M.Sc. Agronomy

Programme Code: 352
Programme Summary
Duration: 2 years
Eligibility
B.Sc. in Agri/Horti/Forestry with minimum 45% marks in aggregate.

Programme Outcome:

- To get acquaintance with statistical methods like processing of data, measure of location and dispersion like mean median partition values deviation, kurtosis, coefficient of variation, probability calculation of different types of distribution and test for their goodness of fit, correlation and regression, estimation including concept of population, confidence interval, hypothesis testing, various test of significance, Analysis of variance and covariance. It provides in depth information on different design of experiment like CRD, RBD, LSD and Their analysis with missing plot technique in RBD.
- To learn the principles and practices of Organic Farming for water use efficiency, soil fertility, biofertilizers, crop rotations, control of weeds, disease and insect pest management, inspection, certification, labelling and accreditation procedures for organic farming and their contribution in national economy.
- To learn aerobic and anaerobic methods of composting, vermicompost preparation.
- To develop the skills to treat legume seeds with rhizobium culture, use of azotobacter, azospirrilum and PSB cultures.
- To learn the Weed control by different methods in field crops, herbicide structure factors affecting herbicide selectivity in different situations, calculation of cost benefit ratio, weed control efficiency.
- It provides concepts of soil fertility and productivity, essential plant nutrients & their importance, transformation, it also imparts preparation and use of Farm Yard Manures, commercial manure and fertilizers, fertilizer mixtures, ways to increase fertilizer use efficiency.
- To gain the knowledge for determination for organic carbon, pH, EC in soil and macro and micro nutrients in soils and plants.
- To learn the different methods of irrigating different field crops and managing water as precious element of crop production and increasing water use efficiency. To develop the skill for measurement of soil moisture by different direct and indirect methods.
- To understand the effect of meteorology on crops production and weather forecasting models which are helpful for prediction of Indian weather conditions. To gain the in-depth knowledge and their measurement for solar radiation, energy balance, environmental temperature, temperature profile in air, soil and crop canopy.
- To learn principles and techniques for agronomy of rabi oil seed, kharif oil seed, fibre crops, sugar crops, forage crops, medicinal and aromatic crops along with their estimation for quantitative and qualitative parameters for growth, yield and quality.
- To gain the knowledge and concepts of crop ecology, agriculture systems, ecosystem characteristics, exploitation of solar energy in crops, distribution of temperature improvement of unproductive land through crop selection and management.
- The skills of cropping systems under different land use pattern, farming systems, allelopathic effects, selection of plants for dry land, forage crop production, different indices like LER, CEY etc.
- It gives basic understanding for soil survey, soil taxonomy and use of remote sensing as its application in agriculture and soil classification.

- To become familiarise with storage insect pest, post harvest losses traditional storage structures types of losses in stored grains their effect on quality biochemical changes impotent rodent pest, preventive and curative measures.
- To learn the basic concepts of seed production technology for different self-pollinated and cross-pollinated crops, its importance, seed quality, seed storage, seed testing for purity, viability, moisture and germination, seed certification, processing, distribution & marketing of seeds.
- To gain the practical and theoretical concepts of soil erosion and various soil conservation techniques, watershed management, land use capability classification, alternate land use systems for agroforestry, ley farming and drainage methods.
- To learn the research methodology and techniques for field crops using principles of agronomy.
- To learn in-depth knowledge for analysis of soil and plant samples for micro and macro nutrients. Determination of lime and gypsum requirements, analysis of soil extract and irrigation water.
- To gain the knowledge of grassland ecology, problems and management of grassland, establishment and management of pasture, agroforestry systems, techniques for crop production in agroforestry.
- To explore about response of plant to different stress like drought stress, temperature stress, salinity stress. Problems related to soil, water and air associated with agriculture. To understand the effect of sewage and industrial effluents, pesticides, toxic elements and their remediation / amelioration.

Course outcome:

Sr.No.	Course Code	Course name	Credits (Theory+Lab.)	Course outcome
				1st Semester
1.	SOA/AGRON/C-501	Statistical Methods and Experimental Designs	3 + 1	Students will be able understand Processing of data: Classification and tabulation of statistical data by categories and measurements, graphical and diagrammatic representation-histogram. Frequency polygon, frequency curve and cumulative frequency curves. Students will be able to explain measure of location and dispersion: Mean, median, mode, partition values (quartiles, deciles and percentiles). Range, quartile deviation, mean deviation about mean and median, standard deviation coefficient of variation, moment kurtosis. Students will be able to calculate Probability & distribution: Random experiment, sample space (discrete case only), events mathematical and statistical definition of probability, random variable (discrete and continuous), bermoulli trials, and binomial distn. poision distn. Poision distn as a limiting case of the bionominal distn, normal sistn, properties of the above distributions and fitting with available date, Test for their goodness offit. Students will be able to calculate and describe Correlation and regression : Bivariate data, bivariate frequency distn, correlation coefficient, rank correlation, Regression lines, regression coefficients and their relation with correlation coefficient, Multiple regression, multiple and partial correlation coefficients. Students will be able to explain Estimation: Concept of population and sample; parameters and statistics: criteria for Good estimator unbiasedness, consistency of population mean and its confidence internal in the normal case. Students will be able to understand testing of hypothesis : Null and alternative hypotheses, two type of errors, level of significance, power of the test, one tailed and two tailed tests.

| | | | | Students will be able to describe tests of significance: (a) large sample tests for mean & equality of means of two populations (2-tests).

Students statistic and its use of testing the mean equality of means of two populations (with independent and paired observations) correlation coefficient and regression coefficients. (b) Chi-Square statistics and its use as a test of goodness of fit, independence of attributes (contingency table) with Yates correction, and testing for the variance of a population. (c) Fishers statistic and its use in testing the equality of two variances and homogeneity of means (analysis of variance).

Students will be able to explain analysis of variance and covariance (ANOVA and ANCOVA) .Analysis of variance and covariance with one way and two-way classifications (one observation per cell). Bartlettin test for testing the homogeneity of variances.

Students will be able to use different design of experiments : Need : uniformity trials, Principles of experimental design-replication, randomization and local control,
(a) Completely randomized, randomized block and Latin square designs and their analysis, missing plot technique in RBD.
(b) Simple factorial experiments of the type 22, 33, 24, 32, confounding in factorial experiments.
(c) Split-plot experiments. |
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| 2 | SOA/AGRON/C-502 | Advances in Soil fertility and Nutrient Management | 2 + 1 | Students will be able to understand concepts of Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions.

Students will be able to describe the Criteria of essentiality of nutrients; Essential plant nutrients - their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

Students will be able to understand preparation and use of farmyard manure, compost, green manures, vermicompost, bio-fertilizers and other organic |

				concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Students will be able to know about Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions. Students will be able to understand time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermi-compost and residue wastes in crops.
3	SOA/AGRON/C-503	Advances in Weed Management	2 + 1	Students will be able to explain weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices. Students will be able to understand Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides. Students will be able to describe herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allele chemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation. Students will be able to explain weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control. Integrated weed management; cost; benefit analysis of weed management.
4	SOA/AGRON/C-504	Principles and Practices of Water Management	3 + 1	Students will be able to describe water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states.

				Students will be able to understand soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition.
				Students will be able to explain soil, plant and meteorological factors determining water needs of crops; scheduling, depth and Methods of irrigation; micro irrigation system; fertigation; management of water in controlled environments and poly houses.
				Students will be able to describe water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency.
				Students will be able to know about excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.
5	SOA/AGRON/C-505	Agronomy of Major Cereals and Pulses	3 + 1	Students will be able to get exposure for Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of *Rabi* cereals: Wheat and Barley. *Kharif* cereals. : Paddy, Maize, Sorghum, Bajra & Smaller Millets *Rabi* pulses: Gram, Lentil and Pea. *Kharif pulses*: Arhar, Mung and Urd.
2nd Semester				
6	SOA/AGRON/C-506	Agro meteorology and crop Weather Forecast	2 + 1	Students will be able to get exposure of Agro meteorology - aim, scope and development in relation to crop environment; composition of atmosphere, distribution of atmospheric pressure and wind.
				Students will be able to explain characteristics of solar radiation; energy balance of atmosphere system; radiation distribution in plant canopies, radiation utilization by field crops; photosynthesis and efficiency of radiation utilization by field crops; energy budget of plant canopies; environmental temperature: soil, air and canopy temperature.

				Students will be able to describe the temperature profile in air, soil, crop canopies; soil and air temperature effects on plant processes; environmental moisture and evaporation: measures of atmospheric temperature and relative humidity vapor pressure and their relationships; evapo-transpiration and meteorological factors determining evapo-transpiration.
				Students will be able to explain modification of plant environment: artificial rain making, heat transfer, controlling heat load, heat trapping and shading; protection from cold, sensible and latent heat flux, controlling soil moisture; monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon; weather hazards, drought monitoring and planning for mitigation.
				Students will be able to understand weather forecasting in India - short, medium and long range; aerospace science and weather forecasting; benefits of weather services to agriculture, remote sensing; application in agriculture and its present status in India; atmospheric pollution and its effect on climate and crop production; climate change and its impact on agriculture.
7	SOA/AGRON/C-507	Principles and Practices of Organic Farming	2 + 1	Students will be able to understand concepts of organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.
				Students will be able to describe organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermin compost, green manures and bio-fertilizers. Students will be able to explain farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.
				Students will be able to know control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.
				Students will be able to describe socio-economic impacts; marketing and export

				potential: inspection, certification, labelling and accreditation procedures; organic farming and national economy.
8	SOA/AGRON/C-508	Agronomy of Oil Seed, Fibre & Sugar Crops	3 + 1	Students will be able to get exposure for origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of : *Rabi* oilseeds - Rapeseed and mustard, linseed, etc. *Kharif* oilseeds - Groundnut, sesame, castor, sunflower, soybean etc. Fibre crops - Cotton, jute, sun hemp etc. Sugar crops - Sugar-beet and sugarcane.
9	SOA/AGRON/C-509	Agronomy of Fodder and Forage crops	3 + 1	Students will be able to get exposure for adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like maize, *bajra, guar,* cowpea, oats, barley, berseem, *senji,* lucerne etc. Students will be able to get exposure for adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses- lime, Napier grass, *Panicum, Lasiuras, Cenchrus* etc. Students will be able to describe year-round fodder production and management, preservation and utilization of forage and pasture crops. Students will be able to understand principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Students will be able to explain economics of forage cultivation, uses and seed production techniques.

10	SOA/AGRON/C-510	Agronomy of Medicinal and Aromatic Crops	3 + 1	Students will be able to explain Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and uses. Students will be able to describe climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Isabgol, Rauwolfia, Poppy, *Aloe vera*, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, *Nux vomica*, Rosadle etc). Students will be able to explain climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium, Levender & Jasmine etc.).
				3rd Semester
11	SOA/AGRON/C-511	Self-study courses to be decided by concern department/college	3 + 0	Students will be able to explain cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use. Students will be able to understand Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems. Students will be able to describe above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture. Students will be able to understand crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Students will be able to know plant ideotypes for drylands; plant growth regulators and their role in sustainability.
12	SOA/AGRON/C-	Dryland Farming	2 + 1	Students will be able to explain definition, concept and characteristics of dry

	512			land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture. Students will be able to understand soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. Students will be able to describe stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions. Students will be able to get exposure to tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); anti- transparent; soil and crop management techniques, seeding and efficient fertilizer use. Students will be able to understand concept of watershed resource management, problems, approach and components.
13	SOA/AGRON/C-513	Management of Problem Soils	2 + 1	Students will be able to explain problem soils classification and distribution. Nature and properties of saline, alkali and acidic soils. Students will be able to describe plant responses to soil reaction, extent of damage to crops, salt tolerance of the crops. Management and improvement of saline, alkali and acidic soils. Students will be able to understand excess soil water conditions – sources and occurrences. Rainfall analysis and water balance. Effect of excess soil water on crop growth. Students will be able to explain management of excess soil water, water fluctuation and side movements, lowering of water table for successful crop

				production. Degraded soils and their rehabilitation.
14	SOA/AGRON/C-514	Modern concept in Crop Production	2 + 1	Students will be able to understand the concepts of crop growth analysis in relation to environment; Agro-ecological zones of India. Students will be able to explain quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit. Students will be able to describe effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modelling for desired crop yield. Students will be able to explain scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress. Students will be able to understand integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture.
15	SOA/AGRON/E-515	Crop Ecology	2 + 1	Students will be able to understand concept of crop ecology, agricultural systems, ecology of cropping systems, principles of plant distribution and adaptation, crop and world food supply. Students will be able to explain ecosystem characteristics, types and functions, terrestrial ecology, flow of energy in ecosystem, ecosystem productivity, biomass, succession and climax concept. Students will be able to describe physiological response of crop plants to light, temperature, CO_2, moisture and solar radiation; influence of climate on photosynthesis and productivity of crops; effect of global climate change on crop production.

				Students will be able to get exposure for exploitation of solar energy in crops; vertical distribution of temperature; efficiency in crop production.
				Students will be able to understand concepts of competition in crop plants; environmental pollution, ecological basis of environmental management and environment manipulation through agronomic practices; improvement of unproductive lands through crop selection and management.
16	SOA/AGRON/E-517	Soil Taxonomy, Survey and Remote sensing	2 + 1	Students will be able to describe soil survey — definition, objectives, methods, soil mapping units, types and advantages; land capability classification. Students will be able to understand morphological, physical and chemical properties used in distinguishing and classifying soils, principles of soil taxonomy, classification systems. Students will be able to describe soils of India and their taxonomic classification, Important characteristics, potential and constraints. Students will be able to understand the concepts of Remote sensing-introduction, definition, concept, principles, importance, scope, types, advantages and disadvantages and its application in agriculture and soil classification.
17	SOA/AGRON/E-518	Storage insect pests and their Management	2 + 1	Students will be able to explain introduction, history concepts and significance of management of storage insect pests. Postharvest losses *in toto visà-vis* total production of food grains in India. Scientific and socioeconomic factors responsible for grain losses. Students will be able to describe important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes. Students will be able to Understand ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and

				humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage- types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions. Students will be able to describe important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures-Hygiene/sanitation, disinfestations of stores/receptacles, legal methods. Curative measures-Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control- prophylactic and curative-Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.
4th Semester				
18	SOA/AGRON/C-519	**Thesis**	0 + 8	Students will be able to conduct research in field and laboratory in specified crop(s) on different agronomic aspects.
Or in lieu of thesis student can opt for course 520 & 521				
19	SOA/AGRON/C-520	Seed Production Technology	3 + 1	Students will be able to explain objectives of seed production technology: Role in increasing agriculture production seed its importance, in green revolution difference between grain and seed. Concept of seed quality, steps involve in seed production. Principles of seed production, concept and factors that affect the seed quality in the growing; processing and distribution of seed, seed replacement rate, multiplication rate, seed industry in India and role of various agencies, important terminology used in seed industry, breeders, foundation, and certified seed, maintenance of genetic purity. Students will be able to get exposure to seed certification: Its concept, role & goal, necessity of seed certification, minimum seed certification standard for self and cross pollinated crops, Field and seed inspections, objectives, general principles and methods. Preparation of field reports, seed certification terms; seed certification agencies, certified and truthfully ladled seeds. Students will be able to understand the concepts of nucleus and breeders seed

				production of self-pollinated crops: Viz. Rice, Wheat, Arhar, Gram, Soybean, Rapeseed and Mustard.
				Students will be able to understand maintenance of nucleus and breeders seed in cross pollinated crop varieties: in breds and noinbreds, maintenance of seed of established varieties, foundation, and certified seed production of Maize inbreeds, single and double cross hybrids.
				Students will be able to explain hybrid seed production: of Rice, Maize, Sorghum, and Bajra, and Sunflower using male sterility systems.
				Students will be able to get exposure to latest released hybrids L of Rice, Maize, Sorghum, and Bajra, their characteristic features.
				Students will be able to describe seed testing: Importance of seed testing in production of high quality seed. Techniques of seed testing; Sampling, Sample preparation for seed testing, purity testing, germination test, physiology of seed in relation to viability, vigour & dormancy of seeds, Varietal identification, through electrophoresis. Growth out test for cultivar, purity. Seed legislation and seed law enforcement including IPR, PBR in India. Recent development in seed industry. Genetic aspect of varietal deterioration.
				Students will be able to explain seed processing storage and marketing principle & practices of seed drying and seed separation selecting of sources air and screen seed cleanness physical characteristics utilized in seed cleaning & grading; seed treatment, type of seed treatment, materials & methods of seed packing, factors affecting seed in storage, problems of stored grains pest & methods to avoid the loss. Distribution & marketing of seed.
20	SOA/AGRON/C-521	Soil Conservation and watershed Management	3 + 1	Students will be able to explain Soil erosion: definition, nature and extent of erosion; types of erosion, factors affecting erosion.
				Students will be able to describe soil conservation: definition, methods of soil conservation; agronomic measures - contour cultivation, strip cropping, cover crops; vegetative barriers; improved dry farming practices; mechanical measures - bunding, gully control, bench

				terracing; role of grasses and pastures in soil conservation; wind breaks and shelter belts.
				Students will be able to understand watershed management: definition, objectives, concepts, approach, components, steps in implementation of watershed; development of cropping systems for watershed areas.
				Students will be able to explain land use capability classification, alternate land use systems; agro-forestry; ley farming; *jhum* management - basic concepts, socio-ethnic aspects, its' layout.
				Students will be able to describe drainage considerations and agronomic management; rehabilitation of abandoned *jhum* lands and measures to prevent soil erosion.
21	SOA/AGRON/C-522	**Seminar**	0 + 1	Students will be able to present the classical and innovative work related to agronomy. This will be helpful for developing their presentation skills for research activities.
22	SOA/AGRON/E-524	Agrostology and Agroforestry	2 + 1	Students will be able to understand the concepts of agrostology: definition and importance; principles of grassland ecology: grassland ecology - community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India; problems and management of grasslands.
				Students will be able to explain importance, classification (various criteria), scope, status and research needs of pastures; pasture establishment, their improvement and renovation-natural pastures, cultivated pastures; common pasture grasses.
				Students will be able to describe agro forestry: definition and importance; agro forestry systems, agrisilviculture, silvipasture, agrisilvipasture, agrihorticulture, aqua- silviculture, alley cropping and energy plantation.
				Students will be able to get exposure crop production technology in agro-forestory and agrostology system; silvipastoral system: meaning and importance for wasteland development; selection of species, planting methods and problems of seed germination in agro-forestry systems; irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and

				underground interferences; lopping and coppicing in agro-forestry systems; social acceptability and economic viability, nutritive value of trees; tender operation; desirable tree characteristics.
23	SOA/AGRON/E-525	Stress Physiology	2 + 1	Students will be able to explain the response of plants to abiotic stresses: Abiotic stresses affecting plant productivity. Basic principles of a crop improvement programme under stress. Interactions between biotic and abiotic stresses.

Students will be able to understand drought stress: Physiological, biochemical and molecular mechanism, strategies to alleviate drought stress, signal transduction mechanism, Drought in relation to MAS and QTL, Role of ROS/ antioxidants, ABA, Cytokinin and other hormones.

Students will be able to know temperature stress (high and low): Tolerance mechanisms-role of membrane lipids in temperature tolerance. Functions of regulatory proteins.
Students will be able to describe salinity stress: Species variation in salt tolerance. Salinity effects at – Cellular and whole plant level, tolerance mechanisms. Salt tolerance in – Glycophytes and halophytes, breeding for salt resistance.

Students will be able to explain heavy metal stress: Aluminium and cadmium toxicity in acid soils. Role of phytochelatins (heavy metal binding proteins). |
| 24 | SOA/AGRON/E-526 | Soil, Water and Air pollution | 2 + 1 | Students will be able to explain soil, water and air pollution problems associated with agriculture, nature and extent.

Students will be able to describe nature and sources of pollutants — agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

Students will be able to get exposure of sewage and industrial effluents — their composition and effect on soil properties/health, and plant growth and human beings; sol as sink for waste disposal.

Students will be able to describe pesticides — their classification, behavior in |

				soil and effect on soil microorganisms.
				Students will be able to explain toxic elements their sources, beha
				effect on nutrients availability, effect on plant and human health.
				Students will be able to explain pollution of water resources due t
				nutrients and pesticides from soil; emission of greenhouse gases
				dioxide, methane and nitrous oxide.
				Students will be able to understand the concepts of remediation/
				contaminated soil and water; remote sensing applications in moni
				management of soil and water pollution.