JIWAJI UNIVERSITY
GWALIOR (M.P.)

SYLLABUS

FOR

School of Studies in Botany

M. Sc. (Botany)

CBCS
(Choice Based Credit System)

SESSION

2019 – 2021

M.Sc. Botany, Choice Based Credit System-2019-21
Course Structure and Scheme of Examination

Semester	Course Code	Title of Paper(s)		Course Type	Credit				
					L	T	P	Total	Marks
FIRST	**BOT 101**	Bacteriology, Virology & General Microbiology		Core	3	0	-	3	**100**
	BOT 102	Biology and Diversity of Fungi and Plant Pathology		Core	3	0	-	3	**100**
	BOT 103	Biology and Diversity of Algae, Bryophytes and Lichens		Core	3	0	-	3	**100**
	BOT 104	Biology and Diversity of Pteridophytes and Gymnosperms		Core	3	0	-	3	**100**
	BOT 105	Lab Course I		Core	0	-	3	3	**100**
	BOT 106	Lab Course II		Core	0	-	3	3	**100**
	BOT-107	Seminar		AE & SD	-	-	-	1	**100**
	BOT-108	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education		AE & SD	-	-	-	1	**100**
		Total Valid Credits						**20**	
	BOT-109	Comprehensive viva-voce exam		**Virtual credit**				**4**	**100**
	Total Credits for First Semester (Valid Credits + virtual Credits)							**24**	**900**
SECOND	**BOT 201**	Ecology-I Climatology, Soil Science and Autecology		Core	3	0	-	3	**100**
	BOT 202	Angiosperm anatomy, Embryology and Palynology		Core	3	0	-	3	**100**
	BOT 203	Water Relations, Growth and Development		Core	3	0	-	3	**100**
	BOT 204	Plant Biochemistry and Metabolism		Core	3	0	-	3	**100**
	BOT 205	Lab Course I		Core	0	-	3	3	**100**
	BOT 206	Lab Course II		Core	0	-	3	3	**100**
	BOT-207	Seminar		AE & SD	-	-	-	1	**100**
	BOT-208	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education		AE & SD	-	-	-	1	**100**
		Total Valid Credits						**20**	
	BOT-209	Comprehensive viva-voce exam		**Virtual credit**				**4**	**100**
	Total Credits for Second Semester (Valid Credits + virtual Credits)							**24**	**900**
THIRD	**BOT 301**	Angiosperm Morphology & Taxonomy		Core	3	0	-	3	**100**
	BOT 302	Ecology-II Synecology, Ecosystematology & Phytogeography		Core	3	0	-	3	**100**
	BOT 303	Plant Biotechnology: In Vitro Culture, Genetic Engineering and IPR Issue		Elective	3	0	-	3	**100**
	BOT 304	Major Elective	1. Ethnobotany and isolation of natural products. 2. Pollution Ecology	Elective	3	0	-	3	**100**
	BOT 305	**Lab Course I**		Core	0	-	3	3	**100**
	BOT 306	**Lab Course II**		Core	0	-	3	3	**100**
	BOT-307	Seminar-II		AE & SD	-	-	-	1	**100**
	BOT-308	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education		AE & SD	-	-	-	1	**100**
		Total Valid Credits						**20**	
	BOT-309	Comprehensive viva-voce exam		**Virtual credit**				**4**	**100**
	Total Credits for Third Semester (Valid Credits + virtual Credits)							**24**	**900**
FOURTH	**BOT 401**	Genetics, Plant Breeding and Evolution		Core	3	0	-	3	**100**
	BOT 402	Cytology and Molecular Biology of Plants		Core	3	0	-	3	**100**
	BOT 403	Major Elective I	1. Industrial Microbiology 2. Plant Pathology	Elective	3	0	-	3	**100**
	BOT 404	Major Elective II	1. Agroecology 2. Stress Physiology	Elective	3	0	-	3	**100**
	BOT 405	**Lab Course I**		Core	0	-	3	3	**100**
	BOT 406	**Lab Course II**		Core	0	-	3	3	**100**
	BOT-407	Seminar-II		AE & SD	-	-	-	1	**100**
	BOT-408	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education		AE & SD	-	-	-	1	**100**
		Total Valid Credits						**20**	
	BOT-409	Comprehensive viva-voce exam		**Virtual credit**				**4**	**100**
	Total Credits for Fourth Semester (Valid Credits + virtual Credits)							**24**	**900**
Total Credits for the Course (20X4=80) + (4X4=16)								**96**	

Minimum Number of the Credits to be earned for the award of Degree=96

* Elective courses shall be conducted as per availability of permanent faculty

* AE & SD – Ability Enhancement and Skill development

SEMESTERWISE SCHEME IN DETAIL

Semester - I

Code	Title of Course	Core / Generic / Centric	T	P	Total Credits	Marks					
						Internal		External		Total	
						Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
BOT 101	Bacteriology, Virology & General Microbiology	Core	3	0	3	40	14	60	21	100	35
BOT 102	Biology and Diversity of Fungi and Plant Pathology	Core	3	0	3	40	14	60	21	100	35
BOT 103	Biology and Diversity of Algae, Bryophytes and Lichens	Core	3	0	3	40	14	60	21	100	35
BOT 104	Biology and Diversity of Pteridophytes and Gymnosperms	Core	3	0	3	40	14	60	21	100	35
BOT 105	Lab Course I	Core	0	3	3	40	14	60	21	100	35
BOT 106	Lab Course II	Core	0	3	3	40	14	60	21	100	35
BOT 107	Seminar	AE & SD	1	0	1	100	35	-	-	100	35
BOT 108	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education	AE & SD	1	0	1	100	35	-	-	100	35
BOT 109	Comprehensive Viva Voce	Core	0	0	4			100	35	100	35

Total Credit Value: # 24 (20 + 4 virtual credits)

* AE & SD – Ability Enhancement and Skill development

SEMESTER WISE SCHEME IN DETAIL
Semester - II

Code	Title of Course	Core / Generic / Centric	T	P	Total Credits	Marks					
						Internal		External		Total	
						Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
BOT 201	Ecology-I Climatology, Soil Science and Autecology	Core	3	0	3	40	14	60	21	100	35
BOT 202	Angiosperm anatomy, Embryology and Palynology	Core	3	0	3	40	14	60	21	100	35
BOT 203	Water Relations, Growth and Development	Core	3	0	3	40	14	60	21	100	35
BOT 204	Plant Biochemistry and Metabolism	Core	3	0	3	40	14	60	21	100	35
BOT 205	Lab Course I	Core	0	3	3	40	14	60	21	100	35
BOT 206	Lab Course II	Core	0	3	3	40	14	60	21	100	35
BOT 207	Seminar	AE & SD	1	0	1	100	35	-	-	100	35
BOT 208	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education	AE & SD	1	0	1	100	35	-	-	100	35
BOT 209	Comprehensive Viva Voce	Core	0	0	4			100	35	100	35

Total Credit Value: # 24 (20 + 4 virtual credits)

* AE & SD – Ability Enhancement and Skill development

SEMESTERWISE SCHEME IN DETAIL

Semester - III

Code	Title of Course	Core / Generic / Centric	T	P	Total Credits	Marks					
						Internal		External		Total	
						Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
BOT 301	Angiosperm Morphology & Taxonomy	Core	3	0	3	40	14	60	21	100	35
BOT 302	Ecology-II Synecology, Ecosystematology & Phytogeography	Core	3	0	3	40	14	60	21	100	35
BOT 303	Plant Biotechnology: In Vitro Culture, Genetic Engineering and IPR Issue	Elective	3	0	3	40	14	60	21	100	35
BOT 304	Major Elective: 1. Ethnobotany and isolation of natural products. 2. Pollution Ecology	Elective	3	0	3	40	14	60	21	100	35
BOT 305	Lab Course I	Core	0	3	3	40	14	60	21	100	35
BOT 306	Lab Course II	Core	0	3	3	40	14	60	21	100	35
BOT 307	Seminar	AE & SD	1	0	1	100	35	-	-	100	35
BOT 308	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education	AE & SD	1	0	1	100	35	-	-	100	35
BOT 309	Comprehensive Viva Voce	Core	0	0	4			100	35	100	35

Total Credit Value: # 24 (20 + 4 virtual credits)

* AE & SD – Ability Enhancement and Skill development

SEMESTERWISE SCHEME IN DETAIL

Semester - IV

Code	Title of Course		Core / Generic / Centric	T	P	Total Credits	Marks					
							Internal		External		Total	
							Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
BOT 401	Genetics, Plant Breeding and Evolution		Core	3	0	3	40	14	60	21	100	35
BOT 402	Cytology and Molecular Biology of Plants		Core	3	0	3	40	14	60	21	100	35
BOT 403	Major Elective I	1. Industrial Microbiology 2. Plant Pathology	Elective	3	0	3	40	14	60	21	100	35
BOT 404	Major Elective II	1. Agroecology 2. Stress Physiology	Elective	3	0	3	40	14	60	21	100	35
BOT 405	Lab Course I		Core	0	3	3	40	14	60	21	100	35
BOT 406	Lab Course II		Core	0	3	3	40	14	60	21	100	35
BOT 407	Seminar		AE & SD	1	0	1	100	35	-	-	100	35
BOT 408	Assignment/Personality development/Yoga/ language/ Environment/ Physical Education		AE & SD	1	0	1	100	35	-	-	100	35
BOT 409	Comprehensive Viva Voce		Core	0	0	4			100	35	100	35

Total Credit Value: # 24 (20 + 4 virtual credits)

* AE & SD – Ability Enhancement and Skill development

Since its inception, the School of Studies in Botany has been actively engaged in conducting high grade research work. More than 150 students have obtained Ph.D. degree under the supervision of the teachers of the School. The School of Studies in Botany has occupied an important position amongst the institutions of the country. Several research projects sponsored by DST, DBT, DOEn, MPCST, Potash Research Institute, UGC, ICMR etc. have been conducted successfully. The department is also supported by DST (FIST) Programme. Many teachers of the School have been honored by various international and national awards. Highly qualified teachers of the School are specialized in various fields viz. Plant Pathology, Mycology, Ethnobotany, Ecology, Microbial Physiology, Industrial Microbiology and Microbial Biotechnology. The School is well equipped with a number of modern instruments like, Portable Photosynthesis Unit, Gel Electrophorosis Unit, Water Purification Unit, Bomb Colori meter, Lypholizer, Phase contrast Microscope, Nitrogen analyser, UV- Vis Spectrophotometer, PCR, High Speed Centrifuge, Deep Freezer, Air Samplers etc. The School has organized several conferences, seminars, symposia workshops and Refresher courses. International eminent botanists of the country have been associated with the School as visiting and honorary professors. The Botanical garden of the department comprises a good number of taxa of various groups including a large number of medicinal plants. The Herbarium consists of over 6500 specimens and is recognized by New York Botanical Garden, New York.

M.Sc. Botany

M.Phil. Botany

Ph.D. Botany

Programme Outcomes (POs)

1. **PO1. Holistic approach:** The programme gives an insight into the holistic concept of Botany.
2. **PO2. Critical Thinking**: Identifying the assumptions that frame our actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
3. **PO3. Effective Communication:** Read, Write, Speak and listen clearly in English and Hindi (Bilingual).
4. **PO4. Ethics:** Recognize different value and moral systems and correlate them with present environment and plant system..
5. **PO5. Effective Citizenship:** Demonstrate social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
6. **PO6. Environment and sustainability:** Understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
7. **PO7. Plant Resource:** To understand the value of plant resource and their importance in Biodiversity conservation, for future generation.

Programme Specific Outcomes (PSOs)

The programme of Botany is designed to prepare post graduates to understand the following:

PSO1: An ability to understand and identify the vegetation in nature

PSO2: An ability apply various conservation practices to different species of lower and higher plants.

PSO3: To display critical thinking for creating new ideas and innovative concepts.

PSO4: To explore world class research opportunities for doctoral and post- doctoral studies.

PSO5: To demonstrate broad mindset with respect to knowledge penetration and accumulation in their professional activities.

PSO6: To enhance project the potential of students and for getting appropriate endorsement through qualifying competitive examinations, of All India level.

PSO7: To understand the application of Botany to various faculties of biological science.

Course outcome:

- Students will be able to know about the basic knowledge of bacteria and various diseases caused by different forms of bacteria.
- Students will be able to classify the bacteria on the basis of their growth, morphology and nutrition characteristics.
- It also includes the methods of purification of bacteria; their physical and chemical control.
- Provides knowledge about viruses, their transmission, cultivation and diseases caused by them.
- In addition to the basic knowledge, the course includes the laboratory techniques that include various methods which will help the students to isolate the bacteria and identify them.
- The course provides the detailed understanding of fixation of Nitrogen into usable forms and also the conversion of waste products into useful ones.

UNIT 1:

Bacterial taxonomy; Taxonomic criteria for the identification of bacteria.
Identification of bacteria.
General characters of *Rickettsia* and *Chlamydia.*
Diseases caused by *Rickettsia* and *Chlamydia.*
Mode of nutrition in bacteria; autotrophy, heterotrophy, symbiosis.

UNIT II

General account of sterilization and disinfection. Culture media, pure culture techniques;
A general idea about bacterial toxins and enzymes;
Bacteriophage; General account and importance.
Bacterial diseases: caused by *Escherichia coli, Shigella.*

UNIT III

General properties and evolution of viruses;
Cultivation of virus and viral assay;
Transmission of plant viruses and control measures.
Oncogeneic viruses and tumorogenesis;
Viral diseases: Encephalitis, Hepatitis AIDS and Rabies.

UNIT IV

Biological nitrogen fixation: symbiotic and non symbiotic nitrogen - fixation;
Fermentation technology: principle and types of fermentation.
Microbial degradation of pesticides and hydrocarbons.
Mycoplasma: general account and important diseases caused by them.

UNIT V

Microbial conversion of waste product with particular reference to alcohol and biogas
General account of Immunity, properties of antigens and antibodies.
Allergy and types of allergies.
Mycotoxins and their harmful effects.

PRACTICALS: 101

1. Preparation of culture media.
2. Isolation of *Bacillus* and *Rhizobium* spp form soil and nodules.
3. Various methods of bacterial staining to study cell wall, endospore, capsule and flagella.
4. Identification of important genera by using biochemical tests: *Escherichia. Azotobacter, Staphylococcus, Bacillus, Pseudomonas, Rhizobium, Streptomyces, Xanthomonas.*
5. Construction of bacterial growth curve.
6. Quantitative estimation of bacteria in milk.
7. Isolation of streptomycin – resistant mutants of bacteria.
8. Sensitivity test of bacteria using different antibiotics.
9. Purification of TMV and study of thermal inactivation point and dilution point.
10. Virus concentration determination by local lesion on host.
11. Study of common vectors of plant virus: Nematodes, fungi and insects.
12. Bacteriophage isolation
13. Isolation and enumeration of bacteria: Actinomycetes and fungi from soil, rhizosphere and seed using different techniques.
14. Use of selective media for isolating micro- organisms.
15. Fermentation of alcohol and biogas from waste materials (Demonstration)

BOT 102: BIOLOGY AND DIVERSITY OF FUNGI AND PLANT PATHOLOGY

Course outcome:

- To gain knowledge of fungal diversity in nature.
- To develop an understanding about important sub- divisions of fungi.
- To develop an insight into cultivation techniques of Mushroom.
- Identify the symptoms of plant disease on the basis of symptomatological characters.
- To get the information about how to control plant disease by the use of physical, chemical and biological methods.

UNIT I

Recent trends on the classification of fungi with reference to morphological and
Para- morphological criteria;
Symptomatology of fungal, bacterial and viral diseasesin plants.

UNIT II

Comparative study of following sub-divisions;
Mastigomycotina: *Albugo,Peronospora, Plasmopora.*
Zygomycotina: *Mucor, Rhizopus, Syncephalastrum*
Ascomycotina: *Tapharina, Emericella, Penicillium, Chaetomium, Morchella*

UNIT III

Comparative study of following sub-divisions;
Basidiomycotina: *Puccinia, Melampsora, Ustilago, Polyporus, Cyathus*
Deuteromycotina: *Fusarium, Cercospora, Colletotrichum.*
Mushroom cultivation: Mycorrhizal application in agriculture and forestry;
Fungal cytology and genetics: Heterothallism, heterokaryosis, parasexual cycle, mutation.

UNIT IV

Symptomatology, etiology and control of the following crop diseases:

1. Paddy: paddy blast, paddy blight
2. Wheat: Black stem rust, Bunt of wheat
3. Bajara: green ear and Ergot
4. Sugarcane: Red rot disease of sugarcane.
5. Ground nut: Tikka disease
6. Maize Smut

UNIT V

Principles and methods of pre and post harvest plant disease management.;
Disease control by physical, chemical and biological methods, resistant varieties;
Crop rotation, plant quarantines, seed certification

PRACTICALS: 102

1. Study of the morphological characters and reproductive structures of the some genera mentioned in the syllabus.
2. Study of symptomatology of some diseased species.
3. Staining techniques, induction and isolation of mutants.
4. Carbon and nitrogen utilization by fungi (in culture) vitamin requirement,
5. Study of diseased specimens of plants with reference to symptomatology.
6. Isolation, purification and single spore culture of pathogens.
7. Measurement of the activity of enzymes of fungal pathogens: Cellulose, Pectinases.
8. Laboratory testing of fungicides (systemic and non-systemic) against pathogenic fungi.
9. Demonstration of biological control of pathogenic fungi *in vitro*.

BOT 103: BIOLOGY AND DIVERSITY OF ALGAE, BRYOPHYTES AND LICHENS

Course outcome:

- To study the diversity of aquatic flora and amphibian flora i.e. Algae, Bryophytes and Lichens.
- To understand the pigment system of different types of algae and their economic importance along with their taxonomy.
- To understand the projection of algae as a fertiliser and in Biotechnology.
- To understand the Bryophytes and Lichens as a phyto-indicators for pollution and soil fertility.

UNIT I

Comparative survey of important systems of classification of algae;
Criteria for algal classification and modern trends;
Diagnostic features of algal phyla, range of thallus and reproductive diversity; life history patterns, parallelism and evolution.

UNIT II

Comparative account of algal pigments ; light microscopic structure, ultra structure and function of cell wall, flagella, chloroplast, pyrenoids and eyespots and their importance in taxonomy.
Study of Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta up to the order level with reference to the following genera: *Anabaena, Gonium, Chlorella, Enteromorpha, Bulbochaete, Clostridium, Acetabularia, Nitella, Botrydium, Navicula, Cyclotella, Batrachospermum* and *Gracillaria*.

UNIT III

General characteristics of the division: Diophyta, Chrysophyta and Cryptophyta.
Distribution of algae in soil, fresh water and marine environment, role of algae in soil fertility, productivity in fresh water and marine environment, algae in symbiotic association, algae as indicator of pollution, fossil algae, algae in biotechnology, algal use in Bioremediation, Role of algae in different practices related to water

UNIT IV

Bryophytes: Origin, Life history, Distribution, Evolution & Affinites.
Primitive vs. advanced characters, derived features. Classification.
Comparative morphological, anatomical and cytological studies of gametophyte and sporophytes of Calobryales, Jungermanniales, Sphaerocarpales, Marchantiales, Takakiales, Sphagnales, Andreales and Bryales.

UNIT V

Growth Differentiation : Spore germination, Protonemal differentiation, bud formation.
Parthenogenesis, apogamy, apospory and regeneration.
Ecology and Economic Importance of Bryophytes. Contribution to Bryophytes in India.
Bryogeographical regions of India with reference to central India.
Lichens: General account, structure and reproduction.
Lichens as pollution indicator in different strata.

PRACTICALS: 103

1. Collection and study of algae mentioned in theory, identification up to generic level using algal monographs.
2. Preparation of synthetic medium and cultivation of algae, unialgal and axenic culture and their maintenance.
3. Collection, preservation of algal herbarium (10 specimens).
4. Preparation of pigments.
5. Staining techniques of cytology studies.
6. Study of electron microscopy of some algae.
7. Morphology and structural study of representative member of the following group using cleared whole amount preparation, dissection and section: Jungermanniales – *Pellia* and *Porella* (or any other leafy liverwort); Marchantiales-*Plagiochasma, Dumortiera, Fimbriaria,* (*Astralla, Reboulia, Targionia, Conocephalum/ Weisnerella, Sphagnales/ Sphagnum/ Bryales*
8. Experiments to study spore germination, formation of protonema and bud development.
9. Study of Bryophytes in their natural habitats

BOT 104: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Course outcome:

- To gain the knowledge about different forms of lower plants and their evolution.
- Gain knowledge about the evaluation of life cycle pattern of Gymnosperms, and Pteridophytes.
- Get an idea about economic value of Pteridophyte and Gymnosperm.

UNIT I

Evolution of Pteridophytes; Soral and stealer evolution .
Classification of Pteridophytes

UNIT II

Comparative organography, systematics; reproduction and phylogeny of the following:
Psilophytales, Rhyniales, Zosterophyllophytales.
Psilotales.
Lycopdiales, Lepidodendrales
Sphenophyllales
Ophioglossales, Marattiales, Osmundales, Filicales, Marsileates, Salviniales.

UNIT III

Speciation and evolutionary trends in ferns;
Cytology;
Polyploidy and hybridization;
Pteridophytic life – cycle, apospory, vegetative apomixes.
Recent trends in the classification of Gymnosperms

UNIT IV

Morphology and anatomy of vegetative and reproductive organs, fossil representatives and interrelationship of Cycadales, Ginkgoales, Coniferales, Taxales, Ephedrales, Welwitschiales and Gnetales.

UNIT V

Structure and evolution of archegonium in Bryophytes, Pteridophytes and Gymnosperms
Distribution of living and fossil Gymnosperm in India.
Economic importance of Gymnosperms.

PRACTICALS: 104

1. Study of morphology and anatomy of vegetative and reproductive tissues and organs using cleared whole mounts, dissections, sections, macerations and permanent preparations of living and fossil forms covered under theory.
2. Experiments on spore germination of prothallus, induction of sporophytes.
3. Preparation of models (Plasticine/ thermocol) to demonstrate stealer evolution.
4. Study of Pteridophytes in their natural habitats
5. Comparative study of the anatomy of vegetative and reproductive parts of *Ginkgo, Cedrus, Abies, Picea, Cupressus, Cryptomeria, Taxodium, Podocarpus, Cephalotaxus, Araucaria, Agathis, Taxus, Ephedra* and *Gnetum.*
6. Study of the important reproductive stages through specimens and permanent slides.
7. Preparation of models (Plasticine/ thermocol) to demonstrate the position and structure of microsporangia of *Cycas, Pinus, Taxus, Ephedra, Gnetum. S*eed-scale complex in female cone of *Pinus,* embryo of *Pinus.*

BOT 201: ECOLOGY-I CLIMATOLOGY, SOIL SCIENCE AND AUTECOLOGY

Course outcome:

- To understand the concept of autecology along with its principle.
- To develop a comprehensive understanding of various abiotic factor and their measurement techniques.
- To develop the principle understanding of soil as an important and integrated factors.
- To relate various principles of ecology with reference to population ecology and adaptation..

UNIT I

Plant Ecology : Introduction, Definition, Concept, Types and Scope.
History of ecology and its relationship with different disciplines.
Principles of ecology.
Environment : Concept, types, habitat and importance.
Ecological niche. Current Environmental Scenario of India

UNIT II

Light and temperature as ecological factors.
Precipitation and Relative Humidity as ecological factors.
Measurement and analysis of light, temperature, precipitation and relation humidity.
Importance of water as an important factor on the life of plants.

UNIT III

Soil Scenario: Origin, development and formation. Soil profile.
Classification of soil. Soil types of India.
Physical, chemical and Biological characteristics of soil
Soil deteriorating factors
Effects of soil environment of plants.

UNIT IV

Biotic components of an ecosystem.
Interrelation of various organisms.
Population ecology, Natality, Mortality, Age distribution.
Concept of carrying capacity.

UNIT V

Morphological, anatomical and physiological relation of plants with their environment.
Plant indicators.
Ecotypic and Ecadic differentiation
Physical and physiological dryness.
Genecology

PRACTICALS: 201

1. Study of physical and chemical characteristics of soil by rapid field test.
2. Determination of moisture constant of soil.
3. Determination of pH of water.
4. Determination of dissolved oxygen in water
5. Determination of following data.
   a. Solar energy
   b. Atmospheric temperature
   c. Relative Humidity
6. Determination of soil profile.
7. Determination of soil texture, colour, consistence.
8. Determination of height of the tree.
9. Determination of light penetration under water by Sechii dish.

BOT 202: ANGIOSPERM ANATOMY, EMBRYOLOGY AND PALYNOLOGY

Course outcome:

- To understand internal structure of Plant Cell and different types of plant tissues.
- To study the functions of different tissue system of plants.
- To get an insight into cellular level of reproduction and development of male and female gametes in plants.
- Gain the knowledge about primitive and advance types of plant embryo with the relation of plant taxonomy.

UNIT I

structure of plant cell and Types of tissue, fine structure of plasmodesmata, microtubules, microfibrils.
Apical, lateral and intercalary meristems- their ultra structure and histochemistry, organogenesis.
Ontogeny, phylogeny, ultra structure and function of primary and secondary xylem and phloem; wood anatomy.
Structure variability in leaves, leaf histogenesis, leaf meristem, origin, development, ultra strectur of stomata.

UNIT II

Nodal anatomy-nodal types and evolutionary consideration
Vascular cambium vs. cork cambium activity, periderm, lenticles, abscission, wound healing.
Anatomy of monocotyledons and dicotyledonous seed and fruits, seed appendages.
Anatomy in relation to taxonomy.

UNIT III

Microsporangium- structure and function of wall layers, ultra structure change in tapetum and meiocytes during Microsporogenesis, role of tapetum, pollen development, anther culture and haploid plants Megasporangium – structure and function of different parts.
Megasporogensis, various types of embryosacs, their development and fertilization.

UNIT IV

Embryology and taxonomy; diagnostic embryological characters, primitive and advanced characters, Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship.

UNIT V

Development and evolution of pollen types; stereo and ultrastructure of exine, apertures, furrow.
Palynology and taxonomy.
Pollen wall morphogenesis-microspore pollen mitosis; division of generative cell; pollen fertility and sterility; pollen storage viability and germination.
erobiology and its application. Aeropalynology, methods of aerospora survey and analysis, pollen
allergy and pollen calendars system approach for allergy.
Mellitopalyonolgy: general account
Paleopalynolgy: role in coal and oilgenesis.

PRACTICALS: 202

1. Use of paraffin method of microtechnique .
2. Acquaintance with ultratomy: use of wood microtomy and common and anatomy and histochemical methods.
3. Learning techniques of making temporary and permanent microscopic preparation.
4. Knowledge and use of photomicrography in anatomical studies.
5. Knowledge and use of the principles and working of electron microscopes.
6. Learning to use simple experimental method in anatomical studies.
7. Laboratory work planned on the basis of topic listed under theory.
8. Preparation of dissected whole mount of endothecium, tapetum, ovule, endosperm and embryo, squash preparation of tapetum, microspore mother cell, dyads, tetrads, pollinia, massulae.
9. Study of seed appendages from dissection, structure of seed coat from section and macerations.

BOT 203: WATER RELATIONS, GROWTH AND DEVELOPMENT

Course outcome:

- To create an understanding of water and its role in various physiological processes and hormonal studies..
- To develop an understanding about various enzymes in the plant system and their impact on Biological processes.

UNIT I

Water relations of plants: Unique physio-chemical properties of water, chemical potential , water potential.Apparent free space, bulk movement of water, soil plant atmosphere, contuum (SPAC), stomatal regulation of transpiration, hormonal and energy dependent hypothesis. Inorganic nutrition, physicochemical aspects of solute transport, diffusion and facilitated diffusion, passive and active transport Nernst equation and Donnan's potential. Role of ATPase as a carrier, co-transport (symport) and counter transport (antiport). Ion channels, role of calmodulin Importance of foliar nutrition and use of chelates.

UNIT II

Photosynthesis: Energy pathway in photosynthesis, chloroplast as an energy transducing organelle. Composition and characterization of photo systems, I and II , electron flow through cyclic, non cyclic and pseudo cyclic photophosphorylation. Pathways of CO_2 fixation. Differences between C_3 and C_4 fixation and different kinds of C_4 pathways.

UNIT III

CAM pathway: Occurrence, biological events and adaptive advantage.
Photorespiration : Mechanism and regulation of photorespiration.
Introductory studies on water stress and its tolerance mechanisms.

UNIT IV

Enzymes: Classification, Nomenclature, mode and mechanism of action,
Factors affecting enzyme activity, Michealis-Menten Equation.
Industrial application, immobilized enzymes, their preparation and application.
Enzyme regulation: Competitive and non-competitive, allosteric enzymes

UNIT V

Chemical control of growth and morphogenesis.
Hormonal effects on growth and development.
Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action of Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene.
Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.
Genetic study of secondary metabolites such as alkaloids (only types of wide occurrence.)
Dormancy: Seed and bud dormancy; hormonal regulation.

PRACTICALS: 203

1. To determine the water potential using weight method.
2. To determine leaf/ tissue water potential by Chandarkov:s method.
3. To determine the Osmotic potential using plasmolytic method.
4. To separate chloplast pigments by paper chromatography.
5. Determination of Hill's activity.
6. Determination of chlorophyll-a chlorophyll-b, total chlorophylls (Arnon's method).
7. Determination of chlorophyll-a chlorophyll-b ratio in C_3 and C_4 plants.
8. Estimation of protein by Lowry's method.
9. Estimation of free proline using Bates et al's method.
10. Demonstration of effects of auxins and kinetins.
11. Estimation of free sugars using Anthrone Method.
12. Principles and working of colorimetry, spectrophotometry, centrifuge and pH meter.

BOT 204: PLANT BIOCHEMISTRY AND METABOLISM

Course outcome:

- To motivate the students for understanding stricture function and types of carbohydrates, proteins and lipids .
- To develop an understanding about various Biochemical processes and cycle.
- To stabilize the concept of fixation and to project the role of N_2 in different Biological processes.
- To develop the concept of phenols and alkaloids and their role in plant metabolism.

UNIT I

Carbohydrates: Composition, structure and function of mono, oligo and polysaccharides .

Proteins: Amino acid, structure and characteristics. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Stability of proteins and nucleic acids.

Function of proteins Conjugate proteins, Account of Lactins their function.

UNIT II

Lipids: classification, occurrence, structure and importance of acryl lipids and phosphates.

Concept of free energy and entropy, high energy compound, Gibb's free energy concept in biochemical reaction.

Synthesis of ATP through oxidative electron transfer chain, chemiosmotic regeneration of ATP.

UNIT III

Biosynthesis of fatty acids, polyunsaturated fatty acids, lipoproteins,

Oxidation of fats, α oxidation, β-oxidation, Glyoxylate cycle,

Gluconeogenesis vs glycolysis

Role of Kreb's Cycle.

UNIT IV

Nitrogen fixation by free living and symbiotic organisms, mechanism of nitrogen fixation, soil nitrogen sources, nitrogen uptake by plants and assimilation.

UNIT V

Nitrate reductase system, substrate controlled induction, interrelation between photosynthesis and nitrogen metabolism. Nitrate and ammonium assimilation; amino acid biosynthesis.

GS-GOGAT system, transmission.

Basic structure of important phenolics and alkaloids: a general view of their synthesis.

PRACTICALS: 204

1. Estimation of total nitrogen by kjaldahl method.
2. Estimation of titrable and total acidity.
3. Estimation of seed germination as affected by red and Infrared radiation.
4. Determination of carotenoids.
5. Radioisotope methodology, auto-radiography, rule pulse and double labeling, isotope dilution method. Instrumentation and principles of counters.
6. Extraction and estimation of starch.
7. Determination of reducing sugars in fruits.
8. Identification of different kinds of sugars (spot tests).
9. Estimation of amino acids by ninhydrin.
10. Identification of proline, sulphur-containing amino acids with aromatic ring (spot test).
11. Determination of Isoelectric point of proteins.
12. Separation of soluble protein by gel electrophoresis.
13. Extraction of amylase and determination of its activity.
14. Determination of Km and Vmax of Amylase or phosphorylase

BOT 301: ANGIOSPERM MORPHOLOGY AND TAXONOMY

Course outcome:

- To be aware of origin and evolution of Angiosperms.
- To have a deep knowledge of Angiosperm Monocot and dicot flowers.
- To find out the knowledge of Evolution of Stamen, Carpel and their types.
- To study the rules of principles of the botanical nomenclature.
- To learn about phylogenetic system of classification given by renowned taxonomist and modern tools of taxonomy.

UNIT I

General concept of morphology, origin and evolution of flower. Co-evolution of flower, vis a vis pollinators.
Origin and evolution of polypetaly, sympetaly, apetaly; monocy, diocy. Monocot flower.

UNIT II

Stamens: origin and evolution from foliar to reduced condition, extension of connective beyond anthers; mono, di and polyadelphy; nectaries and nectar.
Carpels evolution, conduplicate, involute and other types, validity of the concept of foliar origin of carpel: alternative concepts and approaches ; specialized carpels; poly and syncarpy; superior, semi-inferior and inferior ovary; appendicular and receptaclar concepts; evolution of types of placentations.

UNIT III

Role of floral anatomy in interpreting the origin and evolution of a flower and floral parts. Floral anatomy and taxonomy.
Experimental study on flower.

UNIT IV

Botanical exploration-historical perspective, brief account of botanical exploration in south east Asia with special reference to India. Botanical survey of India, its organization and role.
Principles of plant classification with emphasis on modern tools of taxonomy; molecular systematicis, utility of taxonomy; biosystematics.
Phylogenetic systems of classification; Cronquist, Takhatajan, AGP III

UNIT V

Botanical nomenclature, ICBN, principles, articles, recommendation and amendments of code.
Familiarity with botanical literature, monographs, icons and floras, important periodicals with emphasis on Indian floristics, methods of literature consultation.
Threat assessment, different categories of threat, IUCN, Red Data Book. Important threatened plants of India.

PRACTICALS 301:

1. Preparation of cleared whole mounts of floral parts of polypetalae, sympetalae and monocots for vasculature.
2. With the help hand section and dissection prepare longitudinal and transverse sections of flower. Examination of:
    - **a.** Transmitting tissue/ canal is stigma and style.
    - **b.** Various types of ovaries and placenations.
    - **c.** Special types of flowers with emphasis on vasculature of androecium and gynoecium.
3. Preparation of models (plasticine/thermocol) of vascular skeleton of flower and placentaion.
4. Any other laboratory work based on theory syllabus.
5. Description of specimen.
6. Description of species based on various specimens, collective exercise.
7. Description of various species of a genus.
8. Location of key characters, use of keys at generic levels, after the description a collective exercise.
9. Location of key characters, use of keys at family levels.
10. Identification of diagnostic characters and use of key (provided)at level of various families after the description have been made.
11. Preparation of key (using specimens from three or four species).

BOT 302: ECOLOGY-II SYNECOLOGY, ECOSYSTEMATOLOGY & PHYTOGEOGRAPHY

Course outcome:

- The course focuses on the concept of vegetation, and different life forms, energy dynamics and seasonal expectation..
- The course also focuses on various biogeochemical cycles and to develop an understanding of production and productivity at global level..
- The course also relates to various theories of different geological time scale and thus develops a holistic understanding of nature.
- The students are well prepared to understand the dynamic components of nature, so that they can be better planners for sustainable future.
- Students get equipped with ecological concepts which can be applied to various developmental projects.

UNIT I

Concept and characteristics of plant community.
Methods of studying vegetation.
Raunkiers Life Forms- Concepts with merits.
Biological spectrum- Advantages
Seasonal aspect of vegetation.

UNIT II

Plant succession.- Different themes and principles.
Concept of climax and climax communities.
Energy flow.
Trophic dynamics aspect of ecology.
Food chain, food web, pyramid of number, biomass and energy.

UNIT III

System transfer function.
Agroecosystem.- Concept.
Biologeochemical cycles.- of at least three.
Forest ecosystem.
Rangeland management.- different approaches

UNIT IV

Vegetation types of India.
Floristic regions of India.
Production and productivity of various ecosystems.

UNIT V

Phytogeography as a border line science.
Principles of interpretation phytogeography.
Age and Area Hypothesis.
Satpura hypothesis.
Gates of angiospermy.

PRACTICALS : 302

1. Determination of minimum size of quadrat by species area curve method.
2. Determination of minimum number of quadrat by species area curve method.
3. Determination of frequency of various species by quadrat method and preparation of frequency diagram.
4. Determination of density of quadrat method.
5. Determination of abundance of species by quadrat method.
6. Determination of relative frequency by quadrat method.
7. Determination of relative density by quadrat method.
8. Determination of basal area by quadrat method.
9. Determination of relative dominance by quadrat method.
10. Determination of IVI by quadrat method.
11. Determination of community coefficient of two sties by quadrat method.
12. Preparation of biological spectrum of a locality.

BOT 303: PLANT BIOTECHNOLOGY: IN VITRO CULTURE, GENETIC ENGINEERING AND IPR ISSUE

Course outcome:

- This course provides the clear understanding of biotechnology, sterilization techniques, various tissue culture techniques and its applications.
- Various IPR issues
- Provides insights in the various biotransformation processes and development of useful strains.
- This course will help the students to acquire a vast knowledge of recombinant technology and its use in production of transgenic plants.
- This course provides a deep knowledge about cloning vehicles, phages, restriction endonucleases and blotting techniques.

UNIT I

Concept and scope of Biotechnology.
Techniques of tissue culture, cell culture and organ culture.
Sterilization techniques and culture media used in tissue culture.
In-vitro auxotrophs, disease resistance, salt and drought resistance, nutritional quality and herbicide resistance.

UNIT II

Micropropagation.
Production of haploids: anther culture and pollen culture
Somatic embryogenesis, somaclonal variation.
Protoplast culture: isolation, culture and fusion of protoplast.
IPR-general idea about patents. Copyright, trademark and geographical indication.

UNIT III

Biotransformation: production of useful compounds through cell culture; factors affecting yield: bioreactors: Principles and design.
Strategies of microbial strain improvement.
The recombinant DNA concept and principle of cloning.
Isolation and purification of DNA.

UNIT IV

Restriction endonuclease: properties and types.
Blotting southern, northern and western
Selection and screening of recombinant clone.
Cloning vehicles salient features: plasmid , cosmid & Tiplasmid.

UNIT V

Single stranded DNA viruses CaMV Lambda phage vectors M13 vectors.
Expression vectors.
Cloning construction of genomic and DNA libraries
Application of r- DNA technology in plant improvement.

PRACTICALS: 303

1. Selection of salt tolerance / amino acid analogue resistance through cell culture.
2. Isolation and culture of protoplast.
3. Isolation and screening of industrially important microorganism.
4. Isolation of plant DNA, plasmid DNA, bacteriophage DNA.
5. Genetics colonization and tumour induction Agrobacterium Tiplasmid.
6. Restriction analysis and molecular weight DNA.
7. Sequencing and polymerase Chain Reaction.
8. Demonstration of Agarose gel electrophoresis.
9. Preparation of genomic DNA from bacteria.

MAJOR ELECTIVE-I

BOT 304: ETHNOBOTANY AND ISOLATION OF NATURAL PRODUCTS

Course outcome:

- To get an insight into Ethnobotany with special reference to India, and its interdisciplinary approaches.
- To gain knowledge about Ayurvedic, Homeopathic, Allopathic, Unani and Siddha system of medicine.
- To study the medicinal value and uses of plants by different tribes of India.
- Scope and isolation of plant and plant products and their uses in medicine in cosmetic and other herbal industries.
- To gain the knowledge about uses of plants during emergency, scarcity and as supplementary foods by the tribes of India.

UNIT I

Ethnobotany, its scope, interdisciplinary approaches.
Ethnic groups of India: major and minor tribes, life styles of ethnic tribes, conservation practices of biodiversity, taboos and totems.

UNIT II

Role of Ethnobotany in national priorities, health care and development of cottage industries in India.
History and principles of Ayurveda, Homeopathy, Allopathy, Unani and Siddha system of medicines.
Regional relevance and credibility of medicinal plants used by tribals of M. P.; Plants used in scarcity, emergency and as supplementary foods by tribals of India.

UNIT III

Scope and uses of essential oil from plants as perfumes, cosmetics and as flavoring agents.
Preparation of perfumes from aromatic plants with special reference to the following Lemon grass, Palm-rosa, Mint, Lavender, Rose, Eucalyptus and Vetiver.

UNIT IV

Plants used in medicine with special reference to following.
Adhatodavasica, Asparagus racemosus, Hollarhinaantidysenterica, Tinosporacordifolia
Terminalia arjuna, Terminalia bellerica,Terminalia chebula,Pterocarpus marsupium, Commiphorawightii.Argemone mexicana, Boerhaaviadiffusa, Ecliptaprostrata, Psoraliacoralifolia, Withaniasominifera, Tylophoraindica, Rauwolfia serpentina, Dioscorea deltoids.

UNIT V

A general idea of active principles of plants and plant parts their extraction and preparation of medicines in different systems. Study of method of extraction; Crude plant extract – Crude plant extract drugs as pharmaceutical aids; its therapeutic uses; adulteration; Drug evaluation; Storage of crude drugs; Marketing of drugs – dry, garbling and packing.

PRACTICALS: 304

1. Visit to tribal area and study of plant material used tribals.
2. Identification and description of important plants of ethno botanical importance.
3. Identification of important aromatic plants of the locality.
4. Extraction of active ingredient
5. Extraction of perfumes of aromatic plants.
6. Pharmacognostic method of identification of drugs.
7. Methods of preparation of Kwath, Churra, Ark, Saiva Asav.
8. Diseases of some common medicinal plant of the locality.
9. Identification and description of 10 plants used by tribal for household purpose.
10. Studies on anti-microbial activity of some medicinal plants.
11. Identification & properties of dried parts of medicinal plants.

BOT 304: POLLUTION ECOLOGY

Course outcome:

- To propagate the concept of pollutant and pollution, disasters and their permissible limits .
- To develop an understanding of different types of pollutions, bioaccumulation and biomagnifications.
- To create an understanding about monitoring of pollution, their control and abatement.
- To suggest different measures for different types of waste generation and their disposal techniques .
- To create the concept of various tools and eco-techniques for calibrating and studding pollution.

UNIT I

Pollution and pollutants :

Concept, Definition and characteristics of Pollution. Sources, types, classification of pollutants. Pollution problems of World/India/Madhya Pradesh. Brief account of major environmental disasters of the past. Present status of pollution in the country. Standards and limits prescribed by different agencies for Pollutants.

UNIT II

Air & Water Pollution :

Air pollution: Types and sources, Effects of SO_2, NO_2, O_3, HF, photochemical smog and particulates on plants and human health, aeroallergens and allergies.

Climate change, Green House effect and Ozone layer depletion: Causes and consequences.

Water Pollution: Types and sources; Effects on water quality, plants and human health;

Concept of bioaccumulation and biomagnifications.

UNIT III

Soil / Agro-Chemical and other pollutions

Soil pollution: Types and sources, Effects of pesticides and heavy metals on ecosystems, mechanisms of metal toxicity, metallophytes.

Pesticidal and heavy metal pollution- sources, classification, chemical properties, effects on living organisms (Plants and animals).

Solid Wastes: Pollution and disposal problems, Hospital Wastes and their effects and disposal

Nuclear pollution, thermal pollution and Noise pollution – causes, sources and effects.

Electronic waste (E-waste**):** Sources and types, constituents of E-wastes, recycling of e-wastes and its impacts on environment, management of e-wastes.

UNIT IV

Pollution monitoring and control

Methods of collection and analyses of ambient air pollutants and water pollutants.

Control and abatement measures for pollution

Brief account of legislation and environmental protection acts in India.

Environmental management system (EMS): ISO-14000; Environmental audit; Environmental Impact Assessment (EIA), Environmental taxes.

UNIT V

Tools & Eco-Techniques

Basic concept & application of Ecotechnology, Vermitechnology & Bioremediation, Sludge treatment, Ecosystem Restoration –concept & success.

Principles of Gravimetry chromatography, spectrophotometry, electro-analytical and radio-analytical techniques.

International trade and environment; Trade Related Intellectual Properties (TRIPs), Intellectual Property Rights (IPRs), Corporate environmental ethics.

PRACTICALS 304:

1. To determine the TS (Total Solids), TDS (Total Dissolved Solids) & TSS (Total Sispended Solids) of water samples.
2. Estimation of total hardness, Ca & Mg Hardness in water samples.
3. Detection of Chloride in given water sample by Argentometric method.
4. To determine the COD (Chemical Oxygen Demand) in water samples
5. To determine the Alkalinity in water samples.
6. Estimation of total organic carbon in soil samples.
7. To determine the DO (Dissolve Oxygen) in water sample.

Minor exercise

1. Measurement of pH & conductivity in water samples.
2. Measurement of pH & conductivity in soil samples.
3. Calculate the % WHC (water holding capacity) in different soil types.
4. Determine CO_3^{--} & NO_3^{-}ions in soil samples.

BOT 401: GENETICS, PLANT BREEDING AND EVOLUTION

Course outcome:

- To learn the concept and background knowledge of Plant Genetics and different laws of Inheritance.
- To study Linkage, crossing over and gene mapping.
- To develop an understanding about Evolution and origin of life.
- To understand the importance of Plant Breeding – development of hybrid varieties of plants and different hybridization techniques.

UNIT I

A brief history, scope and significance of genetics.
Mendel's law of inheritance.
Lethality and Interaction of genes.
Quantitative inheritance: polygenic inheritance.
Nature and concept of chemical basis of heredity.

UNIT II

Multiple alleles.
Self sterility.
Linkage and its measurement.
Crossing over: theories of crossing over.
Mapping of genes on chromosomes.

UNIT III

Genetic recombination in bacteria: conjugation, transformation and transduction.
Cytoplasmic inheritance.
Genetics and evolution.
Genetic drift.
Speciation.

UNIT IV

Evolution – origin of life- theories of evolution Darwin, Lamark and De veries, Modern synthetic theory, variation- adaptation and selection.
Mutation and evolution.

UNIT V

Methods of plant breeding, plant introduction, mass, pure line and clonal selection.
Aims and objectives of hybridization types: inter specific and intergeneric; back crossing.
Grafts hybrids, chimeras and bud spot.
Heterosis: theories and applications with reference to maize.
Plant breeding work done in India with reference to wheat and rice.

PRACTICALS: 401

1. Determination of probability of tossing for one coin.
2. Determination of probability for the throw of dice.
3. Determination of probability for tossing of two coins.
4. X^2 test as applied to the result of above three experiments.
5. Determination of size of the leaves on a specific size of two population of a species and calculation of standard deviation and standard error.
6. Permutation and combination.
7. Correlation analysis.
8. Determination of genotype from the data provided.
9. Determination of linkage values from the data provided and preparation of chromosome map.
10. Determination of various Mendelian ratio by checker board as well as by binomial equation.
11. Effect of mutagen (Chemical and radiation)

BOT 402: CYTOLOGY AND MOLECULAR BIOLOGY OF PLANTS

Course outcome:

- The course provides the vast knowledge of the cell organization and cell functioning in plants.
- It provides a detailed understanding of cell genome and its organization in prokaryotes and eukaryotes, Packing of DNA within the cell,
- This course deals with the understanding of physiological processes like replication, transcription and translation in prokaryotes and eukaryotes.
- It imparts knowledge of understanding the cell cycle and molecular events, mutations, transposons and signal transduction pathways.

UNIT I

The plant cell: structure, organization, cell cycle mechanism and its molecular basis, cytokinesis.
Nucleus: structure, nucleolus organization.
Generalized structure of plant cell organelles.

UNIT II

Chromosome: structure, molecular basis of Chromosome structure. Eukaryotic genome.
organization, prokaryotic genome organization, variation in Chromosome and its significance.

UNIT III

DNA: packaging of DNA, nucleosome, nuclear membranes, C-value paradox, cot curves, chemical structure. genetic code.
DNA replication in prokaryotes and eukaryotes.
Transcription, RNA splicing.
Translation: Prokaryotic and eukaryotic gene regulation (Operon concept).

UNIT IV

Meiosis: origin and molecular events during meiosis.
Mitosis: origin and molecular events during mitosis.
Chromosomal aberrations: Heteroploidy, structural changes in chromosomes.

UNIT V

Transposable elements and its significance. molecular basis of transposans.
Membrane structure and function, ATPase sites.
Membrane transport with reference to transport protein.
Signal transduction: on overview.

PRACTICALS 402:

1. Staining.
2. Study of the microscope.
3. Study of the size and shape of the cell.
4. Staining and study of flagellum.
5. Vital staining.
6. Staining of mitochondria.
7. Study of chloroplasts.
8. Cytoplasmic streaming.
9. Study of mitosis by squash and smear.
10. Study of meiosis.
11. Measurement of meiosis chromosomes and comparison of their sizes.
12. Study of salivary gland and Meiotic chromosome.
13. Study of chromosome aberration like ring, anaphase bridges etc.
14. Camera-Lucida diagrams of chromosome.
15. Preparation of diagram.
16. Study of ultra structure of various cell organelles from electron micrographs.
17. Collection, fixation and preparation of paraffin blocks of materials.
18. Microtomy and staining of the slides by various methods.

MAJOR ELECTIVE I

BOT 403: INDUSTRIAL MICROBIOLOGY

Course outcome:

- The course provides knowledge about the scope of industrial microbiology and fermentation technology.
- Isolation and development of different industrially important microorganisms and a practical idea about their applications for human welfare.
- Students will have opportunities to know about production of important products by the help of microorganisms such as antibiotics, enzymes, vitamins, SCPs, Biofertilizers
- Students will get a vision of latest microbial applications in production of fermented foods and dairy products.
- It will help students to understand the use of microbes in bioremediation and pesticide development.

UNIT I

Development and scope of Industrial Microbiology. Use of Fermentation equipments: Design and construction of fermenters, Batch and Continuous fermenters. Computer control of fermentation process. Characteristics of fermentation media, Raw materials (substrates).

UNIT II

Use of microorganisms in industries through ages.
Strategies for isolation and screening of industrially important microorganism.
Strategies for improvement of industrially important microbial strains.

UNIT III

Industrial product of vinegar and acetic acid.
Industrial product of citric acid.
Industrial product of antibiotics; penicillin and streptomycin.
Industrial product of amino acids; glutamic acid and lysine.

UNIT IV

Microbes as a source of Single Cell protein (SCP).
Mushrooms cultivation and food value of mushrooms.
Dairy product from microorganisms; butter, yogurt and cheese.
Hygine and safety in fermentation industries.

UNIT V

Biopesticides: bacterial, fungal and viral control of insect pests.
Bio fertilizer: production and method of application.
Bioremediation.

PRACTICALS: 403

1. Isolation and identification of bacteria, yeast and fungi from bakeries and fermenters of distilleries.
2. Inoculation of fungi and bacteria on sterilized glucose and sucrose solutions and identification of the different types of amino acids and organic acids in filterate during different incubation periods. (Chromatography)
3. Isolation and identification of different types of fungi and bacteria from curd, rotten fruits and vegetables.
4. Collection of different types of mushrooms from local area/ region: inventory and analysis of their amino acid contents. (Chromatography)
5. Preparation of spawn for cultivation of edible mushrooms.
6. Observation of the antagonism of three antibiotics against common plant pathogens in Petri plates (disc methods).
7. Demonstration of fermentation by using yeast.
8. Isolation of industrially important microorganisms from different environment.

MAJOR ELECTIVE II

BOT 403: PLANT PATHOLOGY

Course outcome:

- To develop an insight into disease resistance mechanism in plants: Phytoalexins.
- To learn about parasitism and pathogenicity in relation to plant disease.
- To gain the knowledge of Symptomatology of different Fungal, Bacterial, Viral, Mollicutes and Nematode disease in plants.
- To study the biological, physiological and chemical methods of control/ management of plant diseases.

UNIT I

The concept of diseases in plants; History of plant pathology;
Environmental factors affecting the development of plant disease: Infection, colonization and symptom development.
Parasitism and plant disease: Parasitism and Pathogenicity, Enzymes and toxins in relation to plant disease.
Mechanism of resistance: Phytoalexins.

UNIT II

Symptomatology, Etiology and control of the plant disease caused by **fungi**;
Characteristics of Plant pathogenic fungi
Diseases caused by Omycetes, Zygomycetes, Ascomycetes, Basidiomycetes
& Fungi imperfecti.

UNIT III

Symptomatology, Etiology and control of the plant disease caused by **Viruses;**
Characteristics of plant viruses and diseases caused by viruses
Symptomatology, Etiology and control of the plant disease caused by **Bacteria;**
Characteristics of plant pathogenic bacteria.

UNIT IV

Symptomatology, Etiology and control of the plant diseases caused by **Mollicutes;**
Phytoplasma and Spiroplasma
Symptomatology, Etiology and control of the plant disease caused **Nematodes**.

UNIT V

Control / Management of plant diseases: General principles of plant quarantine;
Cultural, biological, physical and chemical methods; Disease control by Immunizing or Improving resistance of the host;
Integrated disease management.

PRACTICALS: 403

1. Preparation of different types of media: solid liquid synthetic, semi synthetic.
2. Isolation of fungi from infected plant material and stored material.
3. Identification of fungi, and micrometry
4. Pathogenesis: Koch's Postulates.
5. Collection of diseases plants and preparation of Herbarium.
6. Pathological studies: study of morphological symptoms of host plant.
7. Section cutting of infected parts of plants and preparation of slides.
8. Isolation and identification of plant pathogenic fungi.
9. Pathological studies of viral diseases of plants.
10. Pathological studies of bacterial diseases of plant.

MAJOR ELECTIVE I

BOT 404: AGROECOSYSTEM

Course outcome:

- Croplands are fast decreasing by way of area and productivity. They are needed for our survival as they form the primary producers which serve other trophic levels of cropland ecosystem...
- The programme focuses on croplands specially their management, and gives an insight into various biotic & abiotic components..
- The programme allow the students to develop an understanding on various cropland ecosystems of India.
- It develops an understanding about, crop geometry Energy flow and Input/ Output ratio.
- Students can be absorbed as form managers or they can be entrepreneurs them selves.

UNIT I

Introduction and concept of agroecosystem**.**
Agroclimatic zones of India.
Various types of Indian field and plantation crops.
Various types of Indian commercial and horticultural crops.

UNIT II

Various agronomic practices, adapted in cropland ecosystem.
Weed control-normal, Mechanical and biological.
Insects and pests of cropland ecosystem-any five forms.
Green revolution evolution.- Concepts

UNIT III

Structure of biotic and abiotic community of a cropland ecosystem-a case study.
Herbicide degradation and accumulation in a cropland ecosystem.
Sink source relationship. And their importance.

UNIT IV

Influence of irrigation cycling on cropland ecosystem.
Crop geometry and its advantages and disadvantages.
Influence of mineral cycling on cropland ecosystem.
Phytoallelopathy in croplands.

UNIT V

Input-output ratio in agroecosystem.- concepts and merits.
Energy flow in a cropland ecosystem.- with special reference to Indian cropland.
Biofertilizers.
Farm management.

PRACTICALS: 404

1. To determine the percentage Frequency of the different Species of natural and artificial ecosystem by quadrate method.
2. To determine the density of different species of a natural and artificial ecosystem with the help of quadrate.
3. To determine the abundance of different species of a natural and artificial ecosystem.
4. To determine the community coefficient of a natural and two artificial ecosystem under study with the help of a quadrate.
5. To determine the relative density of a natural and artificial ecosystem.
6. To determine the Relative Frequency of a natural and artificial ecosystem.
7. To prepare a random experimental design for the levels of irrigation and fertilizer

BOT 404: STRESS PHYSIOLOGY

Course outcome:

- To create an understanding about various stresses of environment and a biotic factors which affect the various processes of plant physiology..
- To develop the concept of different mitigation properties adopted by plants to face draught conditions..
- To study the impact of soil salinity and their impact on plant growth parameters.

UNIT I

Plants and water: Chemical and water potential gradients.
Determination of water potential of plants and tissues by Chardakov's, pressure chamber and psychrometric methods.
Stomatal size, frequency and measurements of stomatal aperture, porometry, Mechanism of stomatal opening and closing.
Physiological principles of dry land farming.
Wilting coefficient, water use efficiency, stress - degree - day concept, plant water - stress index and their relationship to several plant physiological processes.
Availability of soil water and determination of soil water potential.

UNIT II

Drought and drought tolerance mechanisms: drought escape, drought tolerance with high tissue water potential; drought tolerance with low tissue water potential.
Morphological, physiological and biochemical parameters of drought resistance.
Screening methods to study drought resistance.

UNIT III

Antitranspirants : Different types, mode of action and their use in alleviation of water stress.
Nitrogen fixation and drought.
Ultra structural consequences of drought

UNIT IV

C_4 photosynthesis as CO_2 concentrating mechanism and its comparison with C_3 fixation
Elementary idea about chilling stresses.
Ultra violet stresses: Different band of UV radiations. Sensitivity of various bio-organic molecules; resistance mechanisms and measurement of resistance.

UNIT V

Salinity and plant growth.
Saline and alkali soils
Salt tolerance: Halophytes; physiological aspects of salt tolerance,
Screening methods for salt tolerant varieties.
Elementary idea about temperature stresses.

PRACTICALS: 404

1. Estimation of free proline in leaves subjected to water stress.
2. Estimation of protein using Lowry's Method.
3. NR assay.
4. Determination of relative water content (RWC).
5. Determination of potassium and sodium using flame photometer.
6. To determine soil water potential using Tensiometer.
7. Determination of leaf water potential by using Chardakov's method.
8. Determination of water potential using pressure chamber.
9. Discussion on the working of colorimeter, flame photometer tensiometer and pressure chamber.
10. Separation of amino acid by TLC method.
11. Estimation of free sugars using anthrone method.