PROF. RAJENDRA SINGH (RAJJU BHAIYA) UNIVERSITY, PRAYAGRAJ

Subject : BOTANY

Structure of Syllabus for the Program: B. Sc. 4th Year/ M.Sc. (Two Year and One Year Programme)

(Session: 2024-2025 Onwards)

Structure of Syllabus Developed by			
Name of BoS Convener/ BoS Member	**Designation**	**Department**	**College/University**
PROF. ARVIND MISHRA	CONVENOR	BOTANY	M. D. P. G. COLLEGE, PRATAPGARH
DR. JUHI SINGH	MEMBER	BOTANY	DDU GOVERNMENT PG COLLEGE SAIDABAD, PRAYAGRAJ
DR. SHRADDHA TIWARI	MEMBER	BOTANY	BHAVAN'S MEHTA P. G. COLLEGE, BHARWARI, KAUSHAMBI.
DR. PIYUSH CHANDRA MISRA	MEMBER	BOTANY	H. N. B. GOVERNMENT P. G. COLLEGE, NAINI, PRAYAGRAJ.

Course Code		**Course Title**	**Credits**	**T/P**	**Evaluation**	
					CIE	**ETE**
A	B	C	D	E	F	G

UG SEMESTER-VII/PG SEMESTER-I

B040701T	CORE	Plant Virology and Bacteriology	**3**	T	25	75
B040702P	CORE	Practical on Plant Virology and Bacteriology	**1**	P	25	75
B040703T	CORE	Mycology and Plant Pathology	**3**	T	25	75
B040704P	CORE	Practical on Mycology and Plant Pathology	**1**	P	25	75
B040705T	CORE	Research Methodology	**4**	T	25	75
B040706T	Discipline Centric Elective (Select any one)	Limnology, Phycology, Lichenology and Bryophyta	**4**	T	25	75
B040707T		Applied Microbiology		T	25	75
B040708T	Discipline Centric Elective (Select any one)	Advanced Plant Pathology	**4**	T	25	75
B040709T		History of Botany and Microtechnique		T	25	75

UG SEMESTER- VIII (for Four Year Undergraduate Programme)/ PG SEMESTER- II

B040801T	CORE	Pteridophyta, Gymnosperms and Palaeobotany	3	T	25	75
B040802P	CORE	Practical on Pteridophyta, Gymnosperms and Palaeobotany	1	P	25	75
B040803T	CORE	Plant Morphology, Plant Anatomy and Embryology	3	T	25	75
B040804P	CORE	Practical on Plant Morphology, Plant Anatomy and Embryology	1	P	25	75
B040805R	Research Project	Research Project	12	R	25	75

or

UG SEMESTER- VIII (for Four Year Undergraduate Programme)/ PG SEMESTER-II (For Two Year Post Graduate Programme- Lateral Entry)

B040801T	CORE		Pteridophyta, Gymnosperms and Palaeobotany	3	**T**	25	75
B040802P	CORE		Practical on Pteridophyta, Gymnosperms and Palaeobotany	1	**P**	25	75
B040803T	CORE		Plant Morphology, Plant Anatomy and Embryology	3	**T**	25	75
B040804P	CORE		Practical on Plant Morphology, Plant Anatomy and Embryology	1	**P**	25	75
B040805T	Discipline Centric Elective (select any one)		Taxonomy of Angiosperms	4	**T**	25	75
B040806T			Medicinal Plants and Ethnobotany		**T**	25	75
B040807T	Discipline Centric Elective (select any one)		Plant resource Utilization	4	**T**	25	75
B040808T			Plant Breeding and Crop Improvement			25	75
B040809T	Ability Enhancement Course (Select any one group)	**A**	Plant Propagation and Nursery Management	3	**T**	25	75
B040810P			Practical on Plant Propagation and Nursery Management	1	**P**	25	75
B040811T		**B**	Mushroom Culture Technology	3	**T**	25	75
B040812P			Practical on Mushroom Culture Technology	1	**P**	25	75

PG SEMESTER-III/ PG SEMESTER-I (One Year PG Programme- Lateral Entry)

B040901T	CORE		Plant Physiology	3	T	25	75
B040902P	CORE		Practical based on Plant Physiology	1	**P**	25	75
B040903T	CORE		Cytogenetics and Biostatistics	3	T	25	75
B040904P	CORE		Practical based on Cytogenetics and Biostatistics	1	**P**	25	75
B040905T	Discipline Centric Elective-1 (Select any one)		Ecology and Phytogeography	4	T	25	75
B040906T			Molecular biology and Molecular Technique				
B040907T	Discipline Centric Elective-2 (Select any one)		Plant Biotechnology	4	**T**	25	75
B040908T			Biochemistry				
B040909T	Ability Enhancement Course (Select any one group)	**A**	Herbal Cosmetics	3	T	25	75
B040910P			Practical on Herbal Cosmetics	1	**P**	25	75
B040911T		**B**	Bio-fertilizer	3	T	25	75
B040912P			Practical on Bio-fertilizer	1	**P**	25	75

PG SEMESTER-IV/ PG SEMESTER-II (One Year PG Programme)

B041001R	MRP	**MASTER DISSERTATION**	20	R	-	100

NOTE:

1. **T/P** in Column-E stands for **Theory/Practical**.
2. **CIE** in Column-F stands for **'Continuous Internal Evaluation'** and depicts the maximum internal marks. Respective examination will be conducted by subject teacher.
3. **ETE** in Column-G stands for **'External Evaluation'** and depicts the maximum external marks. Respective Examination will be conducted by the University.
4. Column-B defines the nature of course/CORE. The word **CORE** herein stands for **Compulsory Subject CORE**.
5. Column-D depicts the credits assigned for the corresponding course/CORE.
6. **Discipline Centric Elective:** It will be a Subject Elective. Students may select one of the two subject COREs under this category.
7. **Discipline Centric Elective:** It will designate a Practical CORE or equivalently a Field Visitor Project Presentation. In case of Field Visit, student is required to submit a detailed report of the visit for the purpose of evaluation. The report should include the observational features and benefits of the visit. In case of Project Presentation, the student may be assigned to go for a survey/practical or theoretical project/assignment or seminar with presentation
8. **Ability Enhancement Course-** This course can be opted as an elective by the students. Students will learn about concern course and can seek the opportunity of setting up their own business.
9. **Master Dissertation:** It will be a master Dissertation on the allotted topic. The student will have to complete his/her research project under any supervisor. The supervisor and the topic for research project shall be allotted in first semester.

UG SEMESTER-VII/PG SEMESTER-I

CORE–1. PLANT VIROLOGY AND BACTERIOLOGY

UNIT I

Morphology and Structure of Bacterial cell: Morphology of Bacterial cell based on size, shape and arrangement, fine structure of bacterial cell (of Gram positive and Gram negative bacteria)- Capsule, cell wall, cell appendages **(**Flagella, Fimbriae and pili), Structure of Plasma membrane, cytoplasmic inclusions- mesosomes, Chlorosome.

UNIT II

Morphology and Structure of Viruses: History, Discovery, General characteristics of Viruses, Biological status of Viruses, Morphology, Fine structure, Shape and Classification of viruses. Microphages, Viroids, Virusoids and Prions, Tobacco Mosaic Virus (TMV), T4 Bacteriophages and HIV- their fine structure, genome organization and multiplication, Bacteriophage therapy.

UNIT III

Microbial Nutrition: Microbial requirement, Nutritional forms (Autotrophic and Heterotrophic), Nutritional Classification of Microorganisms, Quorum sensing in Bacteria. Economic importance.

UNIT IV

Some Important Diseases: Important Diseases caused by Bacteria, Viruses and mycoplasma. Cirtus Canker, Tobacco Mosaic disease and yellow vein Mosaic of lady finger, Little leaf of brinjal.

Suggested Readings:

1. Matthew'sPlantVirology,R.Hull,4thedition,2003,Elsevier.
2. Prescott(2000).Microbiology.
3. Dubey, R.C. and D.K. Maheshwari (2010). A Textbook of Microbiology. S. Chand and Co.Pvt. Ltd. New Delhi.
4. Singh,R.S.2008.Plant Diseases, Oxford and IBH PublishingCo.Pvt Ltd.
5. Singh,R.S.2008. Principles of Plant Pathology, Oxford and IBH Publishing Co.PvtLtd.

PRACTICAL ON PLANT VIROLOGY AND BACTERIOLOGY.

CORE-2 - MYCOLOGY AND PLANT PATHOLOGY

UNIT I

General characteristics of Fungi, Nutrition (Saprophytic, Symbiotic and biotrophic), Reproduction, Recent trends in Classification of Fungi. Heterothallism, Heterokaryosis, Parasexual cycle and sex hormones in Fungi, Phylogeny of Fungi, Economic Importance of Fungi. Symbiotic Association of Fungi, Mycorrhizae

UNIT II

Systematic study of Structure, Reproduction and life cycle, Phylogeny and affinities of main groups of Fungi with special reference to following: Myxomycetes (Trichicales, Stemonitales, Physarales), Plasmodiophoromycetes (Plasmodiophorales).

Oomycetes:Saprolegniales(*Saprolegnia,Achyla*),Pernosporales(*Phytopthora,Pernospora*)

Chytridiomycetes: Chytridales, Blastocladiales, Monoblepharidales.

Zygomycetes: Mucorales, Entomophthorales.

UNIT III

Systematic study of Structure, Reproduction and life cycle, Phylogeny and affinities of main groups of Fungi with special reference to following:

Ascomycetes: Protomycetales (*Protomyces*), Endomycetales (*Saccharomyces*), Taphrinales (*Taphrina*), Eurotiales (*Aspergillus, Penicillium*), Erysiphales *(Erysiphe, Phyllactinia*), Sphaeriales (*Neurospora, Xylaria, Claviceps*), Pezizales (*Ascobolus, Peziza, Morchella*).

Basidiomycetes: Uredinales, Ustilaginales, Auriculariales (*Auricularia*), Agaricales(*Agaricus, Amanita*), Lycoperdales (*Lycoperdon*),

Deuteromycetes: Moniliales (*Cercospora, Helminthosporium, Alternaria, Fusarium*), Melanconiales (*Colletotrichum*), Sphaeropsidales.

UNIT IV

Plant Pathology: General Principle, Classification of Plant disease, Symptoms of Fungal, Bacterial and viral disease. Disease Management, Forecasting and Defence mechanism. Principle of Plant disease control (Chemical and Biological).

Fungal Disease: White rust of crucifers, Lateblight of potato,Early blight of potato,Powdery mildew of pea, Black rust of wheat and Red rot of sugarcane.

Suggested reading:

1. Gangulee,H.C.&Kar,A.K.CollegeBotanyVol.II(Algae+Fungi+Brophyta+Pteridophyta), New Central Book Agency, Kolkata
2. Singh, Pande, Jain, 2010,AText Book of Botany(Algae+Fungi+Brophyta+Pteridophyta) Pub. Rastogi Publication, Meerut

3. Agrios,G.N.,1998.PlantPathology,Academic Press.
4. JohnALucas,1998.PlantPathology and PlantPathogens, Wiley-Blackwell,CRCPress.
5. Alexopoulos,C.J.,Mims,C.W.and Blackwell,M. 1996,IntroductoryMycology, Wiley
6. Cathie,M.J.,WatkinsonS.C.andBooday,G.W.,2001,TheFungi,AcademicPress
7. Maheshwari,R.,2012,Fungi:ExperimentalMethodsinBiology,CRCPress,Boka Raton, Florida.

PRACTICAL ON MYCOLOGY AND PLANT PATHOLOGY

CORE III. RESEARCH METHODOLOGY

Unit-I

- Research Problem – Its importance, aims and objectives, literature collection, Methodology (Experimental design/Field data collection).Data presentation and interpretation. Drawing conclusions.
- Scientific paper writing–Manuscript preparation and presentation
- Research Journals, Impact Factor and paper citation index
- Statistical methods in Biology: Mean, Variance, Standard deviation, Standard error, Chi square and 't'– test

Unit-II

- Culture of Algae :Media and isolation of pure cultures
- Culture and preservation of Fungi
- Plant tissue culture methods. Genetic transformation methods (*Agrobacterium*-mediated and microprojectile / Biolistic methods).
- Herbarium techniques

Unit-III

- Plant Microtechnique–Fixatives and staining (single and double).Fixation for histological and histochemical study. Microtomy.
- Histochemical methods in Pharmacognosy and Forensic Botany. Organoleptic evaluation of market drugs.
- Preparation of Cytological slides for study of Mitosis and Meiosis
- Principles of Microscopy (Light microscope, phasecontrast, ElectronMicroscope(SEM & TEM) and Fluorescence microscope).

Unit-IV

- Methods of expressing concentration: Physical and chemical methods.
- Basic concepts of Recombinant DNA technology. Gene cloning, DNA fingerprinting technique, Polymerase Chain Reaction and Southern blotting.

Suggested Reading-

1. Research Methodology- G.R.Basotia and K.K .Sharma.
2. Research Methodology- C.H .Chaudhary ,RBSA Publication

3. Research Methodology: An Introduction- Wayne Goddard & Stuart Melville
4. Research Methodology- Ranjit Kumar
5. Research Methodology: Methods &Techniques-Kothari, C.R.
6. Molecular cloning Laboratory Manuals: Sambrrok, Russel and Maniatis
7. Principle Practices in Plant Biotechnology–Wilson and Walker

DISCIPLINE CENTRIC ELECTIVE (S**elect any one**)-

I. LIMNOLOGY, PHYCOLOGY, LICHENOLOGY AND BRYOPHYTA

UNIT –I

Limnology: Introduction to limnology, General study of morphological and reproductive feature of micro and macrophytes growing in sea water with special reference to their adaptation.Generalaccountofabioticandbioticfactorsinfluencingthegrowthoffreshwater and marine water flora. Physical factors: Light, Temperature Heat and Stratification. Chemical factors: DIC, Oxygen in lakes, effect of DOC and BOD. Size spectrum of planktonic organisms, Human impact on lake ecosystem.

UNIT-II

Algae in diversified habitats (terrestrial, freshwater and marine), Thallus organization, cell ultra structure, reproduction, Classification of algae, cell wall compostion, reserve food material, Flagellation and Heterocyst. Symbiotic algae, algal bloom, Ecological and economic importance of algae. A comparative study of range of thallus organization, cell structure, reproduction (asexual & sexual), of flowing class: Cyanophyceae (*Scytonema, Spirulina*), Chlorophyceae (*Chlamydomonas, Volvox, Chara, Nitella, Acetabularia*), Phaeophyceae (*Laminaria, Dictyota*), Bacillariophyceae (*Navicula*), Xanthophyceae (*Vaucheria, Botrydium*), Rhodophyceae (*Batracospermum, Gelidium*).

UNIT–III

Lichens – A general account classification and distribution of Lichens. A comparative study of thallus organization, cell structure, physiology and reproduction. Economic importance of lichens.

UNIT-IV

Bryophyta: General introduction, classification, Origin and evolution of bryophytes, Fossil history of Bryophytes, Ecological significance and economic importance of Bryophytes. Characteristic features, criteria of classification, range of gametophytic and sporophytic organization(morphology, anatomy and their distribution in India) in various orders/families of the class: Marchantiales (*Plagiochasma, Targionia, Cyathodium*), Sphaerocarpales (*Sphaerocarpus, Riella*), Calobryales (*Calobryum*), Metzgeriales (*Riccardia*),Jungermanniales *(Porella, Frullania*), Anthocerotales (*Anthoceros, Notothylus*), Sphagnales (*Sphagnum*), Polytrichales (*Polytrichum, Pogonatum*), Buxbaumiales (*Baxbaumia*), Bryales (*Funaria*).

Suggested reading:

1. Dodson,S.(2005).Introduction to Limnology .New York .McGraw-Hill.
2. Moss,B.(1998).Ecology of fresh waters: man and medium, past to future .Oxford Blackwell Science.
3. Horne,A.J .and C.R .Goldman(1994).Limnology. Toronto ,McGraw-Hill.
4. Lee,RobertEdeward,2008,Phycology,Fourthedition,CambridgeUniversityPress
5. GrahamRobinSouthandAlanWhittick,1998,IntroductiontoPhyclogy,Blackwell Scientific Publication
6. Bold, H.C. and Wynne, M.J., 1985, Introduction to the Algae, 2"dEdition, Prentice-Hall Inc.
7. Dixon,R., Biology of Rhodophyta, Kock Science Publisher,West Germany
8. Fritsch, F.E., Structure and Reproduction of Algae, Vol. 1 & II, Cambridge University Press, Cambridge
9. SmithA.L.(1921)Lichens, Cambridge universityPress
10. OrangeA,JamesPWandWhiteFJ(2001)Microchemical methods for identification of lichens. British Lichen Society.
11. Parihar N. S. 1965, An Introduction to Embyophyta- Bryophyta. Central Book Depot. Allahabad.
12. Kashyap S. R. 1972, Liverworts of the Western Himalayas & the Punjab Plains. Part 1 & 2.
13. RichardsonD. H. 5, TheBiology of Mosses.
14. Janice.M.Glime,2006,Bryophyte Ecology.
15. GoffmetB.&Shaw.A.J.2008,Bryophyte Biology.

II. APPLLIED MICROBIOLOGY

UNIT- I

General account of Microorganisms: History of microbiology, characteristic features of Bacteria and actinomycetes, classification of microorganisms- Three domain classification, Bergey's classification. Morphology of Bacterial cells, capsule, cell wall, cell appendages (flagella, fimbriae and pili).Methods of isolation and culture of microorganisms, measurement of microbial growth, microbial genetics.

UNIT-II

Role of microorganisms: Root nodules, nif gene organization, role of microorganisms in soil (decomposition and nutrient cycling), water and air; role in industry- production of antibiotics, bio-fertilizers and bio-pesticides.

UNIT-III

Microbial Ecology and Environmental Microbiology of air, water and soil. Microbiology of Solid waste,Sewage and Industrial waste,Bioleaching and Biomining.Microbiology of food, Milk and dairy products.

UNIT-IV

Infection and Diseases: Human Diseases caused by Fungi, Bacteria and Viruses, their diagnostics and managements.

Suggested Readings:

1. Madigan,M.T.,Martinko,J.M.,Dunlap,P.V.,Clark,D.P.,2011.BrockBiologyof Micmorganiss. 13th edition, Pearson Education Inc.
2. Stanier, R.Y., Ingraham, J L Wheelis, M.L., Painter, P.R., 1987. General Microbiology. Fifth edition. MacMillan.
3. Dubey,R Cand Malieshwari.DK.1999.ATextbookofMicrobiology.S.Chand& Company Ltd.
4. Atlas,RM.1995.Principles of Microbiology.Mobsy.
5. Lim,DV.2003.Microbiology.Kendall/Hunt.
6. Boundless.2013.Microbiology.Boundless Learning, Incorporated.
7. Comelissen, CN, Harvey, RA and Fisher, BD. 2012. Microbiology. Lippincott Williams & Wilkins,
8. Talaro,K.P.,Chess,B.2011,FoundationsinMicrobiology.8th edition.McGraw-Hill.
9. Tortora, G.I., Funke, B.R.., Case, C.L. 2003, Microbiology: An Introduction. Benjamin Cummins
10. Willey, J.M., Sherwood, L., Woolverton, C.J., 2010. Prescott's Microbiology. 8th edition, McGraw-Hill.

DISCIPLINE CENTRIC ELECTIVE-2 (Select any one)

ADVANCE PLANT PATHOLOGY

UNIT-I

General introduction of Plant Pathology, Chemical weapons of pathogens-Enzymes and toxins; Role of growth hormones in plant diseases, Defense mechanism of the host, how the pathogen affects plant physiological functions.

UNIT-II

Genetics of plant disease, effect of environmental factors on the plant disease development, Plant disease epidemiology: Preexisting structural and chemical defense, induced structural and chemical defense, hypersensitive reaction, role of phytoalexins and other phenolic compounds. Management of plant diseases: Cultural, chemical, biological, biopesticides, breeding for resistant varieties, Plant quarantine, integrated pest management.

UNIT-III

Diseases caused by Fungi,Bacteria,Viruses and Mycoplasma.

UNIT-IV

Molecular plant pathology: Molecular aspects of host pathogen interaction – PR proteins, degradation of phytoalexins, systemic resistance mechanism; application of molecular biology to plant disease control- transgenic approach for crop protection.

Suggested Readings:

1. Mehrotra R.S.Plant Pathology.Tata Mc Grow Hill Publishing Co.Ltd.NewDelhi.
2. Agrios,G.N.Plant Pathology.
3. Mehrotra and Agrawal.PlantPathology.
4. Narayansamy,P.Plant Pathogen detection and disease diagnosis.
5. Butler,EJ.Fungi and Diseases in Plants.
6. Singh,R.S.Plant Disease,Oxford and IBH Publishing Co.Pvt.Ltd.

HISTORY OF BOTANY AND MICROTECHNIQUE

UNIT- I

A brief introduction of major discoveries in Botany and contribution of renowned Indian Scientist:Prof.Birbal Sahni,Prof.Panchanan Maheshwari,Prof. Shiv Ram Kashyap,Prof. M.O.P. Iyenger, Prof. P.N. Mehra, Prof. Divya Darshan Pant, Prof. K.C. Mehta, Prof. R.N.Singh, T.V. Desikachary, Prof. Ramdeo Mishra and K.S. Bhargava.

UNIT-II

A brief introduction of major discoveries in Botany and contribution of renowned scientists: Pier Antonio Micheli, Melvin Kelvin, Sir Hans A. Kreb, Kary Bank Mullis, E.J. Butler, F.E. Fritsch, Prof. T.H. Morgan, Sir Charles Darwin, Sir George Bentham, Sir Joseph Dalton Hooker, Carlous Linnaeus.

UNIT-III

Microscopy: Optical, Electron, Scanning probe, Ultraviolet, Infrared, Fluorescence. Staining techniques: Gram staining and Acid Fast staining. Reagents used for the microscopic examinations eg. Methylene Blue, Fast Green, Phloroglucin/HCl, Safranin, Hematoxylin, Lugol's solution, Retenium red, Cotton Blue and eosin.

UNIT-IV

Chromatography: Basic concept, GC, TLC, HPLC, HPTLC, Affinity chromatography, Ion Exchange chromatography. Spectroscopy: Basic concept, Mass Spectroscopy, X-Ray Diffraction. Gel Electrophoresis: AGE, PAGE, SDS-PAGE, 2D Electrophoresis, IEF.

Suggested reading:

1.Wilson, K.AndWalker, J., 2000. Practical Biochemistry: Principles &techniques (5th Edition), Cambridge University Press.

UG SEMESTER VIII(for Four Year Undergraduate Programme who obtained above 75% marks)

OR

PG SEMESTER II (for Two Year Post Graduate Programme- lateral entry)

CORE-I. PTERIDOPHYTA, GYMNOSPERM AND PALAEOBOTANY

UNIT-I

A brief account of origin of pteridophytes, classification of pteridophytes, heterospory and seed habit, evolution of steler system, telome theory, evolution of sorus, apogamy, apospory and apomixis.

A brief account of the following classes with emphasis on the given genera:

Psilophytopsida: Rhynia, Horneophyton; Psilotopsida*: Psilotum*; Lycopsida: *Lycopodium, Lepidodendron, Lepidocarpon, Selaginella, Isoetes'*; Sphenopsida: *Hyenia, Sphenophyllum, Calamites, Equisetum*; Pteropsida: Eusporangiate (Ophioglossales and Marattiales) with special reference to phylogeny of Ophioglossales; Protoleptosporongiate (*Osmunda, Leptopteris)*;Leptosporongiate:(a)Filicales(*Hymenophyllum,Adiantum,Pteris,Dryopteris)* (b)Marsileales(*Marsilea*)(c)Salviniales(*Salvinia, Azolla*)

UNIT-II

Introduction: History, classification, distribution and evolution of Gymnosperms with special reference to Progymnosperms and origin of seeds. Endangered gymnosperms, their conservation and present status. Economic importance of Gymnosperms.

UNIT-III

Brief account of the families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae) and Cycadeoideales. General account of Cordaitales. General account of Pentoxylales. Morphology, anatomy and reproduction in Cycadales, Ginkgoales and Coniferales. General account of Ephedrales, Welwitschiales and Gnetales.

UNIT-IV

Preservation of fossil plants. Types of fossils, modes of formation of different kinds offossils, Gondwana flora.

Suggested readings:

1. Rashid,A,2011, An Introduction to Pteridopyta,Ir^d edition,(Reprint),Pub.Vikas Publishing House Pvt. Ltd., Noida.
2. Gifford,Ernest,M.,Foster,Adriance.S.,1989,MorphologyandEvolutionofvascularplant. W.H.Freeman;Third Edition.
3. Rashid,A.1999,An Introduction to Pteridophta:Diversity,Development,Differentiation. Vikas Publishing House Pvt Ltd.
4. Parihar, Narayan Singh., 1977, The Biology and Morphology of The Pteridophyte. CentralBook Depot
5. Eames,A.J.(1936)Morphology ofVascularplant-lowergroup.TataMcGrawHill,New Delhi.
6. Chamberlain, Charles Joseph,b.1863, Gymnosperm S;Structure and Evolution.

Chicago,III.,The University of Chicago Press
7. ChhayaBiswasandB.M.Johri.TheGymnosperm.Springer;1997edition(16April 2014)
8. Bhatnagar,S.P.Moitra,Alok.1996.Gymnosperms.NewAgeInternational.
9. PantDD.2002,AnIntroductiontoGymnosperms,Cycas,andCycadales,BirbalSalmi Institute of Palaeobotany.

PRACTICAL ON PTERIDOPHYTA, GYMNOSPERMS AND PALAEOBOTANY.

CORE-II. PLANT MORPHOLOGY, PLANT ANATOMY AND

EMBRYOLOGY

UNIT-I

Morphology of flower, stamen and carpel. Plant adaptations and their morphological nature. Shoot Development: Organization of the shoot apical meristem (SAM); control of cell division and tissue differentiation especially xylem and phloem; secretory ducts andlaticifers; wood development in relation to environmental factors and wood anatomy. Leaf growth and differentiation (structural development and classification of stomata and trichomes). Root development: Organisation of root apical meristem (RAM); vascular tissue differentiation; lateral roots; root hairs.

UNIT-II

Tissue - General account; Stem anatomy - Dicot and Monocot; Root anatomy - Dicot and Monocot. Anomalous Secondary Growth - Boerhaavia, Dracaena, Nyctanthes, Mirabilis, Salvadora, Laptadenia. Periderm formation.

UNIT-III

Male gametophyte: Structure of anther; microsporogenesis; pollen germination, pollen allergy; pollen embryos. Female gametophyte: Ovule development; megasporogenesis; development and organization of the embryo sac.

UNIT-IV

Pollination, Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanism and vectors; commercial consideration; structure of the pistil; pollen stigma interactions,sporophytic and gametophyticself-incompatibility(cytological,biochemicaland molecular aspects); double fertilization; in vitro fertilization. Seed development and fruit growth: Endosperm development during early, maturationand desiccation stages; embryogenesis, cell lineages during late embryo development; polyembryony; apomixis, embryo culture.

Suggestedreadings:

1. Katherine Esau(1965),Plant Anatomy,published by John Wiley and Sons. Inc,New York.
2. ArthurJ.Earnes;Laurence H.Mac Daniels(1951),An Introduction To Plant Anatomy, published by London; New York: Mc Graw Hill.

3. Carquist,S.(1961),ComparativePlantAnatomyHolt,RinehartandWinston,publishedby New York Press.
4. A.Fahn (1982), Plant Anatomy Vol I and Vol II, published by Pergamon Press. Oxford New York
5. Pandey, B.P., Angiosperms-Taxonomy, Emrbyology and Anatomy, S. Chand and Co., New Delhi
6. Bhojwani,S.S.and Bhatnagar,S.P.,Embryology of Angiosperms,Vikash Publishing House, New Delhi

PRACTICAL ON PLANT MORPHOLOGY, PLANT ANATOMY AND

EMBRYOLOGY.

RESEARCH PROJECT

UG SEMESTER VII (for Four Year Undergraduate Programme who obtained below 75% marks)

OR

PG SEMESTER II (for Two Year Post Graduate Programme- lateral entry)

CORE-1. PTERIDOPHYTA, GYMNOSPERM AND PALAEOBOTANY

UNIT-I

A brief account of origin of pteridophytes, classification of pteridophytes, heterospory and seed habit, evolution of steler system, telome theory, evolution of sorus, apogamy, apospory and apomixis.

A brief account of the following classes with emphasis on the given genera:

Psilophytopsida: Rhynia, Horneophyton; Psilotopsida*: Psilotum*; Lycopsida: *Lycopodium, Lepidodendron, Lepidocarpon, Selaginella, Isoetes'*; Sphenopsida: *Hyenia, Sphenophyllum, Calamites, Equisetum*; Pteropsida: Eusporangiate (Ophioglossales and Marattiales) with special reference to phylogeny of Ophioglossales; Protoleptosporongiate (*Osmunda, Leptopteris)*;Leptosporongiate:(a)Filicales(*Hymenophyllum,Adiantum,Pteris,Dryopteris)* (b)Marsileales(*Marsilea*)(c)Salviniales(*Salvinia, Azolla*)

UNIT-II

Introduction: History, classification, distribution and evolution of Gymnosperms with special reference to Progymnosperms and origin of seeds. Endangered gymnosperms, their conservation and present status. Economic importance of Gymnosperms.

UNIT-III

Brief account of the families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae) and Cycadeoideales. General account of Cordaitales. General account of Pentoxylales. Morphology, anatomy and reproduction in Cycadales, Ginkgoales and Coniferales. General account of Ephedrales, Welwitschiales and Gnetales.

UNIT-IV

Preservation of fossil plants. Types of fossils, modes of formation of different kinds offossils, Gondwana flora.

Suggested readings:

1. Rashid,A,2011, An Introduction to Pteridopyta,Ird edition,(Reprint),Pub.Vikas Publishing House Pvt. Ltd., Noida.

2. Gifford,Ernest,M.,Foster,Adriance.S.,1989,MorphologyandEvolutionofvascularplant. W.H.Freeman;Third Edition.

3. Rashid,A.1999,An Introduction to Pteridophta:Diversity,Development,Differentiation. Vikas Publishing House Pvt Ltd.

4. Parihar, Narayan Singh., 1977, The Biology and Morphology of The Pteridophyte. CentralBook Depot

5. Eames,A.J.(1936)Morphology ofVascularplant-lowergroup.TataMcGrawHill,New Delhi.

6. Chamberlain, Charles Joseph,b.1863, Gymnosperm S;Structure and Evolution. Chicago,III.,The University of Chicago Press

7.ChhayaBiswasandB.M.Johri.TheGymnosperm.Springer;1997edition(16April 2014)

8. Bhatnagar,S.P.Moitra,Alok.1996.Gymnosperms.NewAgeInternational.

9. PantDD.2002,AnIntroductiontoGymnosperms,Cycas,andCycadales,BirbalSalmi Institute of Palaeobotany.

PRACTICAL ON PTERIDOPHYTA, GYMNOSPERMS AND

PALAEOBOTANY.

CORE-2. PLANT MORPHOLOGY, PLANT ANATOMY AND EMBRYOLOGY

UNIT-I

Morphology of flower, stamen and carpel. Plant adaptations and their morphological nature. Shoot Development: Organization of the shoot apical meristem (SAM); control of cell division and tissue differentiation especially xylem and phloem; secretory ducts andlaticifers; wood development in relation to environmental factors and wood anatomy. Leaf growth and differentiation (structural development and classification of stomata and trichomes). Root development: Organisation of root apical meristem (RAM); vascular tissue differentiation; lateral roots; root hairs.

UNIT-II

Tissue - General account; Stem anatomy - Dicot and Monocot; Root anatomy - Dicot and Monocot. Anomalous Secondary Growth - Boerhaavia, Dracaena, Nyctanthes, Mirabilis, Salvadora, Laptadenia. Periderm formation.

UNIT-III

Male gametophyte: Structure of anther; microsporogenesis; pollen germination, pollen allergy; pollen embryos. Female gametophyte: Ovule development; megasporogenesis; development and organization of the embryo sac.

UNIT-IV

Pollination, Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanism and vectors; commercial consideration; structure of the pistil; pollen stigma interactions,sporophytic and gametophyticself-incompatibility(cytological,biochemicaland molecular aspects); double fertilization; in vitro fertilization. Seed development and fruit growth: Endosperm development during early, maturationand desiccation stages; embryogenesis, cell lineages during late embryo development; polyembryony; apomixis, embryo culture.

Suggestedreadings:

1. Katherine Esau(1965),Plant Anatomy,published by John Wiley and Sons. Inc,New York.
2. ArthurJ.Earnes;Laurence H.Mac Daniels(1951),An Introduction To Plant Anatomy, published by London; New York: Mc Graw Hill.
3. Carquist,S.(1961),ComparativePlantAnatomyHolt,RinehartandWinston,publishedby New York Press.
4. A.Fahn (1982), Plant Anatomy Vol I and Vol II, published by Pergamon Press. Oxford New York
5. Pandey, B.P., Angiosperms-Taxonomy, Emrbyology and Anatomy, S. Chand and Co., New Delhi
6. Bhojwani,S.S.and Bhatnagar,S.P.,Embryology of Angiosperms,Vikash Publishing House, New Delhi

PRACTICAL ON PLANT MORPHOLOGY, PLANT ANATOMY AND

EMBRYOLOGY.

DISCIPLINE CENTRIC ELECTIVE- 1 (Select any one)-

I. TAXONOMY OF ANGIOSPERMS

UNIT-I

History of plant taxonomy in India, history of plant classification, needs and aim of classification, units of classification, delimitation of taxa and their practical consideration,

artificial, natural and phylogenetic system of classification, A critical study of Takhtajans, modem system of classification, an introduction of angiosperm phylogeny group (APG), characteristics and phylogeny of orders. A brief account of major contribution made by the following Taxonomists: Carl Linnaeus, Joseph Dalton, Hooker, William Roxburgh, John Friminger and Duthie.

UNIT-II

Needs and aim of nomenclatures ,International Rules of Botanical Nomenclature ,Concept of species, genus, family with special reference to the type concept. Interrelationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, phytogeography and Chemistry, A general survey of recent advances in taxonomy: Biosystematics, biochemical and molecular systematic and numerical taxonomy.

UNIT-III

Indigenous flora of the country with special reference to local flora (Uttar Pradesh), A general knowledge of Herbarium and Botanical garden of the world and India, organization of Botanical Survey of India and its role.

UNIT-IV

Distinguishing features only of the following families and their economic importance: Ranunculaceae, Rutaceae, Fabaceae, Rosaceae, Cucurbitaceae, Apiaceae, Asteraceae, Apocynaceae,Asclepiadaceae,Acanthaceae,Rubiaceae,Solanaceae,Lamiaceae ,Verbenaceae ,Polygonaceae Euphorbiaceae , Orchidaceae, Zingiberaceae, Cyperaceae and Poaceae.

Suggestedreadings:

1. Sumbhamurti A.V.S.S.,Taxonomy of Angiosperm,I.K.internationalPvt Ltd.
2 . APGIII2009.AnupdateoftheAngiospermPhylogenyGroupClassificationforthe Order and Families of Flowering Plants: APG III. *Bot. J Linn. Soc.* 161: 105-121.
3.Jain, S.K. and Rao, R.IL 1977. *A Handbook of Field and Herbarium Methods.* Today and Tomorrow's Printers and Publishers, New Delhi.
4.Jones,SB.1986.PlantSystematics.McGrawHill
5.N.S.Subramaniam,Taxonomy of Angiosperm,Vikas publishing house Pvt Ltd.
6. Pandey,A.K.,J.V.V.Dogra.&Wen,J.2006.*PlantTaxonomy:AdvancesandRelevance.* CBSPvt. Ltd.
7. Pullaiah,T.2007.Taxonomy of Angiosperm.RegencyPublications,New Delhi.
8.Rao, R. It 1994. *Biodiversity in India* (Plant Aspects), Bishan Singh Mahandrapal Singh, Dehradun.
9. S.N.PandeyandS.P.Mishra,Taxonomy of Angiosperm.Awe Books Pvt Ltd.
10.Sharma,0.P.1993.*PlantTaxonomy*.Tata Mc Graw Hill PublishingCo.Ltd.,New Delhi
11.Singh,V.and Jain,DX.,Taxonomy of Angiosperms. Rastogi Publication, Meerut
12.Velma, B. K. 2010. An *introduction to Taxonomy of Angiosperms.* PHI Learning Pvt, Ltd. New Delhi.

II. MEDICINAL PLANTS AND ETHNOBOTANY

UNIT-I

Ethnobotany: Its Concept, Scope and Relevance. Indigenous systems of medicines in India. Traditional Agriculture Practices in Ancient India. Some aspects of Biodiversity and Indian Traditions.

UNIT-II

Role of Ethnobotany in primary health care programmes and development of new drugs. Ethnobotany on development and conservation of bioresources.

UNIT-III

Plant exploration, Crop and Germplasm collection of land races: Methods and strategies. Traditional knowledge of Uttar Pradesh: With special reference to food and medicine. Ethanobotany of major tribal communities(Gond, Bhil, Baigaetc) of Uttar Pradesh.

UNIT-IV

Contributions of Ethnobotanists: J.W.Harshberger, R.E.Schultes, E.K.Janakiammal,S.K.Jain, K.S.Manilal, V.V Sivarajan & P.Pushpangadan. Role of ethnobotany in conservation and sustainable development.

Suggested Reading:

1. Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co.Pvt. Ltd., New
2. Jain, S. K. (1989).Methods and approaches in Ethnobotany. Societyof Ethnobotanists, Lucknow13.
3. Jain,S.K. (1995).A manual of Ethnobotany. Scientific Publishers, Jodhpur.

DISCIPLINE CENTRIC ELECTIVE- 2 (Select any one)-

PLANT RESOURCE UTILIZATION

Unit-I

Food Plants: Cereal crops, sugar yielding plants, legume or pulses, vegetablcs, fruit, oil and fats, spices, condiments.

Unit-II

Medicinal and Aromatic Plants: Medicinal plant, aromatic plants, insecticide, herbicide and s acred plants.

Unit-III

Beverages and Masticatories: Tobacco, areca, cannabis,coca,tea,coffee

UNITIV

Timber, fibre and petro crops: Timber, tannins and dye stuffs, rubber, gums, resin and bio-fuels.

Suggestedreading:

1. S. L.Kocchar,Economic Botanyinthe Tropics. Macmillan Publisher,
2. Albert F. Hill, Economic Botany: A Textbook of Useful Plants and Plant Products .McGraw-Hill publications, New York

PLANT BREEDING AND CROP IMPROVEMENT

UNIT-I

Importance, scope and major achievements of plant breeding. Germplasm; kinds of germplasm, collection, evaluation and organizations concerned with germplasm, in-situ and ex-situ conservation. Modes of reproduction in crop plants; sexual and asexual reproduction, apomixis, identification of apomictic plants. Incompatibility; genetic, physiological and biochemicalbasisofincompatibility,utilityofselfincompatibility.Malesterility;geneticand cytoplasmic male sterility and its applications.

UNIT-II

Plant introduction; types of introduction, procedure, uses of plant introduction and organizations associated with introduction. Pure line selection, mass and progeny selection, procedureandachievements.Pedigreeselection,recurrentselectionandtheirapplications.

Role of mutation in plant breeding, isolation of useful mutants and major achievements. Role of polyploidy in crop improvement.

UNIT-III

Hybridization- kinds of hybridization, procedure of hybridization, types of hybridization and utility of hybridization. Hybrid breeding in self- and cross-pollinated crops. Back cross breeding. Heterosis; theories of heterosis, inbreeding depression.

UNIT-IV

Protoplast fusion and somatic hybrids. Method of gene transfer and transgenics. Marker assisted selection. Breeding for disease resistance, salinity tolerance and quality traits.

SuggestedReadings:

1. IntroductiontoPlantBreeding,R.C.Chaudhary, Oxford&IBHPublishers,1982.
2. PlantBreeding,V.Kumaresan,SarasPublication,2015.
3. PlantBreedingPrinciples&Methods,B.D.Singh,KalyaniPublishers,1983.
4. FundamentalsofPlant Breeding,PhundanSingh, KalyaniPublishers,2017.
5. PrinciplesofPlantBreeding, I.D.Tyagi,Jainbrothers,2015
6. PrinciplesofPlant Breeding,Robert W.Allard, JohnWiley&sons, 1960.

ABILITY ENHANCEMENT COURE (Select any one)-

I. PLANT PROPAGATION AND NURSERY MANAGEMENT

Unit-I: Propagation- Importance and potentialities, Sexual and asexual methods of propagation, Advantages and disadvantages of propagation.

Unit-II: Methods of vegetative propagation: Cutting, budding, layering and grafting techniques. Preparation of nursery bed, orchard layout, system of crop planting, pot mixture and making.

Unit-III: Problems of horticulturecrops, Factors influencing rooting of cutting, layering and grafting.

Unit-IV: Use of growth regulators in propagation, media for propagation of plants in nursery beds.

PRACTICAL:1.Preparation of different types of cuttings, budding ,layering and grafting.

2.Uprooting,digging,labellingand packing of nursery plant.

Suggested Readings-

1. Dr. Arun kumar Singh and Abhinav kumar (2020). Propagation and nurserymanagement.
2. R.R.SharmaandManishSrivastav(2004).Plantpropagationandnurserymanagement.
3. B.S.Chundawat(2017).Plant propagationandnursery management.

II. MUSHROOM CULTURE TECHNOLOGY

Unit: I Cultivation System & Farm design:

Fundamentals of cultivation system- small village unit & larger commercial unit.

Principles of mushroom farm layout- location of building plot, design of farm, bulk chamber, composting platform, equipment & facilities , pasteurization room & growing rooms.

Unit: II Compost & Composting:

Principles of composting, machinery required for compost making, materials for compost preparation.

Methods of Composting- Long method of composting (LMC) & Short method of composting (SMC).

Unit: III Spawn & Spawning:

Facilities required for spawn preparation, Preparation of spawn substrate, preparation of pure culture, media used in raising pure culture, culture maintenance, storage of spawn.

Unit: IV Casting materials & Case running:

Importance of casing mixture, Quality parameters of casing soil, different types of casingmixtures, commonly used materials.

Unit: V Cultivation of Button , Oyster and Straw Mushrooms:

Collection of raw materials, compost & composting, spawn & spawning, casing & case run, cropping & crop management, picking & packing. Visit to relevant Labs/Field Visits

Suggested Readings-

1.Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

2.Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).

3.A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi

4.Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co.

PRACTICAL BASED ON ABILITY ENHANCEMENT COURSE

PG SEMESTER-III/ PG SEMESTER-I (One Year PG Programme- Lateral Entry)

CORE-1
PLANT PHYSIOLOGY

UNIT-I

Membrane transport and translocation of water and solutes: Plant-water relations, mechanism of water transport through xylem, phloem loading and unloading, passive and active solute transport, membrane transport of proteins. Transpiration: Types and mechanism of stomatal opening and closing. Mineral Nutrition: Essential and beneficial elements, Role and deficiency effects of essential nutrient elements.

UNIT-II

Nitrogen fixation and metabolism: Biological nitrogen fixation, mechanism of nitrate uptake and reduction, ammonium assimilation. Glycolysis, TCA Cycle, electron transport and ATP Synthesis, pentose phosphate pathway, glyoxylate cycle, Cyanide resistant respiration, Lipid metabolism.

UNIT-III

Photosynthesis: General concepts and historical background, steps of photosynthesis, Emerson's effect, two pigment systems, Calvin cycle, photorespiration and its significance, C4 cycle, CAM pathway.

UNIT-IV

Plant growth regulators: Physiological effects and mechanism of auxins, gibberellins, cytokinins, ethylene, abscisic acid, polyamines, jasmonic acid, hormone receptors and vitamins and hormones. Photoperiodism and vernalization: Photoperiodism and its significance, floral induction and development, significance of vernalization,devernalization.

Plant growth: Growth stages, Apical dominance, germination, dormancy (bud and seed).

Phytochrome: Its structure and functions. Biological clock and circadian rhythms.Stress physiology: Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, freezing and heat stress, oxidative stress.

SuggestedReadings:

1. Hopkins,W.G.1995.Introductiontoplant physiology.
2. Salisbury&Ross2003.PlantPhysiology.
3. FrankBoyerSalisburyandCleonRoss,1991,PlantPhysiology,CA
4. Peter Scott,Physiology and Behaviour of Plants.Wiley-Blackwell.

PRACTICAL ON PLANT PHYSIOLOGY

CORE -2

CYTOGENETICS AND BIOSTATISTICS

UNIT-I

Basic concept and organization: Chromosome structure, nucleosome, solenoid model, euchromatin and heterochromatin, special type of chromosomes- Polytene chromosomes, lampbrush chromosomes, B chromosomes. Gene concept; allele concept, multiple alleles, isoalleles, Pseudoalleles, cell division.

UNIT-II

Inheritance Genetics: Principles of Mendelian Inheritance and interaction of genes. Cytoplasmic inheritance involving chloroplast and mitochondria, mitochondrial and chloroplast genomes, interaction between nuclear and cytoplasmic genes, Sex determination in plants.

UNIT-III

Cytogenetics and Induced Variations: Linkage and recombination: Concept of Linkage, evolution of linkage concept, cis and trans arrangement of linked gene, kinds of linkage, germinal and somatic crossing over, detection of crossing over, kinds of crossing over.

Mutation: Spontaneous and induced mutations, point mutation, transitions, transversions, physical and chemical mutagens, molecular basis of mutations.

Numerical alterations in chromosomes: Euploidy, polyploidy and its significance, aneuploidy, autopolyploidy, Induction of trisomics and monosomics.

Structural changes in chromosomes: Deficiency, duplication, inversion, translocation

heterozygotes.

UNIT-IV

ImportanceandscopeofBiostatistics.MeasuresofCentraltendency,Measures of dispersion: range, mean deviation, Standard deviation, Variance, Standard error of mean, Standard error of SD, Students 't' test, Chi-square test. Analysis of Variance (ANOVA). Correlation and regression- meaning, kinds of correlation, coefficient of correlation, method of studying correlation. Aims of regression analysis. Kinds of regression analysis.

Suggested Reading:

1. Lewin,B.2000,Gene.Vol.Vii.OxfordUniv.Press,NewYork,USA.
2. Watson ,J .D. Molecular Biology of the Gene.
3. Gahalain,S.S.2004.Fundamentals of Genetics.
4. Gupta,P.K.,Cytogenetics, Rastogi Publication,Merrut.

PRACTICAL ON CYTOGENETICS AND BIOSTATISTICS.

DISCIPLINE CENTRIC ELECTIVE- 1 (Select any one)-

I. ECOLOGY AND PHYTOGEOGRAPHY

Unit I

Introduction to ecology, and environmental terminology, population dynamics, vegetation organization and development: population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning, r - and k-selection, concept of carrying capacity. Wild life sanctuaries, botanical gardens.

Unit II

Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, competition, ecological niche, succession, mechanism of ecological succession(relay floristic and initial floristic composition facilitation,tolerance and inhibition models), concept of climax.

Unit III

Ecosystem organization, structure and function: primary production (methods of measurement), energy dynamics (tropic organization, energy flow pathway, energy quality, ecological efficiencies), biogeochemical cycles.

Unit IV

Pollution and climate change:kinds,sources and effects of pollution,heavy metals(Pb,Cd,, Hg), green house gases (CO2. CH4, N20, CFCs), green house effect and global warming, ozone layer depletion and ozone hole, acid rain. Environmental impact assessment, threatened and endangered plant species, role of diversity in ecosystem stability, general account of

remote sensing and its application, sustainable development. Major terrestrial biomes, biogeographical area of India, major vegetations.

Suggested reading:

1. Odum,E.P.andBarretG.W.2005.FundamentalsofEcology.Cengage publication
2. Odum,E.P.,1983.Basic Ecology.,SaundersCollege Publishing
3. Singh, LS., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource Conservation. Anamaya Publishers

II. MOLECULAR BIOLOGY AND MOLECULAR TECHNIQUEs

UNIT-I

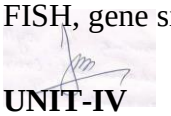
Structure of nucleotides and DNA: A, B, and Z form of DNA and properties, coding and non coding sequences, satellite DNA, DNA damage and repair, replication and transcription of DNA, structure of mRNA, rRNA and tRNA, replication of RNA, Splicing, transport of RNAs, RNA editing

UNIT-II

Protein synthesis: Mechanism of translation-Initiation, elongation and termination, post translational modification, protein targeting to organelles, regulation of protein synthesis at transcription and translation level in prokaryotes and eukaryotes.

UNIT-III

Molecular Technique: Isolation and purification- genomics and plasmid DNA, RNA,Proteins, Blotting principles, types of blotting, immunoblotting- Southern, Northern, Western and dot blots, ELISA, RIA, DNA amplification and genome mapping: PCR, RT-PCR,RFLPs, RADP, FISH, gene silencing



UNIT-IV

DNA Sequencing: Various methods of DNA Sequencing- Sanger's Dideoxymethod, Maxam and Gilbert method, Shotgun, Pyrosequencing.

Genome expression analysis: SAGE, EST, Microarray, Quantitative Real Time PCR; RNAInterference (RNAi), Genome Editing- CRISPR

Suggestedreading:

1. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology ofPlants. American Society of Plant Biologists, USA.
2. BourtonE.Tropp,Molecular Biology,4thEd.,Jones&Barlettlearning.
3. Brown,T.A.,DNA Cloning and Gene Sequencing Willey-Blackwell,Oxford.
4. Dubey,R.C.A textbook of Biotechnology.S.Chand Publication.Pvt.Ltd.
5. Ramawat,K.G.Molecular Biology and Biotechnology.S.Chand Publication.Pvt. Ltd.

DISCIPLINE CENTRIC ELECTIVE-2

(Select any one)

PLANT BIOTECHNOLOGY

UNIT-I

Recombinant DNA technology: Restriction endonuclease, DNA modifying enzymes, Vectors, Cloning techniques, Polymerase chain reaction, Gene transfer method: Direct gene transfer, Agrobacterium mediated genetic transformation, Microinjection, Electroporation; Nucleic acid hybridization.

UNIT-II

Organization of Plant genomes; Molecular markers and its application; Genomic and cDNA library; Modern approaches for the analysis of plant genome and proteome, Mutagenesis, Gene transfer.

UNIT-III

Scope of plant biotechnology in crop improvement, human welfare and industry: Genetic manipulation of pest resistant, abiotic and biotic stress tolerance, improvement of crop yield and quality; Molecular farming, Biosafety concerns in Plant Biotechnology, Transformation of chloroplast genome and its advantage.

NIT-IV

Plant cell and tissue culture: General introduction, history and scope; Concept of cellular differentiation and totipotency; Organogenesis and adventitious embryo genesis: Fundamental aspects of morphogenesis: Somatic embryogenesis and androgenesis, Tissue culture techniques and culture media; Cryopreservation and germplasm conservation. Somatic hybridization: Protoplast isolation, culture and regeneration, Somatic hybridization andhybrid selection; Application of plant tissue culture: Clonal propogation, artificial seed, production of hybrids and soma clones, production of secondary metabolites/natural products.

Suggested reading:

1. Chawla,H.S.19 Introduction to plant biotechnology
2. Gupta,P.K.Elements of biotechnology.
3. S H Mantell, et. al. Principles of Plant Biotechnology: An introduction to genetic engineering in plants.
4. Singh,B.D.Plant Bio technology Kalyani Publications.
5. Dubey,R.C.Advanced Biotechnology.S.Chand.Pvt. Ltd.

PLANT BIOCHEMISTRY

UNIT-I

Bioenergetics: Laws of thermodynamics, concept of enthalpy and entropy and their significance in biological systems, Water biochemistry, high energy molecules, redox potential;Aminoacidsandproteins:Structureandphysiochemicalpropertiesofaminoacids;
Proteins: Primary, Secondary, tertiary and quaternary structure of proteins, physical and chemical properties of proteins and biological significance. Enzymes: Classification,physical-chemical nature, enzyme kinetics, mechanism of action and regulation.

UNIT-II

Carbohydrates: Structure and physical-chemical properties of carbohydrates, biological significance,Glycoprotein,Lipids:Classification,structureandpropertiesofimportantlipids, biological significance of glycolipids, fatty acid biosynthesis and storage lipids and their catabolism. Vitamins and Coenzymes: Structure and general biochemistry.

UNIT-III

Nucleic Acid: Structure and conformation of nucleic acids; replication and transcription of DNA, regulation of transcription, DNA damage and repair, Structure of mRNA, rRNA and tRNA, Splicing, transport of RNAs, RNA editing.

UNIT-IV

Biological Nitrogen Fixation: Nitrogenase enzyme, substrate for nitrogenase, Reaction mechanism, strategies to exclude oxygen and need to control hydrogen evolution.

Suggestedreadings:

1. Devi,P.2000.PrinciplesandmethodsofPlantMolecularBiology,BiochemistryandGenetics.
2. Cooper,T.G.1977.Toolsin Biochemistry.
3. Lehninzer.PrinciplesofBiochemistry
4. Srivastava,H.S.1983.ElementsofBiochemistry.RastogiPublications,Meerut.

ABILITY ENHANCEMENT COURSE

(Select any one)-

I. HERBAL COSMETICS

UNIT I.

Cometics classification and categories, brief history of herbal cosmetics, difference between herbal and synthetic cosmetic products, benefits of herbal cosmetics.

UNIT II.

Challenges in formulating herbal cosmetics, Raw materials, Machinery and Equipments used in preparation of herbal cosmetics.

UNIT III.

Process used in the manufacture of herbal cosmetics, Plants used in skin care products, Plants used in hair care products.

UNIT IV.

Preparation of scrub, face pack, vanishing cream, face wash, soap, moisturizer, talcum powder, sunscreen, shampoo, hair oil, hair conditioners, hair dye.

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1.Classification of cosmetic raw materials and adjuncts IS3958 of Indian Standard 2. Smith R.V., Stewart J.T. Text book of Bio pharmaceutical analysis, Lia and Febiger, Philadelphia (1982). 3. Behl P.N,Srivastava G. Herbs useful in dermatological therapy, CBS (2002). 4. Karnik C.R. Pharmacopoeia standards of herbs, Sri Satguru Publications Delhi (1994) . 5. Bore P. Cosmetics analysis: Selective methods with techniques, Marcel Dekker (1985). 6. Sharma P.P. Cosmetics -Formulation, Manufacturing and Quality control, Vandana Publications (2014). 7. Panda H. Herbal cosmetics handbook, Asia Pacific Business press (2015). 8. Chattopadhyay P.k. Herbal cosmetics and ayurvedic medicines, National Institute of Industrial research (2008). 9. Panda H. The complete technology book on herbal perfumes and cosmetics, NIIR project consultancy services (2012). 10. Kirtikar K.R. and Basu B.D. 8 volumes Indian medicinal plants, Bio-Green Books (2012). 11. Drugs and cosmetics acts and rules Govt of India Publications. 12. Guenther Ernest Vol I The Essential Oils, Ingram short title (2007). 13. Indian Standard Institution Booklets. 14. Nadkarni K.M. Indian Materia Medica, Popular Prakashan (1994). 15. Wealth of India C.S.I.R. 16.Srivastava S.B. ,Perfume Flavour and Essential Oil Industries, Small Industry Research Institute. 17. Das Kuntal , Herbal Plants and their Application in Cosmaceuticals,, CBS Publication (2014) 18. Krishnamurthy K.H., Ayurvedic Technical Studies and Herbal Cosmetics of Ancient India, B.R. Publishing Corporation (2001) 19. Chopra R.N.,Nayar S.L., Chopra L.C., Glossary of Indian Medicinal Plants, , National Institute of Science Communication and Information Resources (1956) 20. Saxena Rajan, Marketing Management, McGraw hill Education (2009) 21.Saraf Swarnlata, Saraf Shailendra, Cosmetics a Practical Manual,(2015), Bsp Books Pvt Ltd 22. EIRI Board, .Herbal Cosmetics and Beauty Products with formulations, Engineers India Research Institute, (2015) 23. NIIR Board, Handbook on herbal products National Institute of industrial Research (2002)

II. BIO FERTILIZERS-

UNIT I.

General account of microbes used as biofertilizers; *Rhizobium:*

Morphology, identification, isolation, cultivation and mass

multiplication.

Azospirillum: Isolation and mass multiplication.

Azotobacter: Classification ,characteristics, crop response to *Azotobacter* inoculum, maintenance

and mass multiplication.

UNIT II.

Cyanobacteria (Blue green algae),*Anabaena-Azolla* ;nitrogen fixation, factors affecting growth, *Anabaena-Azolla*
Association in rice cultivation.

Mycorrhizal association – types of mycorrhizal association, occurrence and distribution of phosphorous nutrition, growth and yield; colonization of VAM

Suggestedreadings

1. Dubey,R.C.(2005).ATextbookofBiotechnology.S.Chand&Co,NewDelhi.
2. Kumaresan,V.(2005).Biotechnology.SarasPublications,NewDelhi.
3. JohnJothiPrakash,E.(2004).OutlinesofPlantBiotechnology.EmkayPublications,NewDelhi.
4. Sathe,T.V.(2004).VermicultureandOrganicFarming.DayaPublications.
5. SubhaRao,N.S.(2000).SoilMicrobiology.Oxford&IBHpublishers,NewDelhi.
6. Somani,L.L.(2004).HandbookofBiofertilizers.AgrotechPublishingAcademy,Udaipur-313002
7. Sharma,A.K.(2005).AHandBookoforganicfarming.Agrobios,Jodhpur,India,Rajasthan
8. Vayas,S.C.,Vayas,S.andModi,H.A.(1998).BiofertilizersandOrganicFarming.AktaPrakashanNadiad.
9. Trueman'sBiofertilizers.(2018).TruemanBookCompany,Jalandhar.

PRACTICAL ON ABILITY ENHANCEMENT COURSE

PG SEMESTER- IV/PG SEMESTER-II (One Year PG Programme- Lateral Entry)-

MASTER DISSERTATION