

SYLLABUS BOTANY
M.Sc (Agriculture Botany)
(Two-Year Post Graduate Course)



DEPARTMENT OF BOTANY
UNIVERSITY OF ALLAHABAD

About the Department

The Department of Botany was established in 1923, making it one of the oldest departments of the University. The department has produced notable scholars and administrators known to hold prestigious positions around the world. It is recognized for its academic and research excellence, evidenced by programs like the Special Assistance Programme (SAP 1976), COSIST Support Programme (1990), and FIST (2016). The department offers a graduate course in Botany and postgraduate courses in Botany and Agricultural Botany. It currently boasts expertise in research and teaching across multiple areas, including:

- **Systematics**
- **Molecular Biology**
- **Microbiology**
- **Virology**
- **Mycology**
- **Ecology**
- **Ethnobotany**
- **Developmental Biology**
- **Physiology**
- **Bioremediation**
- **Forestry**
- **Computational Biology**
- **Biotechnology**

This expertise is attributed to the 21 permanent faculties. Four of the faculty members are counted among the top 2% of highly cited researchers in the world, demonstrating successful national and international collaborations, as evidenced by their highly cited research publications and patent profiles.

Major Focus and Goals

A major focus is to enhance teaching quality by exposing students (undergraduate, graduate, and PhD) to modern biological concepts and techniques, preparing them for global expectations.

Concurrently, the department strives to find sustainable solutions using plants to address:

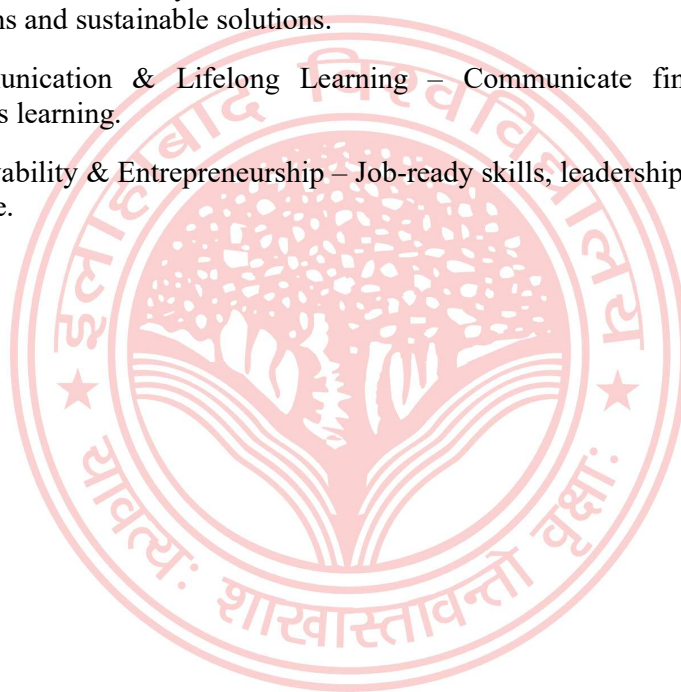
- Higher demands for food
- Efficient land use and freshwater sources
- Remedial efforts to ameliorate the effects of urbanization and industrialization

The department focuses on combating the adverse effects of climate change, industrialization, and urbanization on agriculture and public health, aligning with SDG Goals 2030.

Program Outcomes (POs)

The Program Outcomes outline the knowledge, skills, and values graduates are expected to achieve:

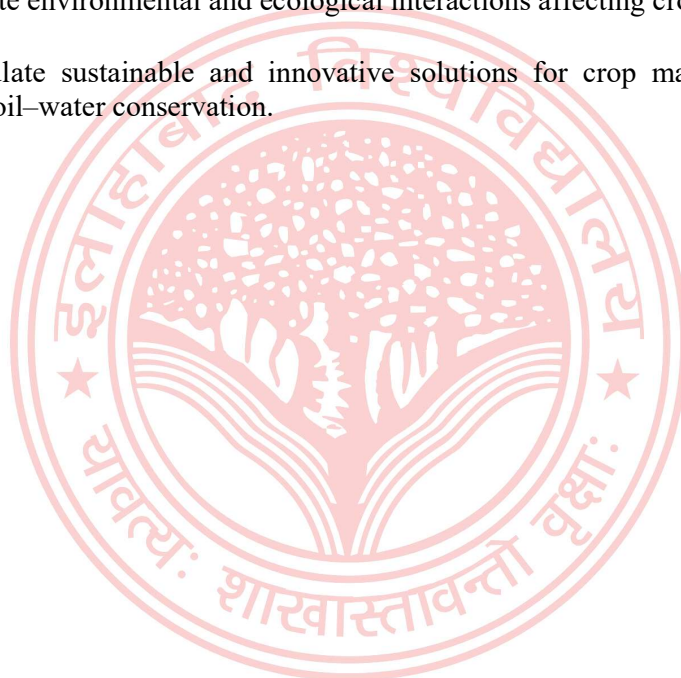
- PO1:** Knowledge and Understanding – Advanced knowledge in cytogenetics, physiology, ecology, and biotechnology.
- PO2:** Research and Analytical Skills – Design, conduct and evaluate research using advanced tools.
- PO3:** Application of Knowledge – Apply breeding, pathology, physiology and lab/field methods to crop problems.
- PO4:** Ethics, Sustainability and Environmental Awareness – Evaluate ecological interactions and sustainable solutions.
- PO5:** Communication & Lifelong Learning – Communicate findings and pursue continuous learning.
- PO6:** Employability & Entrepreneurship – Job-ready skills, leadership and innovation for agriculture.



Program Specific Outcomes (PSOs)

After completing the M.Sc. in Botany, students will be able to:

- PSO1: Explain principles of cytogenetics, physiology, ecology, and biotechnology related to crop plants.
- PSO2: Apply plant breeding, pathology, and physiology knowledge to develop improved crops.
- PSO3: Conduct laboratory and field-based investigations with statistical and analytical tools.
- PSO4: Evaluate environmental and ecological interactions affecting crop productivity.
- PSO5: Formulate sustainable and innovative solutions for crop management, disease control, and soil–water conservation.



M.Sc. Ag. BOTANY SEMESTER-I

Course Details:

Course Code: AGB 501

Course Title: Introductory Microbiology & Plant Pathology

Course Credit: 03

Course Objectives:

Describe microorganisms and plant pathogens. Analyze host–pathogen interactions and disease mechanisms. Apply control methods to manage plant diseases. Evaluate the impact of plant diseases on agriculture.

Course Outcomes (COs):

CO1: Describe microorganisms and plant pathogens.

CO2: Analyze host–pathogen interactions and disease mechanisms.

CO3: Apply control methods to manage plant diseases.

CO4: Evaluate the impact of plant diseases on agriculture.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	2	3	3	2	2	2.50
CO2	3	3	3	3	2	2	2.67
CO3	3	2	3	3	2	3	2.67
CO4	3	3	3	3	3	2	2.83
Average	3.00	2.50	3.00	3.00	2.25	2.25	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	2	3	3	2.80	
CO2	3	3	2	3	3	2.80	
CO3	3	3	3	3	3	3.00	
CO4	3	3	3	3	3	3.00	
Average	3.00	3.00	2.50	3.00	3.00	2.90	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Historical, symptomology, properties and nature of plant viruses, modes of transmission of plant viruses, serology and mutations in plant viruses. General principle of control of virus diseases of potato, Hibiscus cucurbits, beans and banana.

Unit II

Historical, broad outlines of morphology, reproduction, nomenclature and classification of plant pathogenic bacteria and mycoplasmas. A knowledge of more important bacterial diseases with special reference to crown gall, citrus canker, fire blight of pear, sugarcane stripe and bacterial stripe and bacterial wilt of crops.

Unit III

History of Mycology, Taxonomy and nomenclature of fungi, Origin of phylogeny of fungi, different systems of classification and their basis, Physiology of fungi, structure and life history of the chief representatives of fungi.

Unit IV

Detailed study of fungal diseases of bajra, maize, wheat, barley, rice, cotton, sugarcane, potato, arhar, pea, groundnut, mustard, linseed, coriander, peach, mango and papaya.

Unit V

History of plant pathology dissemination of diseases, modes of infection symptomology, physiology of parasitism mechanism of disease resistance, fungicides and their action effect of parasitism, principles and methods for the prevention and control of disease, toxicity caused by control measures.

Suggested Readings:

- Agrios, G.N. (2005). Plant Pathology. Elsevier Academic Press.
- Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. (2009). Microbiology: Concepts and Applications. McGraw Hill.
- Alexopoulos, C.J., Mims, C.W., & Blackwell, M. (1996). Introductory Mycology. John Wiley & Sons.
- Singh, R.S. (2006). Introduction to Principles of Plant Pathology. Oxford & IBH Publishing.
- Talaro, K.P., & Chess, B. (2015). Foundations in Microbiology. McGraw Hill.

Course Details:

Course Code: AGB 502

Course Title: Cytogenetics, Molecular Genetics & Plant Breeding

Course Credit: 03

Course Objectives:

Explain chromosomal structure, mutation, and inheritance. Apply molecular genetics in crop improvement. Analyze breeding systems and genetic variations. Evaluate plant breeding strategies for yield improvement.

Course Outcomes (COs):

CO1: Explain chromosomal structure, mutation, and inheritance.

CO2: Apply molecular genetics in crop improvement.

CO3: Analyze breeding systems and genetic variations.

CO4: Evaluate plant breeding strategies for yield improvement.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	2	2	3	2.67
CO2	3	3	3	2	2	3	2.67
CO3	3	3	3	2	2	3	2.67
CO4	3	3	3	2	2	3	2.67
Average	3.00	3.00	3.00	2.00	2.00	3.00	2.67

CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average
CO1	3	3	3	2	3	2.80
CO2	3	3	3	2	3	2.80
CO3	3	3	3	2	3	2.80
CO4	3	3	3	2	3	2.80
Average	3.00	3.00	3.00	2.00	3.00	2.80

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Interphasic nucleus-its structure and chemical composition. Cell division-A detailed study of mitosis and meiosis. Morphology of chromosomes, special types of chromosomes. Identification of the probable parents of allopolyploids, Methods of nullisomic analysis, alien chromosomal manipulation studies. Role of polyploidy in plant evolution.

Unit II

Chromosome theory of mendelian inheritance, special consequences of differences in gametogenesis in higher plants and animals. Genetic control of chromosomal behaviour. Hypothesis of chromosomal crossing over and chiasmata type theory, sex determination, structural changes in chromosomes, their cytogenetics, breeding behaviour and evolutionary significance, Cytogenetics of haploids, autopolyploids, allopolyploids trisomics, monosomics, nullisomics and breeding behaviour.

Unit III

Chromosomal crossing over, linkage maps, double crossing over coincidence and interference, test crosses, evidence that crossing over is associated with chromosomal exchange factors affecting crossing over polyploids and inversions. Male dressophila crossing over by breakage of chiasmata, chiasmata terminalization, multiple allelism, pseudoalleles, position, mutation rates, mutator genes, radiation and chemical induced mutations. Mechanism of induction of chromosomal structural changes paramutation.

Unit IV

Structure and replication of DNA and RNA, DNA theory as the classical basis of heredity. Recombination in micro-organisms, structure of genes, Molecular aspects of chromosome

structure, Molecular aspects of mutation, Genetic code and genetic control of protein synthesis.,

Unit V

History of Plant breeding, its present status and scope, Mode of reproduction in crop plants, Heterosis and its application, Plant introduction and its utility in crop improvement, general methods of crop improvement, Elementary knowledge of statistics as applied to agriculture.

Suggested Readings:

- Gardner, E.J., Simmons, M.J., & Snustad, D.P. (2011). Principles of Genetics. Wiley.
- Singh, B.D., & Singh, A.K. (2021). Plant Breeding: Principles and Methods. Kalyani Publishers.
- Lewin, B. (2014). Genes XI. Jones & Bartlett Learning.
- Klug, W.S., Cummings, M.R., Spencer, C.A., & Palladino, M.A. (2016). Concepts of Genetics. Pearson.
- Allard, R.W. (1999). Principles of Plant Breeding. John Wiley & Sons.

Course Details:

Course Code: AGB 503

Course Title: Crop Physiology, Growth and Nutrition and Soil – Water Relation

Course Credit: 03

Course Objectives:

Describe plant growth processes and water relations. Apply knowledge of mineral nutrition and drought resistance. Analyze hormonal regulation and growth control.

Course Outcomes (COs):

CO1: Describe plant growth processes and water relations.

CO2: Apply knowledge of mineral nutrition and drought resistance.

CO3: Analyze hormonal regulation and growth control.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	2	3	2	2	3	2.50
CO2	3	3	3	3	2	3	2.83
CO3	3	3	3	3	2	3	2.83
Average	3.00	2.67	3.00	2.67	2.00	3.00	2.72
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	

Average	3.00	3.00	3.00	3.00	3.00	3.00
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Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Nature of plant cell membranes, permeability and absorptions, methods measuring permeability and absorptions, methods of measuring permeability of protoplasmic membranes to solute, cellular physiology. Mineral nutrition of plant, uptake and translocation of solutes.

Unit II

Regional soils of India in relation to crops and their production, Secondary effects on micro flora Formation of usar soils and types of usar, control of alkalinity and salinity, salt tolerance of crops with examples of improved varieties, effects of salinity of plant growth and metabolic processes.

Unit III

Absorption of water, mechanism of water movement in the soil and plant water potential in relation to evaporation and soil water condition, Characteristics of root systems, Drought resistance, chemical control of water relations, Concept of water requirement of crop sand the critical period of water requirement of plants and its significance in crop production.

Unit IV

Growth, methods of growth analysis, control of growth by hormones, mechanism of action of growth regulators, control of differentiation, flowering, dormance and senescence.

Unit V

Physiology of flowering, photoperiodism and vernalization –their impact on crop production, Physiology of fertilization, fruit growth and ripening.

Suggested Readings:

- Taiz, L., Zeiger, E., Møller, I.M., & Murphy, A. (2018). Plant Physiology and Development. Sinauer Associates.
- Salisbury, F.B., & Ross, C.W. (1992). Plant Physiology. Wadsworth Publishing.
- Hopkins, W.G., & Hüner, N.P.A. (2008). Introduction to Plant Physiology. Wiley.
- Gardner, F.P., Pearce, R.B., & Mitchell, R.L. (1985). Physiology of Crop Plants. Iowa State University Press.
- Marschner, P. (2012). Marschner's Mineral Nutrition of Higher Plants. Academic Press.

Course Details:

Course Code: AGB 504

Course Title: Horticulture & Social Forestry

Course Credit: 03

Course Objectives:

Explain principles of horticultural production and propagation. Apply techniques in orchard and garden management. Evaluate horticultural crops for economic and ecological value.

Course Outcomes (COs):

CO1: Explain principles of horticultural production and propagation.

CO2: Apply techniques in orchard and garden management.

CO3: Evaluate horticultural crops for economic and ecological value.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	2	3	3	3	3	2.83
CO2	3	2	3	3	3	3	2.83
CO3	3	2	3	3	3	3	2.83
Average	3.00	2.00	3.00	3.00	3.00	3.00	2.83
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5		Average
CO1	3	3	3	3	3		3.00
CO2	3	3	3	3	3		3.00
CO3	3	3	3	3	3		3.00
Average	3.00	3.00	3.00	3.00	3.00		3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Horticulture- Importance, present position, scope with reference to production, productivity and marketing both in India and abroad, production and marketing problems and remedial measures, rootstocks, special structures for propagation like mist chambers, hot beds, cold frames etc. Physiology of rooting, nurseries and their management.

Unit II

Origin, history, breeding and production technology of important fruits such as mango, banana, citrus, guava, papaya, grape, pineapple, litchi, pomegranate, ber, apple, pear and walnut with special reference to climate, soil, propagation, cultivars, nutrition, irrigation and other orchard management practices, Origin, history, breeding and production technology of important plantation crops like coconut, rubber, tea with special reference to climate, soil, propagation, cultivars, nutrition, irrigation and other management practices.

Unit III

Origin, history, breeding and production of important vegetables, spices and condiments like tomato, brinjal, chillies, radish, turnip, carrot, beans, peas, onion, potato, okra, cucurbits,

coriander, garlic etc. with special reference to climate, soil, seed production including development of hybrids, cultivars, nutrition, irrigation and other management practices.

Unit IV

History of gardening in India, their principles and practices with special reference to Nunggal, Japanese and English gardens. Garden parts (features), their materials and methods of development including garden ornaments. Classification and utilization of ornamental trees, shrubs, climbers, herbaceous, perennials, annuals and foliage plants.

Unit V

Preparation and management Bonsai, Home gardens, Production of important flower crops like orchids, marigold, chrysanthemum, rose, jasmine, dahlia with reference to climate, soil, propagation, cultivars, planting methods, nutrition, irrigation etc. Prolonging, storage adverse life of cut flowers and their utilization.

Suggested Readings:

- Chadha, K.L. (2019). Handbook of Horticulture. ICAR Publication.
- Bose, T.K., Kabir, J., Das, P., & Joy, P.P. (2001). Fruits: Tropical and Subtropical. Naya Udyog Publishers.
- Kumar, N. (2015). Introduction to Horticulture. Oxford & IBH Publishing.
- Pathak, V.N., & Gupta, M.L. (2010). Fundamentals of Horticulture. Agrobios Publishers.
- Dwivedi, A.P. (1992). Forestry in India. Jugal Kishore & Co.

AGB 531: Lab Work I (Based on AGB 501 & 502)

Course Component	Description
Course Objectives	To study microorganisms, plant pathogens, and chromosomal structures. To perform basic microbiological techniques and cytogenetic analysis. To understand plant–pathogen interactions and genetic inheritance mechanisms.
Course Outcomes	CO1: Identify and characterize common microorganisms and plant pathogens. CO2: Demonstrate aseptic techniques and microbial culture preparation. CO3: Analyze mitosis, meiosis, and chromosomal aberrations. CO4: Apply cytogenetic and molecular methods for plant breeding studies.

List of Suggested Practicals:

1. Study of aseptic techniques and preparation of microbial media.
2. Isolation and culture of bacteria and fungi from soil and infected plants.
3. Microscopic observation of fungal and bacterial plant pathogens.
4. Study of mitosis and meiosis using onion root tip and flower buds.

5. Preparation and observation of karyotypes in crop plants.
6. Chromosome staining techniques (Feulgen, Acetocarmine).
7. Study of induced mutations using colchicine treatment in plants.
8. Study of different plant diseases and their symptoms.
9. Isolation of DNA from plant tissues.
10. Visit to pathology and genetics research laboratories.

AGB 532: Lab Work II (Based on AGB 503 & 504)

Course Component	Description
Course Objectives	To understand physiological processes and horticultural practices. To study water relations, mineral nutrition, and plant growth parameters. To apply physiological and horticultural techniques for crop improvement.
Course Outcomes	CO1: Measure physiological parameters such as transpiration and photosynthesis. CO2: Demonstrate nutrient deficiency symptoms in plants. CO3: Perform propagation techniques used in horticulture. CO4: Evaluate plant growth and productivity using physiological tools.

List of Suggested Practicals:

1. Measurement of transpiration rate by potometer.
2. Determination of relative water content and water potential.
3. Estimation of chlorophyll content using spectrophotometer.
4. Study of mineral deficiency symptoms in crop plants.
5. Determination of growth rate using growth analysis techniques.
6. Propagation methods: cutting, grafting, layering, budding.
7. Preparation and maintenance of nursery beds.
8. Study of garden layouts and design principles.
9. Identification of ornamental plants and fruit crops.
10. Visit to horticultural farms and greenhouses.

M.Sc. Ag. BOTANY SEMESTER-II

Course Details:

Course Code: AGB 505

Course Title: Principles of Plant Disease Control

Course Credit: 03

Course Objectives:

Explain principles and methods of plant disease control. Apply biological, chemical, and physical impact of weed management.

Course Outcomes (COs):

CO1: Familiarity with methods of plant disease control.

CO2: Apply biological, chemical, and physical control techniques.

CO3: Impact of weed management.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	3	2	2	2.67
CO2	3	3	3	3	2	3	2.83
CO3	3	3	3	3	2	3	2.83
Average	3.00	3.00	3.00	3.00	2.00	2.67	2.78
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Quarantines and prohibitions, general idea of quarantine regulations in force in India and Uttar Pradesh, Crop rotation, field sanitation, eliminations of alternate hosts, chemical eradication.

Unit II

Biological, cultural and chemical concept of plant diseases, Effect of environment in pathogenesis, Defense mechanisms in plants, Disease control through disease resistance varieties.

Unit III

Genetics of host-parasite interactions. Toxins and plant disease, accumulation of toxic substances, Enzymes and plant disease, Nutrition of plant pathogens, Physiology of diseased plants.

Unit IV

Physical means of plant disease control, Chemotherapy and chemotherapeutant.

Unit V

Topical mechanism and systemic chemotherapy, Systemic fungicides and bacteriocides, Biological control of plant diseases.

Suggested Readings:

- Agrios, G.N. (2005). Plant Pathology. Elsevier Academic Press.
- Singh, R.S. (2006). Plant Diseases. Oxford & IBH Publishing.
- Mehrotra, R.S., & Aggarwal, A. (2017). Plant Pathology. Tata McGraw Hill.
- Horsfall, J.G., & Cowling, E.B. (1980). Plant Disease: An Advanced Treatise. Academic Press.
- Lucas, J.A. (2020). Plant Pathology and Plant Pathogens. Wiley.

Course Details:

Course Code: AGB 506

Course Title: Breeding of Crop Plants

Course Credit: 03

Course Objectives:

Describe principles and methods of plant breeding. Apply selection and hybridization techniques. Analyze breeding programs for crop improvement.

Course Outcomes (COs):

CO1: Describe principles and methods of plant breeding.

CO2: Apply selection and hybridization techniques.

CO3: Analyze breeding programs for crop improvement.

CO-PO and CO-PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	2	2	3	2.67

CO2	3	3	3	2	2	3	2.67
CO3	3	3	3	2	2	3	2.67
Average	3.00	3.00	3.00	2.00	2.00	3.00	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3	3.00
CO2	3	3	3	3	3	3	3.00
CO3	3	3	3	3	3	3	3.00
Average	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Origin and evolution with reference to some important crop plants, Genome differentiation in cultivated polyploidy species, Biological system of plant introduction, its scope and importance in plant breeding, acclimatization.

Unit II

Reproductive systems in cultivated plants, their genetic consequences and their relationship with plant breeding methods. Significance of genetic diversity and recombination in plant breeding, Genetic basis of breeding, self pollinated crop and their breeding methods.

Unit III

Genetic basis of breeding, self pollinated crop and their breeding methods, hybrid varieties and synthetic varieties, Breeding for disease and pest resistance, host parasite relationship, concept of horizontal and vertical resistance.

Unit IV

Polyploidy in plant breeding, breeding behaviour of aneuploids, autopolyploid, allopolyploids and role in induced polyploidy, Macro and micro mutations and plant breeding. Breeding for drought resistance, lodging resistance, dwarfing genes plant type rainfed conditions, saline resistance and clone resistance.

Suggested Readings:

- Singh, B.D., & Singh, A.K. (2021). Plant Breeding: Principles and Methods. Kalyani Publishers.
- Acquaah, G. (2012). Principles of Plant Genetics and Breeding. Wiley.
- Allard, R.W. (1999). Principles of Plant Breeding. Wiley.
- Hayes, H.K., Immer, F.R., & Smith, D.C. (1955). Methods of Plant Breeding. McGraw Hill.
- Sharma, J.R. (1994). Principles and Practice of Plant Breeding. Tata McGraw Hill.

Course Details:**Course Code:** AGB 507**Course Title:** Cell biology and Bioenergetics**Course Credit:** 03**Course Objectives:**

Explain structure and function of cell organelles. Analyze enzyme kinetics and energy metabolism.

Evaluate bioenergetic pathways in plant growth.

Course Outcomes (COs):

CO1: Explain structure and function of cell organelles.

CO2: Analyze enzyme kinetics and energy metabolism.

CO3: Evaluate bioenergetic pathways in plant growth.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	2	2	2	2.50
CO2	3	3	3	2	2	2	2.50
CO3	3	3	3	2	2	2	2.50
Average	3.00	3.00	3.00	2.00	2.00	2.00	2.50
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	2	2	2.60	
CO2	3	3	3	2	2	2.60	
CO3	3	3	3	2	2	2.60	
Average	3.00	3.00	3.00	2.00	2.00	2.60	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)**Unit I**

Cell structure and function, cell wall, nucleus, mitochondria, Golgi apparatus, chloroplasts and other cell organelles, their structure and function.

Unit II

Some important techniques related to crop physiology, determination of water potential, technique related to crop plants.

Unit III

General characters of enzymes with special reference to oxidizing and hydrolyzing enzymes, effects to substrate concentration, temperature, pH, inhibitors and activators on enzyme action, allosteric control, feedback control and genetic control.

Unit IV

Biological oxidation, their mechanisms- The electron transfers in biological systems, oxidases, dehydrogenases and terminal oxidases.

Unit V

Types of energy rich bonds, their formation and role in plant metabolism, Energy relation of plant cells. Oxidative and photophosphorylation, their mechanism and role in plant metabolism.

Suggested Readings:

- Alberts, B. et al. (2017). Molecular Biology of the Cell. Garland Science.
- Karp, G. (2019). Cell and Molecular Biology: Concepts and Experiments. Wiley.
- De Robertis, E.D.P., & De Robertis, E.M.F. (2001). Cell and Molecular Biology. Saunders.
- Nelson, D.L., & Cox, M.M. (2017). Lehninger Principles of Biochemistry. W.H. Freeman.
- Voet, D., Voet, J.G., & Pratt, C.W. (2016). Fundamentals of Biochemistry. Wiley.

Course Details:

Course Code: 508

Course Title: Seed Technology and Seed Biology

Course Credit: 03

Course Objectives:

Describe seed structure, dormancy, and germination. Apply methods of hybrid seed production.

Evaluate seed quality control and certification systems.

Course Outcomes (COs):

CO1: Describe seed structure, dormancy, and germination.

CO2: Apply methods of hybrid seed production.

CO3: Evaluate seed quality control and certification systems.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
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CO1	3	3	3	2	2	3	2.67
CO2	3	3	3	2	2	3	2.67
CO3	3	3	3	2	2	3	2.67
Average	3.00	3.00	3.00	2.00	2.00	3.00	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Fruit and seed development. Apomixis, parthenocarpy, polyembryony and somatic embryos. Seed structure of monocot and dicot, Chemical composition of seeds, seed dormancy- types, causes mechanisms in induction and release, factors affecting, methods to overcome, dormancy and significance in agriculture.

Unit II

Seed germination- requirement, imbibitions pattern, physiological and biochemical changes and role of hormones. Ballders seed or nuclear seed, foundation seed, certify seed testing, Introduction to crop breeding methods, Variety testing, release and notification, Seed production agencies, Factors affecting pollination and seed set, Male sterility, self incompatibility and their role in hybrid seed production.

Unit II

Principles and methods of seed production of varieties and hybrids of cereals like wheat, paddy, sorghum, pearl millet and maize. Pulses like chick pea, pigeonpea, green gram, black gram, soybean and cowpea, Oil seeds like groundnut, brassica, sesame, sunflower and castor, fiber crops like cotton and jute.

Unit IV

Vegetable crops like tomato, brinjal, okra, chilly, important cucurbitaceous crops, important forages legumes and grasses and true seed production in potato with reference to land requirements, isolation, rogueing, seed crop management, time of harvesting, threshing, extraction methods.

Unit V

Seed production technology of plantation crops like potato, sugarcane, mango, citrus, banana, guava, sapota, pineapple, grapes, apple, pear and seed production and clonal propagation of annual and perennial flowers like rose, gladiolus, chrysanthemum, marigold and dahlia.

Suggested Readings:

- Copeland, L.O., & McDonald, M.B. (2001). Principles of Seed Science and Technology. Springer.

- Bewley, J.D., Bradford, K., Hilhorst, H., & Nonogaki, H. (2012). *Seeds: Physiology of Development, Germination and Dormancy*. Springer.
- Basra, A.S. (2006). *Handbook of Seed Science and Technology*. CRC Press.
- McDonald, M.B., & Copeland, L.O. (1997). *Seed Production: Principles and Practices*. Chapman & Hall.
- Hampton, J.G., & TeKrony, D.M. (1995). *Handbook of Vigour Test Methods*. ISTA.

AGB 533: Lab Work III (Based on AGB 505 & 506)

Course Component	Description
Course Objectives	To study plant disease control methods and plant breeding techniques. To identify pathogenic organisms and understand breeding for resistance. To apply hybridization and selection methods for crop improvement.
Course Outcomes	CO1: Identify disease symptoms and pathogens under laboratory conditions. CO2: Demonstrate plant protection methods using chemicals and bioagents. CO3: Perform hybridization and selection experiments. CO4: Analyze crop breeding data using statistical tools.

List of Suggested Practicals:

1. Identification of fungal, bacterial, and viral disease specimens.
2. Preparation of fungicide and pesticide formulations.
3. Demonstration of biological control using *Trichoderma* spp.
4. Hybridization experiment in self- and cross-pollinated crops.
5. Study of pollen viability and germination.
6. Seed purity and germination tests.
7. Estimation of heritability and variability in crop populations.
8. Calculation of mean, standard deviation, and analysis of variance.
9. Field visit to crop breeding stations or seed production units.
10. Demonstration of resistant and susceptible plant varieties.

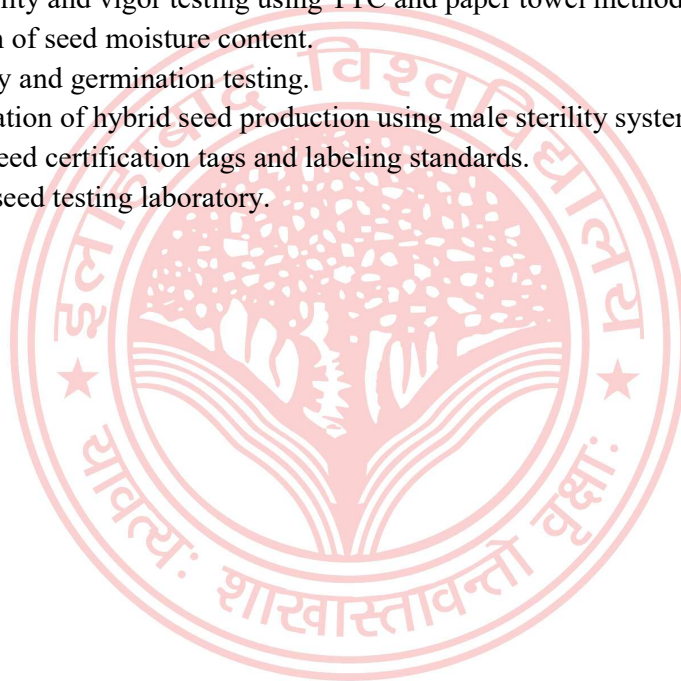
AGB 534: Lab Work IV (Based on AGB 507 & 508)

Course Component	Description
Course Objectives	To understand cellular structures and bioenergetic processes in plants. To study seed morphology, viability, and quality testing techniques.
Course Outcomes	CO1: Identify plant cell organelles using microscopy and staining methods.

	CO2: Analyze enzyme activity and bioenergetic reactions. CO3: Perform seed testing, purity, and germination assessments. CO4: Demonstrate hybrid seed production techniques.
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List of Suggested Practicals:

1. Microscopic study of cell organelles using temporary mounts.
2. Preparation of protoplasts and plasmolysis experiment.
3. Assay of enzyme activity (amylase, catalase, peroxidase).
4. Demonstration of oxidative phosphorylation and respiration rate.
5. Seed viability and vigor testing using TTC and paper towel methods.
6. Estimation of seed moisture content.
7. Seed purity and germination testing.
8. Demonstration of hybrid seed production using male sterility systems.
9. Study of seed certification tags and labeling standards.
10. Visit to a seed testing laboratory.



M.Sc. Ag. BOTANY SEMESTER-III

Course Details:

Course Code: AGB: 601

Course Title: Microbiology and Plant Pathology

Course Credit: 03

Course Objectives:

Describe major microbial groups and plant diseases. Analyze pathogen physiology and infection mechanisms. Evaluate control measures and disease forecasting.

Course Outcomes (COs):

CO1: Describe major microbial groups and plant diseases.

CO2: Analyze pathogen physiology and infection mechanisms.

CO3: Evaluate control measures and disease forecasting.

CO-PO and CO-PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	3	2	2	2.67
CO2	3	3	3	3	2	3	2.83
CO3	3	3	3	3	2	3	2.83
Average	3.00	3.00	3.00	3.00	2.00	2.67	2.78
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

History of Mycology, Physiology of fungi, structure and life history of chief representatives of fungi, Morphology, classification and characteristics of plant pathogenic bacteria, Symptoms and transmission of viral diseases of plants.

Unit II

Physiological plant diseases- Diseases due to unfavorable environmental condition with particular reference to the following: Black tip of mango, chlorosis and sun scald,

Unit III

Physiology of penetration and infection in fungi. Pathogen factors in the physiology of disease- toxins, enzymes and other metabolites. Factors governing resistance and susceptibility of the host of disease.

Unit IV

Influence of environmental factors on plant disease, Epiphytotics and conditions necessary for its establishment, Physiological specialization in parasitic fungi, forecasting of plant diseases.

Unit V

Study of important bacterial, viral, mycoplasma and fungal diseases of wheat, barley, rice, gram, maize, bazra, potato, brassica, groundnut, linseed, sugarcane, guava, papaya, apple, peach, pear, cucurbits and banana, A study of the economically important flowering parasites, Orobanche, Cuscuta, Striga, Loranthus and Biscum, Important nematode diseases of plants.

Suggested Readings:

- Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. (2009). Microbiology. McGraw Hill.
- Agrios, G.N. (2005). Plant Pathology. Elsevier Academic Press.
- Alexopoulos, C.J., Mims, C.W., & Blackwell, M. (1996). Introductory Mycology. John Wiley & Sons.
- Singh, R.S. (2006). Introduction to Principles of Plant Pathology. Oxford & IBH Publishing.
- Madigan, M.T., & Martinko, J.M. (2017). Brock Biology of Microorganisms. Pearson.

Course Details:

Course Code: AGB: 602

Course Title: Seed Processing and Storage

Course Credit: 03

Course Objectives:

Explain seed drying, grading, and storage principles. Apply techniques for maintaining seed health and viability. Evaluate pest and pathogen management in storage.

Course Outcomes (COs):

CO1: Explain seed drying, grading, and storage principles.

CO2: Apply techniques for maintaining seed health and viability.

CO3: Evaluate pest and pathogen management in storage.

CO–PO and CO–PSO Mapping Table

CO → /	PO1	PO2	PO3	PO4	PO5	PO6	Average
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PO ↓							
CO1	3	3	3	2	2	3	2.67
CO2	3	3	3	2	2	3	2.67
CO3	3	3	3	2	2	3	2.67
Average	3.00	3.00	3.00	2.00	2.00	3.00	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Principles of seed processing, seed drying principles and methods, Pre-cleaning, grading, treating and packaging.

Unit II

Need for storage, Storage behaviour of orthodox. Factors affecting seed storage and role of moisture, temperature, RH and moisture equilibrium, Storage structures, Methods of stacking and their impact, Germplasm storage.

Unit III

Significance of seed health, Mode of mechanism of transmission of micro-organisms- Fungi, bacteria and viruses. Procedures for seed health test and rules. Externally and internally seed-borne pathogens, mode of infection, development and spread. Methods of detection of seed-borne diseases.

Unit IV

Important seed-borne diseases of cereals, oilseeds, pulses, fiber, crops, vegetables and their control measures.

Unit V

Important storage pests, their identification, monitoring and detection, Biology, ET value, nature and extent of damage, natural enemies and management. Important insecticides and their uses.

Suggested Readings:

- Copeland, L.O., & McDonald, M.B. (2001). Principles of Seed Science and Technology. Springer.
- Basra, A.S. (2006). Handbook of Seed Science and Technology. CRC Press.
- Justice, O.L., & Bass, L.N. (1978). Principles and Practices of Seed Storage. USDA Publication.
- Agarwal, P.K., & Dadlani, M. (1992). Techniques in Seed Science and Technology. South Asian Publishers.

- Harrington, J.F. (1972). Seed Storage and Longevity. In Seed Biology (Academic Press).

Course Details:

Course Code: AGB: 603

Course Title: Weed Control

Course Credit: 03

Course Objectives:

Identify major weeds and their characteristics. Apply mechanical, chemical, and biological control methods. Evaluate environmental microbial pathogenesis and control. Evaluate molecular plant pathology approaches and management.

Course Outcomes (COs):

CO1: Identify major weeds and their characteristics.

CO2: Apply mechanical, chemical, and biological control methods.

CO3: Evaluate environmental

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	2	3	3	2	3	2.67
CO2	3	2	3	3	2	3	2.67
CO3	3	2	3	3	2	3	2.67
Average	3.00	2.00	3.00	3.00	2.00	3.00	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5		Average
CO1	3	3	3	3	3		3.00
CO2	3	3	3	3	3		3.00
CO3	3	3	3	3	3		3.00
Average	3.00	3.00	3.00	3.00	3.00		3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Characteristics and classification of weeds: Harmful effect and usefulness of weeds.

Unit II

A study of Botany of important weeds associated with the crop plants of the region.

Unit III

Methods of preventing introduction and spread of weeds, principles and procedure of weed control.

Unit IV

Ecological study of weeds, Mechanical, Biological and chemical methods of weed control.

Unit V

Classification of pesticides, problems of pesticidal residue in soil, Effect of weed control methods on environment, Calibration of sprayers.

Suggested Readings:

- Gupta, O.P. (2016). Weed Management: Principles and Practices. Agrobios Publishers.
- Zimdahl, R.L. (2018). Fundamentals of Weed Science. Academic Press.
- Auld, B.A., & Medd, R.W. (1987). Weed Control: Principles and Practices. Edward Arnold.
- Rao, V.S. (2000). Principles of Weed Science. Science Publishers.
- Coble, H.D., & Mortensen, D.A. (1992). The Role of Weed Science in Sustainable Agriculture. Weed Technology.

Course Details:

Course Code: AGB: 604

Course Title: Plant Metabolism and Special Problems of Crop Physiology

Course Credit: 03

Course Objectives:

Explain metabolic pathways including photosynthesis and respiration. Analyze nitrogen and hormone metabolism. Evaluate physiological constraints affecting crop yield.

Course Outcomes (COs):

CO1: Explain metabolic pathways including photosynthesis and respiration.

CO2: Analyze nitrogen and hormone metabolism.

CO3: Evaluate physiological constraints affecting crop yield.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	3	2	3	2.83
CO2	3	3	3	3	2	3	2.83
CO3	3	3	3	3	2	3	2.83
Average	3.00	3.00	3.00	3.00	2.00	3.00	2.83

CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average
CO1	3	3	3	3	3	3.00
CO2	3	3	3	3	3	3.00
CO3	3	3	3	3	3	3.00
Average	3.00	3.00	3.00	3.00	3.00	3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

General properties of amino acids, protein-amino acids and protein in amino acids, polypeptides, primary, secondary and tertiary structure of proteins, Detailed study of nitrogen metabolism. Biosynthesis of proteins

Unit II

Role of nucleic acids, bases, nucleotides, DNA, RNA, role of nucleic acids, genetic code and control.

Unit III

Naturally occurring growth substances, auxins, gibberellins, cytokines, inhibitors and vitamins in plants.

Unit IV

Detailed study of photosynthesis and role of carbon assimilation in crop production, Respiration, respiratory substrates, factors affecting respiration, aerobic and alcoholic fermentation and their inter-relationships, Metabolisms of organic acids, Metabolism of fats.

Unit V

Physiological basis of pruning, lodging unfruitfulness and yield. Factors affecting root ratio, Special physiological problems connected with crops like sugarcane, cotton, hemp, wheat, tobacco, rice and groundnut etc.

Suggested Readings:

- Taiz, L., Zeiger, E., Møller, I.M., & Murphy, A. (2018). Plant Physiology and Development. Sinauer Associates.
- Hopkins, W.G., & Hüner, N.P.A. (2008). Introduction to Plant Physiology. Wiley.
- Nelson, D.L., & Cox, M.M. (2017). Lehninger Principles of Biochemistry. W.H. Freeman.
- Heldt, H.-W., & Piechulla, B. (2011). Plant Biochemistry. Academic Press.
- Buchanan, B.B., Gruissem, W., & Jones, R.L. (2015). Biochemistry and Molecular Biology of Plants. Wiley.

AGB 631: Lab Work V (Based on AGB 601 & 602)

Course Component	Description
Course Objectives	To identify plant pathogens and study

	seed processing and storage methods. To assess seed health and storage pest management.
Course Outcomes	CO1: Identify plant pathogens using microbiological and serological methods. CO2: Evaluate seed health using laboratory testing procedures. CO3: Demonstrate seed processing and packaging techniques. CO4: Manage storage pests using integrated methods.

List of Suggested Practicals:

1. Isolation and identification of seed-borne fungi and bacteria.
2. Seed health testing using blotter and agar plate methods.
3. Moisture content determination of seeds.
4. Study of seed grading and cleaning machines.
5. Demonstration of seed treatment using fungicides.
6. Seed packaging and labeling methods.
7. Study of storage structures and pest damage symptoms.
8. Identification of major storage pests and their control measures.
9. Germination and viability tests after storage periods.
10. Visit to seed processing and certification centers.

AGB 632: Lab Work VI (Based on AGB 603 & 604)

Course Component	Description
Course Objectives	To study weed identification and control methods. To examine metabolic pathways and physiological parameters influencing yield.
Course Outcomes	CO1: Identify major weeds and study their biology. CO2: Evaluate mechanical, biological, and chemical weed control techniques. CO3: Demonstrate photosynthesis, respiration, and enzyme metabolism experiments. CO4: Relate physiological processes with crop yield performance.

List of Suggested Practicals:

1. Identification of major field and aquatic weeds.

2. Study of herbicide application and sprayer calibration.
3. Preparation of herbicide formulations.
4. Observation of photosynthetic activity using IRGA or similar instruments.
5. Measurement of respiration using respirometer.
6. Study of effect of growth regulators on seed germination and elongation.
7. Estimation of protein and carbohydrate content in leaves.
8. Analysis of chlorophyll fluorescence and photochemical efficiency.
9. Assessment of enzymatic activity during seed germination.
10. Visit to crop fields demonstrating weed management practices.

11. M.Sc. Ag. BOTANY SEMESTER-IV

Course Details:

Course Code: AGB: 605

Course Title: Agro-ecology of Crop Plants

Course Credit: 03

Course Objectives:

Explain ecological principles in crop management. Analyze environmental factors affecting crop growth. Evaluate biodiversity and ecosystem sustainability.

Course Outcomes (COs):

CO1: Explain ecological principles in crop management.

CO2: Analyze environmental factors affecting crop growth.

CO3: Evaluate biodiversity and ecosystem sustainability.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	2	3	3	3	3	2.83
CO2	3	2	3	3	3	3	2.83
CO3	3	2	3	3	3	3	2.83
Average	3.00	2.00	3.00	3.00	3.00	3.00	2.83
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Concept of crop ecology and its scope in agronomic pursuits, Plant succession, units of vegetation competition and invasion, reaction and stabilization, factors of habitat and development. The ecological optimum and crop distribution, Plant and plant communities as indicators of soil and weather conditions.

Unit II

Temperature effects on plants, length of growing season, thermal and physiological growing season, limits of crop production, Effects of low temperature, chilling and freezing of plants, low night temperature, concepts of freezing injury, Ice crystal formation in intercellular spaces, desiccation theory, chemical injury to protoplasm, evaluation of the degree of hardness, Plan characteristics associated with drought and cold resistance.

Unit III

Responses of crop plants to humidity, evaporation and wind variation crop and ecosystem. Physical Environment, biotic environment, biotic and abiotic interactions.

Unit IV

Structure of function, energy flow and mineral cycling (CNP) primary production and decomposition, structure and function of some Indian ecosystems.

Unit V

Environmental pollution, global environment change, biodiversity status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches.

Suggested Readings:

- Odum, E.P. (2005). Fundamentals of Ecology. Cengage Learning.
- Begon, M., Townsend, C.R., & Harper, J.L. (2006). Ecology: From Individuals to Ecosystems. Wiley.
- Sinclair, T.R., & Muchow, R.C. (1999). Radiation Use Efficiency. Advances in Agronomy.
- Smith, R.L., & Smith, T.M. (2015). Elements of Ecology. Pearson.
- Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications.

Course Details:

Course Code: AGB: 606

Course Title: Agr Problems in Crop Production

Course Credit: 03

Course Objectives:

Identify constraints in crop production. Analyze soil fertility, nutrient, and water issues.

Propose sustainable solutions for yield enhancement.

Course Outcomes (COs):

CO1: Identify constraints in crop production.

CO2: Analyze soil fertility, nutrient, and water issues.

CO3: Propose sustainable solutions for yield enhancement.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	2	2	3	2.67
CO2	3	3	3	2	2	3	2.67
CO3	3	3	3	2	2	3	2.67
Average	3.00	3.00	3.00	2.00	2.00	3.00	2.67
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5	Average	
CO1	3	3	3	3	3	3.00	
CO2	3	3	3	3	3	3.00	
CO3	3	3	3	3	3	3.00	
Average	3.00	3.00	3.00	3.00	3.00	3.00	

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Content (Units)

Unit I

Problems relating to the production of major crops, Maximization of crop yields and their apparent limitations.

Unit II

Fertility evaluation, fertility management in relation to physico-chemical properties of soils, Phosphorus deficiency and soil fertility, Fixation of nutrients in soil, Soil potassium in relation to soil fertility and plants growth and development, C/ N ratio as a function of growth and development.

Unit III

lant problems and methods with special reference to N, P, K and Ca. The problems of irrigated soils, Tillage and influence of plant growth.

Unit IV

Soil microorganisms and their role in production, Principles and practices of dry farming, special problems in during mixed cropping and strip cropping in agriculture in India, Agronomic practices in relation to soil acidity and alkalinity.

Unit V

Soil fertility and soil productivity, assessment of soil fertility, crop planning and budgeting, crop rotation, cropping scheme, cropping intensity, rotational intensity, system of cropping, water management, soil conservation.

Suggested Readings:

- Reddy, S.R. (2017). Principles of Crop Production. Kalyani Publishers.
- Gardner, F.P., Pearce, R.B., & Mitchell, R.L. (1985). Physiology of Crop Plants. Iowa State University Press.
- Tisdale, S.L., Nelson, W.L., Beaton, J.D., & Havlin, J.L. (2003). Soil Fertility and Fertilizers. Pearson.
- Brady, N.C., & Weil, R.R. (2016). The Nature and Properties of Soils. Pearson.
- FAO. (2000). Soil and Water Management for Sustainable Agriculture. FAO Publication.

AGB 633: Lab Work VII (Based on AGB 605 & 606)

Course Component	Description
Course Objectives	To study agro-ecological factors affecting crop growth and production. To analyze soil fertility and plant nutrient management in cropping systems.
Course Outcomes	CO1: Measure ecological parameters affecting crop productivity. CO2: Evaluate soil and water samples for fertility status. CO3: Demonstrate techniques for soil conservation and fertility enhancement. CO4: Design cropping systems for sustainable agriculture.

List of Suggested Practicals:

12. Measurement of soil temperature, moisture, and pH.
13. Estimation of available nitrogen, phosphorus, and potassium in soil.
14. Study of soil microbial populations and their functions.
15. Measurement of light intensity and humidity in crop fields.
16. Observation of crop succession and community structure.
17. Analysis of soil fertility through chemical and biological assays.
18. Study of biodiversity indices and ecosystem interactions.
19. Demonstration of water harvesting and conservation techniques.
20. Preparation of crop rotation and cropping system plans.
21. Field visit to ecological and agronomic research sites.

Course Details:

Course Code: AGB: 607

Course Title: Dissertation / thesis

Course Credit: 03

Course Objectives:

Design and execute independent research projects. Analyze and interpret experimental data statistically. Present research findings effectively.

Course Outcomes (COs):

CO1: Design and execute independent research projects.

CO2: Analyze and interpret experimental data statistically.

CO3: Present research findings effectively.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	3	3	3	3.00
CO2	3	3	3	3	3	3	3.00
CO3	3	3	3	3	3	3	3.00
Average	3.00	3.00	3.00	3.00	3.00	3.00	3.00
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5		Average
CO1	3	3	3	3	3		3.00
CO2	3	3	3	3	3		3.00
CO3	3	3	3	3	3		3.00
Average	3.00	3.00	3.00	3.00	3.00		3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

Course Details:

Course Code: AGB: 65/652/653

Suggested reading:

- Kothari, C.R. (2004). Research Methodology: Methods and Techniques. New Age International.
- Gomez, K.A., & Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. Wiley.
- Cochran, W.G., & Cox, G.M. (1992). Experimental Designs. Wiley.
- Panse, V.G., & Sukhatme, P.V. (1985). Statistical Methods for Agricultural Workers. ICAR Publication.
- Day, R.A., & Gastel, B. (2012). How to Write and Publish a Scientific Paper. Cambridge University Press.

Course Title: Elective papers (Physiology/Genetics/Microbiology)

Course Credit: 03

Course Objectives:

Study water relations and drought resistance mechanisms. Apply nutrient management and crop physiology concepts. Understand chromosomal variation and breeding strategies. Apply induced variation and selection methods. Advanced concepts in the respective elective papers.

Course Outcomes (COs):

CO1: Demonstrate advanced knowledge in chosen specialization.

CO2: Apply experimental approaches in field or lab.

CO3: Evaluate current research and practices.

CO–PO and CO–PSO Mapping Table

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	Average
CO1	3	3	3	3	2	3	2.83
CO2	3	3	3	3	2	3	2.83
CO3	3	3	3	3	2	3	2.83
Average	3.00	3.00	3.00	3.00	2.00	3.00	2.83
CO → / PSO ↓	PSO1	PSO2	PSO3	PSO4	PSO5		Average
CO1	3	3	3	3	3		3.00
CO2	3	3	3	3	3		3.00
CO3	3	3	3	3	3		3.00
Average	3.00	3.00	3.00	3.00	3.00		3.00

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No relation

AGB 634-636: Lab Work VIII (Based on Electives & Dissertation)

Course Component	Description
Course Objectives	To develop practical research skills through experimental work in chosen specialization. To apply analytical, molecular, or physiological tools in dissertation projects. To interpret data and communicate scientific results effectively.
Course Outcomes	CO1: Conduct independent research with proper methodology and documentation. CO2: Analyze data using relevant statistical tools. CO3: Prepare research reports and presentations in scientific format. CO4: Demonstrate hands-on experience in

	advanced instrumentation and data interpretation.
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List of Suggested Practicals:

1. Designing and setting up research experiments based on dissertation topic.
2. Collection and preparation of plant, soil, or microbial samples.
3. Operation of instruments such as spectrophotometer, PCR, electrophoresis unit.
4. Measurement of physiological or biochemical parameters.
5. Microscopy and image documentation of experimental samples.
6. Data recording, tabulation, and statistical analysis using software tools.
7. Preparation of figures, charts, and scientific graphs.
8. Preparation of a short-term report or seminar presentation.
9. Thesis writing and referencing techniques.
10. Presentation and viva-voce of dissertation work.

