

**Faculty of Agricultural Sciences
Rajiv Gandhi University**



UNDER GRADUATE CURRICULA & SYLLABUS

**B.Sc. (Agriculture)
w.e.f. 2020 onwards**

Syllabus structured as per ICAR Vth Deans Committee Report

	<ul style="list-style-type: none"> RESIDENTIAL REQUIREMENT
	<ul style="list-style-type: none"> Minimum residential requirement for completion of Bachelor of Sciences (Agriculture) course shall be eight (8) semesters, extendable to a maximum of fourteen (14) semesters in total.
	<ul style="list-style-type: none"> CREDIT REQUIREMENT
	<ul style="list-style-type: none"> In order to qualify for the B.Sc.(Hons)Ag. degree a student shall be required to complete 182 credits.
	<ul style="list-style-type: none"> A B.Sc. (Ag.) student shall offer, in each semester, a credit load as prescribed
	<ul style="list-style-type: none"> COURSES
	<ul style="list-style-type: none"> A student shall be required to offer six types of courses for completing the credit requirements for the B.Sc.(Hons) Ag. degree: <ul style="list-style-type: none"> i. Core courses: 128 credits ii. Elective Courses: 09 credits iii. Student READY programme (SRP): 20 credits iv. Experiential Learning Courses: 20 credits v. Remedial courses: 02 credits vi. Non-remedial courses : 03 credits
	<ul style="list-style-type: none"> The total courses of 180 credits (core courses 131 credits + elective courses 9 credits + Experiential Learning courses 20 credits + Student READY Program Experience 20 credits) shall be compulsory for all B.Sc.(Hons) Ag. students.

First Year

Table 1 B.Sc.(Hons)Ag. Pt. I			
1 st Semester		2 nd Semester	
Course No. / Credit	Course Title	Course No. / Credit	Course Title
AGR-111/3 (2+1)	Fundamentals of Agronomy	AEC-121/2 (2+0)	Fundamentals of Agricultural Economics
AGR-112/ 2 (1+1)	Agricultural Water Management	AHD-121/1 (1+0)	Introductory Animal Husbandry
AGR-113/ 1 (1+0)	Introduction to Agro-forestry	ENT-121/4 (3+1)	Fundamentals of Entomology
AGR-114/ 1 (1+0)	Agriculture Heritage	EXT-121/3 (2+1)	Fundamentals of Agricultural Extension Education
EXT-111/ 2 (2+0)	Rural Sociology & Educational Psychology	STAT-121/3 (2+1)	Statistical Methods
HOR-111/ 2 (1+1)	Fundamentals of Horticulture	GPB-121/3 (2+1)	Fundamentals of Genetics
PPH-111/3 (2+1)	Fundamentals of Plant Biochemistry and Biotechnology	MPP-121/4 (3+1)	Fundamentals of Plant Pathology
SSC-111/ 3 (2+1)	Fundamentals of Soil Science	PPH-121/3 (2+1)	Fundamentals of Crop Physiology
UGS-111/ 2 (1+1)	Introductory Biology (Remedial)		
UGS-112/ 2 (2+0)	Elementary Mathematics (Remedial)		
UGS-113/ 2 (1+1)	Comprehension & Communication Skills in English		
UGS-114/ 1 (1+0)	Human Values and Ethics (Non-gradial)		
UGS-115/ 2 (2+0)	NSS/NCC/Physical Education & Yoga Practices (Non-gradial)		

Second Year

1 st Semester		2 nd Semester	
Course No. / Credit	Course Title	Course No. / Credit	Course Title
AEC-211/3 (2+1)	Agricultural Finance and Co-operation	AEC-221/3 (2+1)	Agricultural Marketing, Trade and Prices
AGR-211/3 (2+1)	Crop Production Technology-I (Kharif Crops)	AGR-221/3 (2+1)	Crop Production Technology-II (Rabi Crops)
EXT-211/2 (1+1)	Communication Skills and Personality Development	AGR-222/2 (1+1)	Introduction to weed management
ENG-211/2 (1+1)	Introductory Soil and Water Conservation Engineering	AGR-223/2 (1+1)	Introductory Agro-meteorology and Climate Change
ENG-212/2 (1+1)	Farm Machinery and Power	AGR-224/2 (2+0)	Farming System and Sustainable Agriculture
GPB-211/4 (3+1)	Fundamentals of Plant Breeding	AHD-221/2 (1+1)	Livestock Production and Management
HOR-211/2 (1+1)	Production Technology for Vegetable and Spices	GPB-221/3 (1+2)	Principles of Seed Technology
PPH-211/3 (2+1)	Environmental Studies and Disaster Management	SSC-221/2 (2+0)	Problematic Soils and their Management
		HOR-221/2 (1+1)	Production Technology for Ornamental Crops, MAPs and Landscaping
		HOR-222/2 (1+1)	Production Technology for Fruit and Plantation Crops
		AEC-222(E)/3 (2+1)	Agribusiness Management
		GPB-222(E)/3 (1+2)	Commercial Plant Breeding
		PPH-221(E)/3 (1+2)	Micro Propagation Technologies

Third Year

1 st Semester		2 nd Semester	
Course No./Credit	Course Title	Course No./Credit	Course Title
AGR-311/1 (0+1)	Practical Crop Production – I (Kharif Crops)	AEC-321/2 (1+1)	Farm Management, Production and Resource Economics
AGR-312/2 (1+1)	Precision Farming	AGR-321/2 (1+1)	Rain fed Agriculture and Watershed Management
AHD-311/2 (1+1)	Introductory Dairy Science	AGR-322/1 (0+1)	Practical Crop Production-II (Rabi Crops)
ENG-311/2 (1+1)	Protected Cultivation and Secondary Agriculture	AGR-323/1 (1+0)	Organic Farming
ENT-311/3 (2+1)	Pests of Crops and Stored Grains and their Management	ENT-321/2 (1+1)	Management of Beneficial Insects
ENT-312/3 (2+1)**	Principles of Integrated Pest and Disease Management	ENG-321/2 (1+1)	Renewable Energy and Green Technology
EXT-311/2 (1+1)	Entrepreneurship Development and Business Communication	ENG-322/2 (1+1)	Agricultural Informatics
GPB-311/2 (1+1)	Crop Improvement – I (<i>Kharif</i>)	GPB-321/2 (1+1)	Crop Improvement – II (Rabi)
MPP-311/3 (2+1)	Diseases of Field & Horticultural Crops & their Management – I	HOR-321/2 (1+1)	Post-Harvest Management and Value Addition of Fruits, Vegetables and Ornamentals
SSC-311/3 (2+1)	Manures, Fertilizers and Soil Fertility Management	MPP-321/3 (2+1)	Diseases of Field & Horticultural Crops & their Management – II
HOR-311(E)/3 (2+1)	Landscaping	SSC-321(E)/3 (2+1)	Agrochemicals
AGR-313(E)/3 (2+1)	Weed Management	EXT-321(E)/3 (2+1)	Agricultural Journalism
ENG-312(E)/3 (2+1)	System Simulation and Agro-advisory	HOR-322(E)/3 (2+1)	Hi-Tech Horticulture

Fourth year

1st Semester

Student READY Program (SRP)			
S.No.	Activities	No. of Weeks	Credit Hrs.
1.	General Orientation & On Campus training by different faculties	1	14
2.	Village attachment / Unit attachment in Univ./College. KVK / Res Stn./Dept. attachment (one week for each dept.)	11	
3.	Agro-Industrial Attachment/Village attachment/State Dept. of Agriculture	07	06
4.	Project Report Preparations, Presentation and Evaluation	1	
Total weeks for Student READY Programme		20	20

Agro Industrial Attachment/ Village Attachment / State Dept. of Agriculture: In this component teachers from all departments will be involved.

- Students shall be placed in Agro and Cottage industries and Commodities Boards.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing-value addition, Agri-finance institutions, etc.
- Students shall be placed in villages under the supervision of competent authorities of State Dept. of Agriculture of U.P.

Evaluations of SRP Programme

Attendance: Minimum attendance for this programme – 90%

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

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

Note: i) The duration of the SRP programme is 20 weeks with a weightage of 20 credits;
 ii) Wherever facilities are not available for industrial training and / or agri-clinics, the duration of vocational training may be increased to that extent;
 iii) SRP programme will be implemented in the VII Semester of B.Sc.(Hons.)Ag.

2nd Semester

Experiential Learning Course			
S.No	Code and Name of Module	Department	Credit Hrs.
1.	AGR-421: Organic Farming	Agronomy	10(0+10)
2.	AHD-421: Milk Processing and Milk Products Manufacture	Animal Husbandry & Dairying	10(0+10)
3. 4.	ENT-421 : Commercial Bee-Keeping	Entomology and Agricultural Zoology	10(0+10)
	ENT-422: Production Technology for Bio-agents & Bio-fertilizers		10(0+10)
5.	GPB-421: Seed Testing and Seed Production Technology	Genetics & Plant Breeding	10(0+10)
6.	HOR-421: Commercial Horticulture	Horticulture	10(0+10)
7.	MPP-421: Mushroom Cultivation Technology	Mycology and Plant Pathology	10(0+10)
8. 9.	SSC-421: Soil, Plant, Water And Fertilizer Analysis	Soil Science & Agricultural Chemistry	10(0+10)
	SSC-422: Agriculture Waste Management		
Note: Students have to opt any two modules of Experiential learning (total 20 credits)			

I. DEPARTMENT OF AGRICULTURAL ECONOMICS

1 st Year	1 st Semester	-	NO COURSE
	2 nd Semester	Course1	<p>Course No. : AEC-121 - Fundamentals of Agricultural Economics - Credit hours: 2 (2+0)</p> <p><u>Theory</u></p> <p><i>Economics:</i> Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural Planning and development in the country.</p> <p><i>Demand:</i> 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.</p> <p><i>Laws of returns:</i> Law of variable proportions and law of returns to scale.</p> <p><i>Cost:</i> 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.</p> <p><i>National Income:</i> 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.</p> <p><i>Tax:</i> meaning, direct and indirect taxes, agricultural taxation, VAT.</p> <p><i>Economic System:</i> Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.</p>

2 nd Year	1 st Semester	Course 1 Course No.: AEC-211 - Agricultural Finance and Co-Operation – Credit hours: 3 (2+1) <u>Theory</u> <i>Agricultural Finance</i> : Meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports – Bank norms – SWOT analysis. <u>Practical</u> Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of a farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.
	2 nd Semester	Course 1 Course No.: AEC-221 - Agricultural Marketing, Trade and Prices - Credit hours 3(2+1) <u>Theory</u> Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products. Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities. Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions; Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channel: types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, Meaning definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions – CWC, SWC, FCI, CACP & DMI – their objective and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

Practical

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

**Course 2
Elective**

Course No.: AEC-222(E) – Agribusiness Management

Credit Hours: 3(2+1)

Theory

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Goods and Services Tax (GST). Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis. Strategic Management, Sales & Distribution Management. e-NAM. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

3 rd Year	1 st Semester	-	NO COURSE
	2 nd Semester	Course 1	<p>Course No.: AEC-321 - Farm Management, Production and Resource Economics - Credit hours: 2 (1+1)</p> <p><u>Theory</u> 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 exconomics and management of common property resources of land, water, pasture and forest resources etc.</p> <p><u>Practical</u> 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.</p>
4 th Year	1 st Semester	-	RAWE Component – II (10 Weeks)
	2 nd Semester	-	No Course.

II. DEPARTMENT OF AGRONOMY

1 st Year	1 st Semester	Course 1	Course No. : AGR-111 – Fundamentals of Agronomy Credit hours 3(2+1) <u>Theory</u> Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency; conservation agriculture; adaptation and distribution of crops; growth and development of crops, factors affecting growth and development; plant ideo-types; crop rotation and its principles, cropping system and pattern, multiple cropping systems, efficient cropping system and their evaluation; crop management technologies in problematic areas, harvesting and threshing of crops. <u>Practical</u> Identification of crops, seeds, fertilizers, pesticides and tillage implements, seed germination and viability test; methods of fertilizer application, numerical exercises on plant population and fertilizer requirement; Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill; Study of yield attributing characters and yield estimation.
		Course 2	Course No. : AGR-112 – Agricultural Water Management Credit hours 2(1+1) <u>Theory</u> Water management: definition, scope and objectives, water resources and irrigation development in India; soil plant water relationship; soil moisture measurement; soil moisture constants, water and irrigation requirement, irrigation scheduling, irrigation water measurement; irrigation methods: surface, subsurface, sprinkler and drip irrigation; irrigation and water use efficiency, water productivity; irrigation water quality and its management; water management of different crops (rice, wheat, maize, pulses, oilseeds, sugarcane). Drainage: definition, types and management, water logging. <u>Practical</u> Determination of bulk density, soil moisture content by gravimetric method, tensiometer, and electrical resistance block; determination of field capacity and permanent wilting point; measurement of irrigation water through flumes and weirs; problems and calculation of irrigation water requirement and water use efficiency, water productivity; determination of infiltration rate; demonstration of furrow, check basin methods of irrigation; cost estimation of drip and sprinkler irrigation system.
			Course 3

		Course 4	Course No.: AGR-114 – Agriculture Heritage (<i>Remedial Course</i>) Credit hours 1 (1+0) <u>Theory</u> Introduction of Indian agricultural heritage, status of farmers in society; advice by sages to kings on their duties towards farmers, soil management in ancient, medieval and pre-modern India and its relevance in modern day sustainable agriculture, heritage of crop and water management, plant growth and development and plant protection through <i>vrikshayurveda</i> and traditional knowledge. Heritage of medicinal plants and their relevance today, seed health in ancient and medieval history and its relevance to present day agriculture, description of Indian civilization and agriculture by travelers from China, Europe and United States, our journey in agriculture, green revolution and its impact and concerns,, vision for the future.
	2nd Semester	-	NO COURSE
2nd Year	1st Semester	Course 1	Course No. : AGR-211 : Crop Production Technology-I (Kharif Crops) Credit hours 3(2+1) <u>Theory</u> Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals – rice, maize, sorghum, pearl millet and pulses-pigeonpea, mungbean and urdbean; oilseeds – groundnut, sesame and soybean; fibre crops – cotton and jute; forage crops- sorghum, cowpea and napier grass. <u>Practical</u> Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean, maize, groundnut and cotton, 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. Morphological description of kharif season crops, visit to research centres of related crops.
	2nd Semester	Course 1	Course No.: AGR-221 – Crop Production Technology-II (Rabi Crops) Credit hours: 3 (2+1) <u>Theory</u> 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, rajmash; oilseeds-rapeed & mustard, linseed, safflower and sunflower; sugar crops sugarcane; tuber crop – potato, forage crops – berseem, Lucerne and oat. <u>Practical</u> Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield attributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Oil extraction of oilseed crops, visit to research stations of related crops.

		<p>Course 2 Course No.: AGR-222 – Introduction to weed management Credit hours: 2 (1+1)</p> <p><u>Theory</u></p> <p>Weeds – definition, impact, classification, crop weed competition, concepts of weed management – principles and methods – cultural, chemical biological, integrated weed management, and allelopathy; herbicides – classification, selectivity, mode and mechanism of action and herbicide resistance. Weed management in major field crops.</p> <p><u>Practical</u></p> <p>Identification of weeds and herbicide formulations; preparation of herbarium; herbicide label information; method of herbicide application; use of adjuvant; calibration of spray volume; identification of nozzle; numerical on herbicide rate calculation and weed indices.</p>
		<p>Course 3 Course No.: AGR-223 – Introductory Agro-meteorology and Climate Change Credit hours: 2 (1+1)</p> <p><u>Theory</u></p> <p>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. Agroclimatic and agroecological regions of India and Uttar Pradesh.</p> <p><u>Practical</u></p> <p>Visit to agro-meteorological observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck’s intensity law. Measurement of albedo and sunshine duration, computation of radiation intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of windrose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.</p>

		<p>Course 4 Course No.: AGR-224 – Farming System and Sustainable Agriculture Credit hours: 2 (2+0)</p> <p><u>Theory</u></p> <p>Farming System-scope, importance, concept and types of farming system; factors affecting types of farming; farming system components and their maintenance, 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. Integrated farming system-historical background, objectives and characteristics 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 State University / Institute and farmers field.</p>
3 rd Year	1 st Semester	<p>Course 1 Course No.: AGR-311 - Practical Crop Production – I (Kharif Crops) Credit hours: 1(0+1)</p> <p><u>Practical</u></p> <p>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.</p>
		<p>Course 2 Course No.: AGR-312 – Precision Farming Credit hours: 2 (1+1)</p> <p><u>Theory</u></p> <p>Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics – definition, concept, 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.</p> <p><u>Practical</u></p> <p>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 on 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.</p>

		<p>Course 3 Elective</p> <p>Course No.: AGR-313(E) – Weed Management Credit hours: 3 (2+1)</p> <p><u>Theory</u></p> <p>Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.</p> <p><u>Practical</u></p> <p>Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.</p>
2 nd Semester	<p>Course 1</p> <p>Course No.: AGR-321 – Rain-fed Agriculture and Watershed Management Credit hours: 2 (1+1)</p> <p><u>Theory</u></p> <p>Rainfed agriculture: introduction, types, history of rainfed agriculture & 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.</p> <p><u>Practical</u></p> <p>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 evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices 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 & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station / watershed.</p>	
	<p>Course 2</p> <p>Course No.: AGR-322 – Practical Crop Production-II (Rabi Crops) Credit hours: 1 (1+0)</p> <p><u>Practical</u></p> <p>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 procedure. The emphasis will be given to seed production, mechanization, resource conservation and</p>	

			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.
		Course 3	Course No.: AGR-323 – Organic Farming Credit hours: 1 (1+0) <u>Theory</u> Organic farming: introduction, principles, characteristics and scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; 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; ITK for nutrient management and pest control; Operational structure of NPOP; Certification process and standards of organic; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.
4th Year	1st Semester	Course 1	Course No.: RAWE -: AGR-411: Agronomical Interventions (1 week)
	2nd Semester	Course 1 E.L.	Course No.: AGR-421 – Organic Farming (<i>Experiential Learning</i>) Credit hours: 10 (0+10) Unit I- Definition, principle, objectives, components and importance of Organic farming. Unit II- Steps involved in initiating organic farming, conversion period and farm designing. Unit III- Production of inputs for organic farming and their use. Compost, vermin compost, biogas slurry, green manure and bio-fertilizers. Unit IV – Plant protection in organic farming and the use of bio-pesticides. Unit V - Organic certification and package of practices for important crops. Unit VI – Organic farming under IFS and visit of organic farm.

III. Department of Animal Husbandry and Dairying			
1st Year	1st Semester	Course 1	<p>Course No.: UGS-114, Human Values and Ethics (Non-gradual) Credit hours: 1(1+0)</p> <p>Theory</p> <p>UNIT I: Universal human aspirations: Happiness and prosperity; Human values and ethics: Concept, definition, significance and sources; Fundamental values: Right conduct, peace, truth, love and non-violence; Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged and gender.</p> <p>UNIT II : Spirituality, positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony; Modern challenges and value conflict: Sensitization against drug abuse and other social evils; developing personal code of conduct (SWOT Analysis); Management of anger and stress.</p>
	2nd Semester	Course 1	<p>Course No.: AHD-121: Introductory Animal Husbandry Credit hours: 1(1+0)</p> <p>UNIT-I: Significance of livestock in relation to agriculture and National Economy. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.</p> <p>UNIT-II: External anatomy of cattle, buffalo, goat, sheep and poultry. Methods of handling & restraint for different kinds of farm animals.</p> <p>UNIT-III: Breeding principles & selection of animals. Reproduction in farm animals and poultry. Physiology of lactation and milk synthesis.</p> <p>UNIT-IV: Dairying under specialized and mixed farming system. Project formulation.</p>
2nd Year	1st Semester	-	No Course
	2nd Semester	Course 1	<p>Course No.: AHD-221: Livestock Production and Management Credit hours: 2(1+1)</p> <p>Theory</p> <p>UNIT-I : The livestock Industry, its scope and potential. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine and poultry. Incubation, hatching and brooding. Management of growers and layers.</p> <p>UNIT-II : Digestion in livestock and poultry- Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients and ration formulation for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.</p> <p>UNIT-III : Introduction of livestock and poultry diseases. Prevention, including vaccination schedule and their control.</p> <p>Practical</p> <p>External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Visit to IDF and IPF to study breeds of livestock and poultry. Daily routine farm operations and farm records. judging of cattle, buffalo and poultry. Identification methods of farm animals and poultry. Planning and layout of housing for different types of livestock. Culling of livestock and Poultry. Computation of rations for livestock-formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting, and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.</p>

3 rd Year	1 st Semester	Course 1	<p>Course No.: AHD-311: Introductory Dairy Science Credit hours: 2(1+1)</p> <p>UNIT-I : Definition and general composition of milk from different species. Chemistry of milk constituents- lactose, lipids, protein, enzymes, vitamins and nutritive value. Physico-chemical properties of milk. Correlation among compositional parameters, legal standards</p> <p>UNIT-II : Classification of milk products. Elementary knowledge about Indigenous and modern dairy products, composition and methods of manufacture of one product from each class. Adulteration in milk and their detection.</p> <p>UNIT-III : Cleaning and sanitization of dairy processing plant and equipments.</p> <p><u>Practical</u></p> <ol style="list-style-type: none"> 1. Sampling of milk. 2. Measurement of physico-chemical properties of milk- Analysis of milk for, specific gravity, Fat (by Gerber's and Babcock methods), pH, Acidity, Total Solids, Solids-Not-Fat, Total Ash, Calcium and Phosphorus. 3. Detection of various adulterants in milk. 4. Products manufacture and their economics.
	2 nd Semester	-	No Course
4 th Year	1 st Semester	Course 1	Course No.: RAWE - AHD-411: Animal Production Interventions (1 Week)
	2 nd Semester	-	<p>Course No.: AHD-421 : Milk Processing and Milk Products Manufacture Credit 10 (0+10)</p> <p><u>Unit 1</u></p> <p>Introduction Dairy Industry in Indian and Global Scenario. Definition, Indian Standards, Composition of Milk, Food and Nutritive Value of Milk, Collection and Transportation of Milk, Preservation and Refrigeration. Definition & general composition of milk from different species., Colostrums and its properties and difference from normal milk, Correlations amongst Compositional parameters, Legal standards of milk, Chemical test, Adulteration in milk and their detection, Coagulation and heat stabilizing milk, Elementary knowledge about indigenous and modern dairy products.</p> <p>Unit 2 Reception & Treatment of Milk at the Dairy Plant: Reception, Chilling, Clarification and Storage</p> <p>Unit 3 Homogenization – Definition, Effect of Homogenization on Physical properties of Milk.</p> <p>Unit 4 Thermal Processing of Milk ; Definition & Description of Processes – Pasteurization, Thermization, Sterilization and UHT Processing</p> <p>Unit 5 Classification, manufacturing, adulteration in milk & their detection, Defects in Market Milk, Standardized Milk, Manufacturing of Special Milk – Toned, Doubled Toned, Reconstituted, Recombined, Flavored Milk.</p>

IV. Department of Entomology & Agricultural Zoology			
1 st Year	1 st Semester	-	No Course
	2 nd Semester	Course 1	<p>Course No.: ENT-121 – Fundamentals of Entomology Credit hours: 4 (3+1)</p> <p><u>Theory</u></p> <p>Part – 1 : History of Entomology in India. Major points related to dominance of Insecta in Animal Kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapauses in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.</p> <p>Part – II : Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effects of biotic factors – food competition, natural and environmental resistance.</p> <p>Part – III : Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control-importance, hazards and limitations. Insecticides Act 1968 – Important provisions.</p> <p>Part – IV : Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.</p> <p><u>Practical</u></p> <p>Methods of collection and preservation of insects including immature stages; External features of Grasshopper / Blister beetle / cockroach; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper / cockroach); Dissection of male and female reproductive systems in insects (Grasshopper / cockroach); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations.</p>
2 nd Year	1 st Semester	-	No Course

	2 nd Semester	–	No Course
3 rd Year	1 st Semester	Course 1	<p>Course No.: ENT-311 – Pests of Crops and Stored Grains and their Management Credit hours: 3 (2+1)</p> <p><u>Theory</u> 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 insect and non-insect pests (mites, nematodes and mollusks) of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pest, 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.</p> <p><u>Practical</u> Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking field and horticultural crops. Identification of insect and mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations of the doses of insecticides. Fumigation of grain store / go-down. Identification of rodents and rodent control operations in go-downs. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to different storage institutes / warehouses.</p>
		Course 2	<p>Course No.: ENT-312 – Principles of Integrated Pest and Disease Management * Credit hours: 3 (2+1)</p> <p><u>Theory</u> Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and diseases). Political, social and legal implication of IPM. Case histories of important IPM programmes.</p> <p><u>Practical</u> Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of <i>Trichoderma</i>, <i>Pseudomonas</i>, <i>Trichogramma</i>, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (Agro-ecosystem) dynamics of a selected insect pest and diseases. Awareness campaign at farmers fields.</p> <p>* Cross listed with Department of Mycology and Plant Pathology</p>

I. Department of Extension Education			
1st Year	1st Semester	Course 1	<p>Course No.: EXT-111 – Rural Sociology & Educational Psychology Credit hours: 2 (2+0)</p> <p><u>Theory</u> Sociology and Rural Sociology: Definition and scope, its significance in agriculture extension, Rural Society, Social Groups, Social Stratification, Culture Concept, Social Institution, Social Change & Development. Educational Psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning Motivation, Theories of Motivation, Intelligence.</p>
	2nd Semester	Course 1	<p>Course No.: EXT-121 – Fundamentals of Agricultural Extension Education Credit hours: 3 (2+1)</p> <p><u>Theory</u> Education: Meaning, definition & types; Extension Education – meaning, definition, scope and process; objectives and principles of Extension Education: Extension Programme planning – Meaning, Process, Principles and steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.); various extension / agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.) New trends in agriculture extension: private extension, cyber extension / e-extension. Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Development: meaning, definition, concept, principles, and Philosophy. Rural Leadership: concept and definition, types of leaders. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition. Diffusion and adoption of innovations: concept and meaning, process and stages of adoption, adopter categories.</p> <p><u>Practical</u> To get acquainted with university extension system. Group discussion – exercise; preparation of extension literature – leaflet, booklet, folder, pamphlet, news stories and success stories. Visit to villages for assessing problems / needs of villagers; to study organization and functioning of DRDA and other development departments at district level; visit to NGOs and learning from their experiences in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media developing script for radio and television.</p>
2nd Year	1st Semester	Course 1	<p>Course No.: EXT-211 – Communication Skills and Personality Development Credit hours: 2 (1+1)</p> <p><u>Theory</u> Communication: meaning and definition; models and barriers to communication. Communication Skills: meaning and process of communication, verbal and non-verbal communication; impression management, listening and note taking, writing skills, oral presentation skills; field diary and lab record; individual and group presentations, impromptu presentation, public speaking; Group discussion. Personality development – concept and traits.</p> <p><u>Practical</u> Listening and note taking, writing skills, oral presentation skills; field diary and lab record; individual and group presentations. Handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids.</p>
	2nd Semester	–	No Course

3 rd Year	1 st Semester	Course 1	<p>Course No.: EXT-311: Entrepreneurship Development and Business Communication Credit hours: 2(1+1)</p> <p>Theory</p> <p>Concept of Entrepreneur, Entrepreneurship, Entrepreneurial behavior and social entrepreneur. Differences between businessman, entrepreneur, leader, manager and social entrepreneur. Characteristics of entrepreneurs; types of entrepreneurs, Entrepreneurship Development, Opportunities for entrepreneurship and rural entrepreneurship. Government policies and programs and institutions for entrepreneurship development; SWOT Analysis & achievement motivation. Business Leadership Skills; Developing organizational skill , Developing Managerial skills, Problem solving skill, time management; Supply chain management and Total quality management, Project Planning Formulation and report preparation;</p> <p>Practical</p> <p>Communication skills for entrepreneurship development, Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercises in creativity, time audit, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.</p>
	2 nd Semester	Course 1 Elective	<p>Course No. : EXT-321(E): Agricultural Journalism Credit hours: 3(2+1) Elective</p> <p>Theory</p> <p>Agricultural Journalism: nature and scope. Concept of news, elements of news. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, other agricultural news sources, electronic news gathering and transmission. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.</p> <p>Practical</p> <p>Practice of interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from electronic sources. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proof reading, layout. Testing copy with a readability formula. Visit to a publishing office.</p>
4 th Year	1 st Semester	Course 1	<p>Course No.: RAWE - EXT-411: Extension and transfer of technology activities (01 Week)</p>
	2 nd Semester	-	<p>No Course</p>

V. Department of Farm Engineering

1 st Year	1 st Semester	Course 1	<p>Course No.: UGS-112 – Elementary Mathematics (<i>Remedial Course</i>) Credit hours: 2 (2+0)</p> <p><u>Theory</u></p> <p>Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of Circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx+c$ to the given circle $x^2 + y^2 = a^2$. Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n, e^x, $\sin x$ & $\cos x$ from the first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of function (Simple problem based on it), Logarithmic differentiation (simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the Functions of the form $y=f(x)$ (Simple problems based on it).</p> <p>Integral Calculus: Integration of simple functions, integration of product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).</p> <p>Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd Order, Properties of determinants up to 3rd order and their evaluation.</p>
	2 nd Semester	Course 1	<p>Course No.: STAT-121 – Statistical Methods Credit hours: 3 (2+1)</p> <p><u>Theory</u></p> <p>Introduction to Statistics and its Applications in Agriculture, Graphical Representation of data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple problems based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample 't' test for Means, Chi-square Test of Independence of Attributes in 2x2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling Versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for Selection of Simple Random Sample.</p> <p><u>Practical</u></p> <p>Graphical Representation of Data. Measures of Central Tendency (Ungrouped Data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped Data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness and Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of one sample 't' test. Application of Two Sample Fisher's t-test. Chi-square test of Goodness of Fit. Chi-square test of Independence of Attributes for 2 x 2 Contingency</p>

			Table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of Random Sample Using Simple Random Sampling.
2 nd Year	1 st Semester	Course 1	<p>Course No.: ENG-211 – Introductory Soil and Water Conservation Engineering Credit hours: 2 (1+1)</p> <p><u>Theory</u> Introduction to Surveying and leveling – Length and Area Measurement : simple, differential and profile leveling. Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Soil Loss Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund, Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.</p> <p><u>Practical</u> Use of different type of chains and surveying equipments: Use of dumpy level for conducting leveling. General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.</p>
		Course 2	<p>Course No.: ENG-212 : Farm Machinery and Power Credit hours: 2(1+1)</p> <p><u>Theory</u> Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I.C. engines, comparison to two stroke and four stroke cycle engines. Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply, Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.</p> <p><u>Practical</u> Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, learning of tractor driving, Familiarization with operation of power tiller, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow. Familiarization with seed cum fertilizer drills, their seed metering mechanism and calibration, planters and transplanters. Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.</p>
	2 nd Semester	-	No Course

3 rd Year	1 st Semester	<p>Course 1 Course No.: ENG-311 : Protected Cultivation and Secondary Agriculture Credit hours: 2(1+1)</p> <p><u>Theory</u> Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house, heating systems, green house drying. 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, re-circulatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.</p> <p><u>Practical</u> Study of different type of green houses 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 green house 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.</p>
	2 nd Semester	<p>Course 1 Course No.: ENG-312: System Simulation and Agro-advisory Credit hours: 3(2+1)</p> <p><u>Theory</u> System Approach for representing soil-plant-atmospheric continuum, System boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.</p> <p><u>Practical</u> Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, Past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro-advisory.</p>
	2 nd Semester	<p>Course 1 Course No.: ENG-321 : Renewable Energy and Green Technology Credit hours: 2(1+1)</p> <p><u>Theory</u> Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.</p> <p><u>Practical</u></p>

			<p>Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.</p>
		Course 2	<p>Course No.: ENG-322 : Agricultural Informatics Credit hours: 2(1+1)</p> <p><u>Theory</u> 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.</p> <p>Computer Programming; General concepts, Introduction to Visual Basic, Java, Fortran, C/C++, etc., concepts and standard input/ output operations.</p> <p>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. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advises, market price, postharvest management etc.; Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.</p> <p><u>Practical</u> 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++. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/CropSyst/ Wofost. Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools. 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.</p>
4th Year	1st Semester	-	No Course
	2nd Semester	-	No Course

I. Department of Genetics and Plant Breeding

1st Year	1st Semester	Course 1	Course No.: UGS-111 –Introductory Biology * (Remedial Course) Credit hours: 2 (1+1) <u>Theory</u> Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and Cell division. Morphology of flowering plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture. <u>Practical</u> Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues & cell division, Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants – Brassicaceae, Fabaceae and Poaceae. <i>* Cross listed with EAZ</i>
	2nd Semester	Course 1	Course No.: GPB-121: Fundamentals of Genetics Credit hours: 3 (2+1) <u>Theory</u> Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance – cell cycle and cell division – mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept : Gene structure, function and regulation, Lac and Trp operons. <u>Practical</u> Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Numericals on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Numericals on probability and Chi-square test. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structures.
2nd Year	1st Semester	Course 1	Course No.: GPB-211: Fundamentals of Plant Breeding Credit hours: 4 (3+1) <u>Theory</u> Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility – genetics consequences, cultivar options. Domestication, Acclimatization and Introduction; Centers of origin / diversity, components of Genetic variation;

		<p>Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops – mass and pure line selection, hybridization techniques and handling of segregating population; multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; population improvement schemes – Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; 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.</p> <p><u>Practical</u></p> <p>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 experiments, analysis of Randaomized 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.</p>
2 nd Semester	Course 1	<p>Course No: GPB-221 : Principles of Seed Technology Credit hours: 3 (1+2)</p> <p><u>Theory</u></p> <p>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.</p> <p>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. Private and public sectors and their production and marketing strategies.</p> <p><u>Practical</u></p> <p>Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important 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</p>

			inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.
		Course 2 Elective	<p>Course No.: GPB-222(E) – Commercial Plant Breeding Credit hours: 3(1+2)</p> <p>Theory Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality of seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.</p> <p>Practical Floral biology in self and cross pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. Learning techniques in hybrid seed production using male-sterility</p>
3rd Year	1st Semester	Course 1	<p>Course No.: GPB-311 : Crop Improvement – I (<i>Kharif</i>) Credit hours: 2 (1+1)</p> <p>Theory Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; 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) with examples; Hybrid seed production technology in Maze, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future. Concepts of GM Crops.</p> <p>Practical Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, Tobacco crops. Maintenance breeding of different <i>kharif</i> 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 <i>Kharif</i> 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, National and International Organizations of crop Breeding.</p>
	2nd Semester	Course 1	<p>Course No.: GPB-321 : Crop Improvement – II (<i>Rabi</i>) Credit hours: 2 (1+1)</p> <p>Theory Centre of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for</p>

			<p>yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crops varieties for future.</p> <p>Practical Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane; 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 <i>Rabi</i> crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; study of quality characters, study of donor parents for different characters; Visit ot seed production plots; Visit to AICRP plots of different field crops. National and International Organizations of Crop Breeding.</p>
4 th Year	1 st Semester	Course 1	<p>RAWE Component – II (10 weeks)</p>
	2 nd Semester	Course 1	<p>Course No.: GPB-421 : Seed Testing and Seed Production Technology (<i>Experiential Learning</i>) Credit Hours 10 (0+10)</p> <p>Unit-I: Introductory Role of seed technology in modern agriculture, Relation of seed technology with other disciplines, History of seed technology in India, Development of seed programmes, Problems of seed industry, Role of various agencies in development of Indian seed industry, Characterization of hybrids, varieties and parental lines.</p> <p>Unit-II: Seed production & processing General principles and methods of seed production, maintenance of nucleus and breeder’s seed, hybrid seed production techniques. Seed production techniques of major field crops and vegetables. Layout of seed processing plant, seed blending, conditioning, seed drying, seed cleaning, grading. Seed treatment, bagging and storage.</p> <p>Unit-III: Grow out test (GOT) Seed Testing Seed sampling, seed heterogeneity, moisture test, physical purity analysis, determination of other species, genetic purity test, germination test, viability test, seed vigour test, seed health test, coated test, tolerance value, real value of seed, calculation of seed requirements of various crops based on test values.</p> <p>Unit-IV: Seed viability germination tests Seed priming, treatment for breaking dormancy, Bacterial culture treatments, chilling treatment for vernilization effect, seed treatment for control of insect pest and disease. Calculation of seed requirement of various crops based on test values.</p> <p>Unit-V: Seed certification, marketing and legislation Method of seed certification, field inspection minimum certification standards, seed law enforcement, the protection of plant varieties and farmer’s right. Visit to Seed Processing Units, Major components of seed marketing: forecasting of seed demand, Supply of seed, Seed marketing structure, Seed sales promotion, Determination of cost of seed production and seed pricing, Role of different seed, Organizations in seed marketing, DUS testing and molecular markers tests for varietal identification and certification.</p>

II. Department of Horticulture			
1st Year	1st Semester	Course 1	<p>Course No.: HOR-111 : Fundamentals of Horticulture Credit Hours 2(1+1)</p> <p><u>Theory</u> Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Dormancy and rest period, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance and use of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.</p> <p><u>Practical</u> Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.</p>
	2nd Semester	-	No Course
2nd Year	1st Semester	Course 1	<p>Course No.: HOR-211 : Production Technology for Vegetable and Spices Credit hours 2 (1+1)</p> <p><u>Theory</u> Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak). Spice crops- Coriander, cardamom, black pepper, cumin and fenugreek.</p> <p><u>Practical</u> Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation.</p>
	2nd Semester	Course 1	<p>Course No.: HOR-221: Production Technology for Ornamental Crops, MAPs and Landscaping Credit hours 2(1+1)</p> <p><u>Theory</u> Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs, climbers and annuals. Production technology of important cut flowers like rose, gerbera, carnation, liliun under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, sarpgandha, vetiver. Processing and value addition in ornamental crops and MAPs produce.</p> <p><u>Practical</u> Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected</p>

			structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.
		Course 2	<p>Course No. : HOR-222 : Production Technology for Fruit and Plantation Crops 2(1+1)</p> <p><u>Theory</u> Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, apple, pear, peach, and; minor fruits- walnut, almond, date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, cashew, tea, coffee & rubber.</p> <p><u>Practical</u> Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.</p>
3rd Year	1st Semester	Course 1 Elective	<p>Course No.: HOR(E)-311 : Landscaping 3(2+1)</p> <p><u>Theory</u> Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. Trees: selection, propagation, planting schemes, canopy management. Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation and planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses, cacti and succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning. Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, theme park and amusement park. Bonsai: principles and management. CAD application.</p> <p><u>Practical</u> Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/ parks/ institutes.</p>
	2nd Semester	Course 1	<p>Course No.: HOR-321 : Post-harvest Management and Value Addition of Fruits, Vegetables and Ornamentals 2(1+1)</p> <p><u>Theory</u> Importance of post-harvest technology of fruit, vegetable and ornamental crops. Extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity and shelf life of fruit, vegetable and ornamental crops. Ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy and gulkand. Concepts and Standards- Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Pickles- Concepts and Standards; Drying/ Dehydration of fruit, vegetable and ornamental crops – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products.</p>

			<p><u>Practical</u> Applications of different types of packaging. Judging maturity of fruits, vegetables and ornamentals for extension of postharvest life. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables, fruits and ornamentals. Extraction and preservation of pulps and juices. Preparation of jam, jelly, gulkand, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.</p>
		Course 2 Elective	<p>Course No.: HOR(E)-322 Hi-tech. Horticulture 3(2+1)</p> <p><u>Theory</u> Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), Precision farming: components and its application in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.</p> <p><u>Practical</u> Types of poly-houses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.</p>
4th Year	1st Semester	Course 1	Course No.: RAWE - HOR-421 : Fruit and Vegetable production interventions (1 Week)
		-	RAWE Component – II (10 weeks)
	2nd Semester	Course 1	Course No. : HOR-421 : Commercial Horticulture (<i>Experiential Learning</i>) Credit hours: 10(0+10)
			<p>Nursery production of fruit crops: Seed propagation through cutting and layering, raising of rootstocks, grafting and budding, management of nursery plants, packaging, marketing, quality control, plant certification.</p> <p>Nursery production of ornamental plants: Production of ornamentals in nursery through sexual and asexual methods, production potted plants, management, maintenance and multiplication of potted plants, packaging, marketing.</p> <p>Cultivation of high valued vegetables and flowers : Production of vegetables in open and protected conditions, Production of flowers in open and protected conditions, designs and types of protected structures, low cost protected structures, nursery raising in protected structures like poly-tunnels, transplanting, management and maintenance of crop in protected structures, postharvest handling, packaging, marketing.</p>

III. Department of Mycology and Plant Pathology			
1st Year	1st Semester	-	No Course
	2nd Semester	Course 1	<p>Course No.: MPP-121: Fundamentals of Plant Pathology Credit hours 4(3+1)</p> <p><u>Theory</u></p> <p>Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology, Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.</p> <p>Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.</p> <p>Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.</p> <p>Viruses: nature, general morphological characters, replication and transmission. Study of phanerogamic plant parasites.</p> <p>Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (<i>Heterodera, Meloidagyne, Anguina, Radopholus etc.</i>)</p> <p>Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.</p> <p><u>Practical</u></p> <p>Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites.</p> <p>Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.</p> <p>Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.</p>
2nd Year	1st Semester	-	No course.
	2nd Semester	-	No Course
3rd Year	1st Semester	Course 1	<p>Course No.: MPP-311: Diseases of Field & Horticultural Crops & their Management – I Credit hours 3(2+1)</p>

		<p><u>Theory</u></p> <p>Symptoms, etiology, disease cycle and management of major diseases of following crops:</p> <p>Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt</p> <p>Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust</p> <p><u>Practical</u></p> <p>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.</p>
2 nd Semester	Course 1	<p>Course No.: MPP-321 : Diseases of Field & Horticultural Crops & their Management-II 3(2+1)</p> <p><u>Theory</u></p> <p>Symptoms, etiology, disease cycle and management of following diseases:</p> <p><i>Field Crops:</i></p> <p>Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.</p> <p><i>Horticultural Crops:</i></p> <p>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; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.</p> <p><u>Practical</u></p> <p>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.</p> <p><i>Note: Students should submit 50 pressed and well-mounted specimens.</i></p>

4 th Year	1 st Semester	Course 1	Course No.: RAWE – MPP-411 : Plant Protection Interventions	(1 Week)
		-	RAWE Component – II	(10 weeks)
	2 nd Semester	Course 1	Course No.: MPP-421 : Mushroom Cultivation Technology (<i>Experiential Learning</i>)	Credit Hours 10(0+10)
			Importance and characteristics of mushrooms, culture media preparation, mushroom culture technology, spawn production technology, microbial contamination and its avoidance, preservation and maintenance of mushroom cultures, lay out of spawn laboratory and mushroom farm, production technology of mushrooms (white button, oyster and milky) preservation and processing of mushrooms, identification and management of mushroom diseases, insects pest and mites of mushroom and their control, economics of mushroom cultivation.	

IV. Department of Plant Physiology				
1st Year	1st Semester	Course 1	Course No.: PPH-111: Fundamentals of Plant Biochemistry and Biotechnology	Credit hours 3(2+1)
			<p><u>Theory</u></p> <p>Importance of Biochemistry: Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Structures of Disaccharides and Polysaccharides. Lipid: Importance and classification; structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification ; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.</p> <p>Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.</p> <p>Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Fundamentals of recombinant DNA technology, Molecular markers and their applications in agriculture.</p> <p><u>Practical</u></p> <p>Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization.</p>	
	2nd Semester	Course 1	Course No.: PPH-121 Fundamentals of Crop Physiology	Credit hours 3(2+1)
			<p><u>Theory</u></p> <p>Introduction to crop physiology and its importance in Agriculture; Introduction to Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C₃, C₄ and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity. Introduction to seed physiology and its importance in agriculture</p> <p><u>Practical</u></p> <p>Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Experiments related to seed viability and germination, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).</p>	

2 nd Year	1 st Semester	Course 1	<p>Course No.: PPH-211 Environmental Studies and Disaster Management Credit hours 3(2+1)</p> <p><u>Theory</u> Multidisciplinary nature of environmental studies Definition, scope and importance.</p> <p>Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.</p> <p>Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</p> <p>Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p> <p>Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.</p> <p>Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.</p> <p>Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.</p> <p><i>Disaster Management</i> Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.</p>
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	2nd Semester	Course 1 Elective	<p>Course No.: PPH-221(E): Micro Propagation Technology Credit Hours 3(1+2)</p> <p>Theory Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (Callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation.</p> <p>Practical Identification and use of equipments in tissue culture laboratory, Nutrition media compositions, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants : Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.</p>
3rd Year	1st Semester	-	No Course.
	2nd Semester	-	No Course.
4th Year	1st Semester	-	No Course.
	2nd Semester	-	No Course.

V. Department of Soil Science and Agricultural Chemistry			
1st Year	1st Semester	Course 1	Course No.: SSC-111: Fundamentals of Soil Science Credit hours 3 (2+1) <u>Theory</u> Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange and effect on plant growth, Soil temperature; source, amount and flow of heat in soil and effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering capacity, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: soil flora and fauna, their beneficial and harmful effects. <u>Practical</u> Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Determination of soil pH and electrical conductivity. Study of soil map. Determination of soil colour, soil temperature and water holding capacity. Estimation of organic matter content of soil. Estimation of chloride, carbonate and biocarbonate content in irrigation water.
	2nd Semester	-	No course.
2nd Year	1st Semester	-	No Course
	2nd Semester	Course 1	Course No.: SSC-221: Problematic Soils and their Management Credit hours 2 (2+0) <u>Theory</u> Soil quality and health, Distribution of waste land and problem soils in India. Their categorization based on properties. Reclamation and management of saline and sodic soils, calcareous soils, acid soils, acid sulphate soils, eroded and compacted soils, water logged soils, Polluted 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, bio remediation through MPTs of soils, land capability classification, land suitability classification. Problematic soils under different Agro-ecosystems.

3 rd Year	1 st Semester	Course 1	<p>Course No: SSC-311: Manures, Fertilizers and Soil Fertility Management Credit hours 3 (2+1)</p> <p><u>Theory</u> Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Biofertilizers – their preparation and methods of application. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, complex fertilizers, nano fertilizers, soil amendments, fertilizer storage, Fertilizer Control Order. History of soil fertility and plant nutrition. Criteria of essentiality; role, deficiency and toxicity symptoms of essential plant nutrients. Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluations- soil testing. Factors affecting soil fertility. Critical levels of different nutrients in soil. Forms of nutrients in soil. Plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE), methods of fertilizer application under rainfed and irrigated conditions.</p> <p><u>Practical</u> Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils.. Estimation of P, K and S in plants. Estimation of lime requirement and gypsum requirement.</p>
	2 nd Semester	Course 1 Elective	<p>Course No.: SSC-321 (E): Agrochemicals Credit hours 03 (2+1)</p> <p><u>Theory</u> An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides – Classification – Inorganic fungicides – characteristics, preparation and use of sulfur and copper, Mode of action – Bordeaux mixture and copper oxychloride. Organic fungicides – Mode of action – Dithiocarbamates – characteristics, preparation and use of Zineb and maneb. Systemic fungicides – Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use . Introduction and classification of insecticides: inorganic and organic insecticides, Organochlorine, Organophosphates, Carbamates, Synthetic Pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil and plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate.</p> <p>Mixed and complex fertilizers : Sources and compatibility – preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.</p> <p><u>Practical</u></p>

			Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick test for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and indentify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P ₂ O ₅ and citrate soluble P ₂ O ₅ in single super phosphate. Estimation of potassium in Muraite of Potash / Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.
4 th Year	1 st Semester	Course 1	Course No.: RAWE - SSC-411: Soil Improvement Interventions (soil sampling & testing) 1 week GPS based soil sampling & processing in farmers' field. Rapid soil testing for NPK, fertilizer recommendation.
	2 nd Semester	Course 1	Course No.: SSC-421: Soil, Plant, Water and Fertilizer Analysis Credit hours 10 (0+10) SSC Part: Physical properties of soils – bulk and particle density, soil texture, soil colour, water holding capacity. Chemical characteristics – pH, EC, cation exchange capacity, organic matter, plant available N, P, K, S, Ca, Mg and Fe in soils. Nutrient contents in plants– N, P, K & S. Chemical parameters of irrigation water – pH, EC, chloride, sulphate, carbonate & bicarbonate, calcium, magnesium, sodium and potassium – SAR and residual carbonate. Nutrient content in fertilizers; moisture content and particle size analysis of fertilizers.
		Course 2	Course No.: SSC-422: Agriculture Waste management * Credit hours 10 (0+10) Type of waste, sources, quantity generated, process of waste collection, transport systems in waste management, techniques and technologies of waste sorting. Management of wastes for environmental protection and principles like RRR. Waste treatment and recycling. Identification of Agriculture wastes (plant and animal origin) - Pressmud, vegetable and fruit wastes, straw of cereals, oil cakes, livestock wastes:-blood meal, horn meal, poultry liter etc. Preparation of compost:- Indore method, Bangalore method, NADEP and vermin-composting. Processing and preparation of livestock waste manures. Analysis of nutrient contents and heavy metals in plant and animal waste. Prevention of waste origin through cleaner production, ecologically friendly products. Waste Act, implementing regulations. * Cross listed with MPP