

AGRICULTURAL BOTANY

(Subject Code-85)

Unit-1: Introductory Microbiology:

Classification and role of microbes in agriculture, food and environment; Historical, broad outlines of morphology, reproduction, nomenclature and classification of bacteria; History of Mycology, Taxonomy and nomenclature of fungi, Origin and phylogeny of fungi, Different systems of classification and their basis, Structure and life history of the chief representatives of fungi.

Unit-2: Introductory Plant Pathology: History of plant pathology, Dissemination of diseases, modes of infection, symptomology of bacterial and fungal diseases; physiology of parasitism, mechanism of disease resistance, fungicides and their action; Important plant diseases caused by bacteria, fungi and mycoplasma in major agricultural crops; Historical, symptomology, properties and nature of plant viruses, modes of transmission of plant viruses; General principle of control of plant diseases; Concept of biopesticides; A knowledge of the common viral diseases of potato, tobacco, hibiscus, cucurbits, beans and banana.

Unit-3: Cytogenetic, Molecular genetics and plant breeding:

Cell structure and function, cell wall, nucleus, mitochondria, golgi apparatus, chloroplasts and other cell organelles, their structure and function; Cell division: mitosis and meiosis; Polyploidy: Nature and classification of Polyploidy. Heredity and environment, laws of heredity; Linkage, crossing over and mapping of chromosomes; nature of gene and factors affecting mutation; History of plant breeding, its present status and scope: Breeding methods for self –pollinated, cross-pollinated and clonally propagated crops; Component, recombinational and transgressive breeding; Single seed descent; Populations, their improvement methods and maintenance; Hybrid breeding and genetic basis of heterosis; Ideotype breeding; Mutation breeding.

Unit-4: Crop Physiology:

Transpiration, anti-transpirants and their significance; Mechanism of stomatal opening and closing; Physiology of flowering, photoperiodism, vernalization and their impact on crop production; Seed formation, longevity and multiplication; Physiology and biochemistry of herbicides; Physiology of propagation; Physiology of fertilization, fruit growth and ripening; Mineral nutrition, uptake and translocation of solutes; Mutually beneficial and toxic influence of plants; Physiological role of some major and minor elements such as N,P,K,Ca,Mg,B, Mo, Mn, Zn; Photosynthesis: photosynthetic pigments, light and dark reaction; C₃, C₄ and CAM plants; Respiration: R.Q., Glycolysis, TCA cycle and Electron Transport Chain; Factors affecting photosynthesis and respiration; Photorespiration; Abiotic stresses affecting plant productivity; Basic principles of a crop improvement programme under stress, interactions between biotic and abiotic stresses; Biological nitrogen fixation; Growth, methods of growth analysis, control of growth by hormones, mechanism of action of growth regulators; control of differentiation, flowering, dormancy and senescence.

Unit-5: Growth, Nutrition and soil relation:

Regional soils of India in relation to crops and their production; Secondary effects on micro flora; Physical nature of soils and water relation of soils; Concept of water requirement of crops and the critical period of water requirement of plants and its significance in crop production; Principle and practices of dry farming, special problems in dry farming mixed cropping and strip cropping in agriculture in India; Agronomic practices in relation to soil acidity and alkalinity; Soil nitrogen losses and its restoration;

Phosphorous deficiency and soil fertility; Fixation of nutrients in soil potassium in relation to soil fertility and plant growth and development; Concept of biofertilizers; Plant production and methods; C/N ratio as a function of growth and development; Problems of non- irrigated soils; Tillage and its influence on plant growth; Formation of usar soils and their measurement; Control of alkalinity and salinity; Soil micro-organisms and their role in production; Soil reclamation.

Unit-6: Biochemistry, Biotechnology and Molecular Biology:

Scope and importance of Biochemistry in Agriculture; structure and properties of water; Acid base concepts, pH and buffer; Classification, structure and function of carbohydrates, lipids, amino acids, proteins, nucleic acids and vitamins; Fundamentals of thermodynamic principles – application for biological processes; Enzyme classification and mode of action; DNA replication, transcription and translation; rDNA technology; Biotechnological and molecular tools for improved crop production, germplasm conservation and climate resilient agriculture: micropropagation techniques – haploids, somaclonal preservation, somatic embryogenesis, embryo rescue, protoplast fusion and somatic hybridization, transgenic plants; Molecular markers and their applications; DNA sequencing; Genomics, transcriptomics and proteomics; Genetic engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation and nutrient uptake efficiency; Molecular breeding: construction of molecular maps; diversity assessment and phylogenetic analysis; Biosafety and bioethics issues.

Unit-7: Environmental Science:

Concept of ecosystems, energy flow, food chain, food web; Ecological pyramids; Biogeochemical cycle; Environmental factors of crop distribution and production; Environmental Pollution and hazards to crops, animals and humans in relation to air, water, heavy metals, soil and radioactive pollution; Global climate change: green house effect, acid rain, ozone depletion; Disaster management; Environmental legislations and Acts; Study of the botany of important weeds associated with the crop plants of U.P., Methods of preventing introduction and spread of weeds. Principles and procedures of weed control Growth. Inhibiting, and promoting chemicals and their composition; Social issues related to diseases and environmental hazards; Role of women in agriculture; Role of Information Technology in environmental management.

Unit-8: Economic Botany:

Horticulture - importance and present position. Origin, history, breeding and production technology of important fruits such as Mango, Banana, Citrus, Guava, papaya, Grape, Pineapple, Ber, Apple, Pear and Walnut, Cereals: (Wheat, rice, maize, sorghum, pearl millet and minor millets), Pulses: (Pigeon pea, chickpea, black gram, cowpea, soybean, pea, lentil), Oilseeds: (Groundnut, sesame, castor, rape seed, mustard, sunflower), Fibres: (cotton, silk cotton, jute, sunnhemp, agave, flax and Mesta), Vegetables: (tomato, brinjal, okra, cucumber, cole crops, gourds), Spices (Black cardamom, Black pepper, Black Cumin, Capsicum, Cloves, Coriander, Ginger, Turmeric) with special reference to climate, soil, propagation, cultivars, nutrition, irrigation and other orchard management practices; Packages of practices for production of important cereals, pulses, oilseeds, sugar, fibre and cash crops grown during Kharif and Rabi seasons in different parts of U.P.; History of gardening of India. Styles of gardening, their principles and practices with special reference to Mughal, Japanese and English gardens. Frequency distribution. Mean, median and mode

Unit-9: Plant Genetic Resources and Biodiversity;

Plant species richness and endemism; concept and importance of plant genetic resources (PGR) and its increasing erosion; Centres of origin and diversity of crop plants, domestication, evaluation, bioprospecting; National and International organizations associated with PGR; Convention on Biological Diversity (CBD); recent issues related to access and ownership of PGR, IPR, PBRs, farmers rights, *sui-generis* system; Cropping patterns in different agro-climatic zones of U.P.; Organic farming; Biodiversity: status and importance, Red Data Book, Causes of loss of biodiversity; Biodiversity conservation: *in situ* and *ex situ* conservation.

Unit-10: Seed Science and Technology:

Floral biology, mode of reproduction, sporogenesis, pollination, fertilization, embryogenesis, fruit and seed development; Apomixis, parthenocarpy, polyembryony and somatic embryoids and synthetic seeds; Concept of breeder, foundation, certified and registered seeds; Seed structure of monocot and dicot; Seed maturation and longevity in orthodox and recalcitrant seed; Chemical composition of seed; Seed dormancy-types, causes and mechanisms of induction and release, factors affecting, methods to overcome dormancy and its significance in agriculture; Seed germination- requirements, imbibitions pattern, physiological and biochemical changes, and role of growth hormones; Principles of seed processing. Seed drying principles and methods, Precleaning, grading, treatment, pelleting and packaging; Seed invigoration and enhancement treatment and their applications; Seed processing machines like cleaner cum grader, specific gravity separator, indented cylinder, seed treater, weighing and bagging machines, their operation and maintenance; Seed quality maintenance during processing; Seed legislation – Seeds Act 1966, Seed Rules 1969 and New Seed Bill 2004, Seed Law Enforcement; Seed certification- history, concept, organization, phases and minimum certification standards; Field inspection principles and methods. Inspection at harvesting, threshing and processing stages. Pre- and post quality testing or genetic purity; Seed certification Schemes, concepts and procedures; Seed Testing concepts and objectives, its role in seed quality control; Seed sampling, seed moisture testing, purity analysis, germination testing, tolerance tests and equipment.