape vine: Downy mildew, powdery mildew and anthracnose. Apple: Scab, powdery



mildew, fire blight and crown gall. Peach: Leaf curl. Strawberry: Leaf spot. Potato: Early and late blight, black scurf, leaf roll and mosaic, scab and apical leaf curl.

Cucurbits: Downy mildew, powdery mildew and wilt. Onion and Garlic: Purple blotch and stemphylium blight. Chillies: Anthracnose and fruit rot, wilt and leaf curl. Turmeric: Leaf spot, Coriander: Stem gall. Marigold: Alternaria blight, wilt and botrytis blight. Rose: Dieback, powdery mildew and black leaf spot.

**Practical**

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

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

<b>AGRI3115</b>	<b>Pest of Crops and Stored Grain and their Management</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, narcotics, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

**Practical**

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

<b>AGRI3116</b>	<b>Geoinformatics and Nano-technology for Precision Farming</b>	<b>3 (2+1)</b>	<b>Agriculture</b>
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**Theory**

Precision agriculture: Concepts and techniques, their issues and concerns for Indian agriculture. Geo-informatics: Definition, concepts, tool and techniques, their use in precision agriculture. Crop discrimination and yield monitoring, soil mapping. Fertilizer recommendation using geospatial technologies. Spatial data and their management in GIS. Geodesy and its basic principles. Remote sensing concepts and application in agriculture. Image processing and interpretation. Global positioning system (GPS), components and its functions. System simulation: Concepts and principles, introduction to crop simulation models and their uses for optimization of agricultural

inputs. STCR approach for precision agriculture. Nanotechnology: Definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors. Use of nanotechnology in tillage, seed, water, fertilizer, plant protection for scaling-up farm productivity.

**Practical**

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

<b>COAP0102</b>	<b>Agriculture Informatics</b>	<b>2 (1+1)</b>	<b>Comp. Science</b>
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**Theory**

Introduction to computers, anatomy of computers, memory concepts, units of memory, operating system, definition and types. Applications of MS-Office for creating, editing and formatting a document, data presentation, tabulation and graph creation, statistical analysis, mathematical expressions. Database, concepts and types, creating database, uses of DBMS in agriculture. Internet and World Wide Web (WWW): Concepts and components. Computer programming, general concepts. Introduction to Visual Basic, Java, Fortran, C/C++ etc, concepts and standard input/output operations. E-agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in agriculture. Computer models in agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. Smartphone mobile apps in agriculture for farm advises. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information. Decision support systems, concepts, components and applications in agriculture. Preparation of contingent crop-planning and crop calendars using IT tools.

**Practical**

Study of computer components, accessories, practice of important DOS commands. Introduction of different operating systems such as windows, Unix/Linux, creating files & folders, file management. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific document. MS-excel: Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros. MS Access: Creating database, preparing queries and reports, demonstration of agri-information system. Introduction to World Wide Web (WWW) and its components. Introduction of programming languages such as Visual Basic, Java, Fortran, C, C<sup>++</sup>. Hands on practice on crop simulation models (CSM), DSSAT/Crop-Info/CropSyst/ Wofost. Use of smart phones and other devices in agro-advisory and dissemination of market information. Introduction of geospatial technology, for generating information important for agriculture. Hands on practice on preparation of decision support system. Preparation of contingent crop planning.

<b>COMM0105</b>	<b>Farm Management, Production &amp; Resource Economics</b>	<b>2 (1+1)</b>	<b>Com.&amp; Mgmt.</b>
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### **Theory**

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

### **Practical**

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

<b>VII Semester</b>			
<b>S. No</b>	<b>Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &amp;AIA)</b>		
	<b>Activities</b>	<b>No. of weeks</b>	<b>Credit Hours</b>
1	General orientation & on campus training by different faculties	1	
2	Village attachment/ Unit attachment in University/ College/ KVK/ Research Station	10	
3	Agro-Industrial Attachment	6	
4	Project Report Preparation, Presentation and Evaluation	1	
<b>Total weeks for RAWE &amp; AIA</b>		<b>18</b>	<b>20</b>

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 6 weeks to get an experience of the industrial environment and working.

#### **RAWE Component - I Village Attachment Training Programme**

<b>S. No</b>	<b>Activity</b>	<b>Duration</b>
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	2 week
3	Plant Protection Interventions	2 week
4	Soil Improvement Interventions (Soil sampling and testing)	2 week
5	Fruit and Vegetable production interventions	1 week
6	Animal Production Interventions	1 week
7	Extension and Transfer of Technology activities	1 week

#### **RAWE Component - II Agro Industrial Attachment**

- Students shall be placed in agro-and cottage industries and commodities boards for 10 weeks.
- Industries include seed/sapling production, pesticides, post-harvest processing, value addition, agri-finance institutions, etc.

#### **Activities and Tasks during Agro-Industrial Attachment Programme**

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

**Attendance: Minimum attendance - 85%.**

**Records:** Students would complete the record work/ report writing/ presentations, etc. based on daily field observations recorded in notebooks and weekly diaries maintained by them.

**Evaluation Procedure:** Students shall be evaluated component-wise under village attachment and agro-industrial attachment. The respective component In-Charge Instructor(s), agroindustrial official and Course Coordinator will evaluate the students as under:

Activity		Max. Marks
<b>1. Village Attachment Training</b>		
a.	KVK/ARS/NGO scientist	50
b.	Report Preparation	10
c.	University Committee (Presentation & Viva-voce)	40
<b>2. Industrial Attachment Training</b>		
a.	Industry officials	50
b.	Report Preparation	10
c.	University Committee (Presentation & Viva-voce)	40

**Assessment Parameters (RAW & AIA):**

	Parameters	Marks (%)
<b>A</b>	<b>Village Attachment</b>	
	Regularity	10
	Initiative & creativity	10
	General conduct & discipline	10
	Work performance	20
<b>B.</b>	<b>Industrial Attachment</b>	
	Initiative & compliance	10
	General conduct and discipline	10
	Project planning & implementation	10
	Work performance	20

VIII Semester		
(Experiential Learning Programme/ Hands on Training (HOT))		
S.No	Module	Credit
1	Module-I	0+10
2	Module-II	0+10
<b>Total</b>		20 (0+20)

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

Module Code	Title of the Module	Credits	Faculty
AGRI4101	Seed Production and Technology	0+10	Agriculture
AGRI4102	Mushroom Cultivation	0+10	Agriculture
AGRI4103	Soil, Plant , Water and Fertilizer Testing Services	0+10	Agriculture
AGRI4104	Beekeeping	0+10	Agriculture
AGRI4105	Commercial Vegetable Production	0+10	Agriculture
AGRI4106	Organic Production Technology	0+10	Agriculture
AGRI4107	Bioagents and Biofertilizer Production	0+10	Agriculture

**Module Code: AGRI4101 Seed Production & Technology Agriculture Faculty 0+10**

#### **a. Seed Production and Certification**

- Identification of seeds and its classes, generation system of seed multiplication.
- Preparation of herbarium of various seed crops and their objectionable weeds.
- Study of biology of different field and vegetable crops, flower structure, mode of pollination & propagation.
- Concepts of variety release, notification and maintenance of varieties and hybrids of field and vegetable crops.
- Identification of crop varieties/hybrids on the basis of morphological characters.
- Factors affecting seed quality during production.
- Factors influencing deterioration and maintenance of genetic purity of crop varieties.
- Selection of suitable area/ site for high quality seed/ planting material production.
- Calculation of land requirement and isolation distance in field crops & vegetable crops.
- Seed production practices of self-pollinated crops and cross-pollinated crops.
- Hybrid seed production of field and vegetable crops.
- Roguing of off type plants in seed production units.
- Seed act and policies, seed certification standards of field & vegetable crops.
- WTO, IPR, PPV & FR, seed village concept.
- Visit to seed production field public and private seed companies.

#### **b. Seed Processing , Storage & Marketing**

- Principles and importance of seed processing.
- Standardization of process parameters of seed processing machinery for specific crop/variety.
- Maintenance of seed processing equipment like: Air screen cleaner, indent cylinder separator, specific gravity separator etc.
- Determination of seed moisture content before and after drying.

- Maintenance and calibration of different seed treaters.
- Study of different types of seed storage structures i.e, Traditional and Modern.
- Seed marketing and factors influencing it.
- Visit to seed processing plants and seed stores of various public and private seed companies.

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### **c. Seed Testing and Quality Control**

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- Identification and handling of seed testing equipment.
- Identification of different crop and weed seeds.
- Structure of different monocots and dicots seeds.
- Types of Germination and structure of seedling of monocots and dicots.
- Seed sampling procedure in seed stores and seed testing laboratory.
- Physical purity analysis and calculation of its components in seed samples.
- Moisture determination by different methods in various field and vegetable crops.
- Different germination testing methods of field and vegetable crops.
- Seed dormancy and its alleviation.
- Varietal and genetic purity analysis of seeds.
- Seed invigoration techniques.
- Prediction of relative storability by accelerated ageing technique in different crops.
- Seed health management. IMSC standards for seed borne diseases.
- Identification of seed-borne diseases and storage insect pest and their management.
- Different detection methods for seed-borne pathogens and storage insects-pests.
- Visit to seed testing laboratory of various public and private seed companies.

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**Module Code: AGRI4102**

**Mushroom Cultivation**

**Agriculture Faculty**

**0+10**

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- Mushrooms - An agri-business.
- Nutritional and medicinal value of mushrooms.
- Different type of media preparation for raising cultures and single and multi-spore cultures.
- Ingredients of spawn production of button mushroom.
- Isolation of pure culture of different mushrooms.
- Production of mother spawn/master spawn.
- Production of commercial spawn of different mushrooms.
- Qualities of good spawn.
- Production technology of white button mushroom.
- Compost preparation for button mushroom.
- Wetting of substrate mixing of different ingredients and turning of compost for button mushroom.
- Different methods of composting for mushroom cultivation.
- Qualities of good compost and its testing.
- Fabrication of low cost mushroom house.
- Different spawning methods.
- Maintenance of environment in mushroom house.
- Diseases, moulds, insect pests and nematodes of button mushroom and their management.
- Disorders of mushroom and their management.
- Cultivation of oyster and milky mushroom: Substrate preparation/formulation, different cultivation methods, environment management, insect pest disease management.
- Post-harvest processing of mushroom.

- Management of indoor environment parameters i.e. temperature and moisture.
- Cultivation of shiitake, paddy straw mushroom.
- Uses of spent mushroom compost.
- Economics of button, oyster, milky, shiitake mushroom.
- Poisonous mushrooms and mushroom poisoning.
- Fabrication of mushroom farm.
- Visit to different mushroom houses.

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**Module Code: AGRI4103    Soil, Plant, Water and Fertilizer Testing    Agri. Faculty    0+10**

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- Basic concepts of chemical analysis: Principle of pH meter, EC meter, Spectrophotometer, Flame photometer and Atomic Absorption Spectrophotometer and their application.
- Soil analysis: Preparation and standardization of solutions and reagents. Sampling of soil, procedure and precautions. Collection and preparation of soil samples. Determination of texture, bulk density. Estimation of soil pH, EC, organic carbon, available NPKS, micro nutrients (Zn, Cu, Mn, Fe). CEC and exchangeable Na in soil. Estimation of cations and anions in soil. Interpretation of analytical data and nutrient index.
- Plant analysis: Plant sampling and sample preparation for analysis. Sampling stages and plant part to be sampled. Digestion of plant material. Estimation of NPKS and Zn, Fe, Cu, Mn. Rapid time test for determination for NP & K. Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient ranges.
- Water analysis: Collection of water samples. Quality criteria, classification and suitability of irrigation water, and water quality index. Determination of pH, EC, cations ( $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ) and anions ( $\text{NO}_3^-$ ,  $\text{CO}_3^-$ ,  $\text{HCO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^-$ ) in irrigation water. Computation of SAR and RSC of irrigation water.
- Fertilizer analysis: Sampling procedure for fertilizers and manures for chemical analysis. Fertilizer control order. Determination of ammonium and nitrate contents of nitrogenous fertilizers. Total N content in urea. Estimation of water soluble  $\text{P}_2\text{O}_5$  in DAP and SSP. Water soluble potassium in MOP. Determinate of Zn, Fe, Cu & Mn in the fertilizers. Determination of organic carbon, N, P, K, S, Zn, Fe, Cu and Mn contents in organic manures. Adulteration test of fertilizers.

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**Module Code: AGRI4104                      Beekeeping                      Agriculture Faculty                      0+10**

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- Importance and scope of apiculture. History of beekeeping in India. Introduction and spread of *Apis mellifera* in India.
- Taxonomic classification of honey bees. Identification of different species of honey bees, identification of different castes in honey bee colony. Division of Labour.
- Morphological differences between worker, drone and queen. Honey bee morphology (legs, mouthparts, wings, antennae).
- Anatomy (wax glands, hypopharyngeal glands, sting apparatus, digestive system). Honey bee dances, honey bee pheromones.
- Establishment of apiary (suitable site, placement of honey bee colonies in apiary). How to procure honey bee colonies. Colony examination, recording colony parameters data and maintaining record. Identification of bee keeping equipments and their uses. Identification of bee flora.
- Seasonal management of honey bee colonies. Providing artificial diet (sugar syrup and pollen substitute) stimulative feeding. Summer management, winter management, honey flow management.



- Swarming, absconding, and uniting of honey bee colonies. Division of honey bee colonies. Management of laying workers. Management of honey bee colonies for pollination of crops.
- Hive products: Composition, uses and their extraction (Honey extraction and packing, Collection and extraction of hive products other than honey).
- Queen introduction, mass queen rearing methods including Do-lite method.
- Identification of honey bee enemies, diseases and their management. Migratory beekeeping, packing honeys bee colonies for migration. Saving honey bees from pesticide poisoning.

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**Module Code: AGRI4105    Commercial Vegetable Production                      Agri. Faculty    0+10**

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- Identification of vegetable seeds and plants.
- Planning and layout of a kitchen garden.
- Preparation of nursery beds and seedbeds of vegetable seeds and seed treatment before sowing viz. fungicides, dormancy, soaking and inoculation.
- Raising of vegetable seedlings in field and portrays in different seasons.
- Hardening treatments of seedlings, their transplanting and aftercare.
- Identification of critical stages and different methods of irrigation in vegetables.
- Use of plant growth regulators in vegetable production.
- Use of green manure, farmyard manure, compost, vermicompost, fertilizers and fertigation.
- Use of bio-fertilizers in vegetable production.
- Cultural operations including mulching, training, pruning and staking.
- Hoeing, weeding and chemical weed control in vegetable crops.
- Sprays of insecticides, fungicides and growth regulators in vegetable crops.
- Growing of cool and warm season vegetables at Agricultural Farm.
- Protective cultivation of vegetables.

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**Module Code: AGRI4106    Organic Production Technology    Agriculture Faculty    0+10**

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- Concept and principles of organic production technology.
- Role of organic farming in national economy.
- Management of soil health with organic sources and nutrient recycling.
- Types of green manuring crops and its incorporation in soil.
- Biomass production and N accumulation of green manure crops.
- Management of insect- pest under organic production.
- Weed management under organic production.
- Organic production of major crops: Wheat, maize, summer pulses, fodder and vegetable crops.
- Vermicompost production methodology viz. vermiculture bed and vermibeds.
- Harvesting, nutritive value, storing and packing of vermicompost.
- Management of residue under organic farming.
- Aerobic and anaerobic methods of making compost.
- Nursery raising of important agro-forestry and shelter belts tress.
- Quality analysis of organic inputs and products.
- Calculation of relative economics of organic production programmes.
- Socio-economic impacts, marketing and export potential of organic products.
- Quality standards, inspection, certification, labeling and accreditation procedures of organic farm produce.
- Visit to a nearby modern organic farm.

- Familiarization with the working instruments such as Microscope, Shaker, BOD Incubator, Autoclave, UV-VIS spectrophotometer.
- Mass rearing techniques of important host insects of parasitoids, inundative release of important parasitoids - *Trichogramma* sp./*Campoletis chloridae*, important predators - Lady bird beetle and green lacewing.
- Collection and preservation of bio-agents. Mass production *Metarrhizium anisopliae*.
- Preparation of culture media and sterilization.
- Isolation of *Azotobacter*, *Azospirillum*, *Rhizobium* and *Gluconacetobacter*.
- Characterization of different microorganisms on the basis of IAA production, ammonium excretion, phosphate solubilization, zinc solubilization and potash solubilization.
- Isolation of antifungal PGPRs, purification of isolates and storage.
- Inoculum development and mass scale production of *Azotobacter*, *Azospirillum*, *Rhizobium* and *Glucanoacetobacter*. Filling and packing of liquid biofertilizers.

**Evaluation of Experiential Learning Programme/ HOT**

<b>Sl.No.</b>	<b>Parameters</b>	<b>Max. Marks</b>
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output Delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business Networking Skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	<b>Total</b>	<b>100</b>