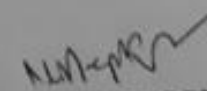


## Curriculum Teaching Plan

Department of Botany

Programme: B.Sc.	Year: First	Semester: First
Name of Faculty: Mrs. Nirlep Kour (NK), Dr. Amita Sharma (AS), Dr. Garima Malik (GM), Mrs. Sanyogita Kumari (SK)		
Course Title: Microbiology & Plant Pathology	Credits: 04	
Course Code: B040101T	Core Compulsory	
Max. Marks: 25+75	Theory	
<p>Course Outcome: After the completion of the course the students will be able to</p> <ul style="list-style-type: none"> <li>• Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi &amp; Lichens &amp; their economic importance.</li> <li>• Develop conceptual skill about identifying microbes, pathogens, biofertilizers &amp; lichens.</li> <li>• Gain knowledge about developing commercial enterprise of microbial products.</li> <li>• Learn host-pathogen relationship and disease management.</li> <li>• Learn Presentation skills (oral &amp; writing) in life sciences by usage of computer &amp; multimedia.</li> <li>• Gain Knowledge about uses of microbes in various fields.</li> <li>• Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens.</li> <li>• Gain Knowledge about the economic values of this lower group of plant community</li> </ul>		
Unit	Topics	No. of Lectures 60hrs
I (AS)	A. Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists (in all branches), in context with the holistic development of modern science and technology, has to be taught, practiced and assessed via class interaction/ assignments / self-study mentioned under Continuous Internal Evaluation (CIE). B. Microbial Techniques & instrumentation Microscopy - Elementary knowledge of Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy. Common equipment of microbiology lab and principle of their working - autoclave, oven, laminar air flow, centrifuge, Colorimetry and spectrophotometry, immobilization methods, fermentation and fermenters.	08
II (GM)	Microbial world Cell structure of Eukaryotic and prokaryotic cells, Gram positive and Gram-negative bacteria, Structure of a bacteria and plasmids, Bacterial Chemotaxis and Quorum sensing, Bacterial Growth curve, factors affecting growth of microbes; measurement of growth, Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes, Sporulation and reproduction and recombination in bacteria, Viruses, general characteristics, viral culture, Structure of viruses, TMV and retro viruses, Bacteriophages, Structure of T4 & $\lambda$ -phage; Lytic and Lysogenic cycles, mycophages, viroid, Prions & mycoplasma & phytoplasma, Actinomycetes (Actinobacteria) and their economic uses.	08
III (GM)	Phycology Range of thallus organization in Algae, Pigments, Flagella, Reserve food, Types of Reproduction, Classification and comparative life cycle of - <i>Nostoc</i> , <i>Chlorella</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Ectocarpus</i> .	07

  
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	<i>Sargassum</i> , <i>Polysiphonia</i> . Phycoviruses, Economic importance of algae - Role of algae in soil fertility- biofertilizer - Nitrogen fixation Symbiosis; Commercial products of algae - biofuel, Agar, Diatomite	
IV (SK)	Mycology Comparative study of general characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class, Distinguishing characters of Myxomycota: General characters of True Fungi (Eumycota): Mastigomycotina: <i>Synchytrium</i> ; Zygomycotina: <i>Rhizopus</i> , Ascomycotina: <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Peziza</i> , Basidiomycotina: <i>Ustilago</i> , <i>Puccinia</i> , <i>Agaricus</i> ; Deuteromycotina: <i>Fusarium</i> , <i>Alternaria</i> ; Heterothallism, Physiological specialization, Heterokaryosis & Parasexuality	07
V (AS)	Mushroom Cultivation, Lichenology & Mycorrhiza Mushroom cultivation General account of lichens, reproduction and significance, Mycorrhiza ectomycorrhiza and endomycorrhiza and their significance.	07
VI (SK)	Plant Pathology Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inoculum, Infection, Pathogenicity and pathogenesis, Koch's Postulates, Mechanism of infection (Brief idea about Pre-penetration, Penetration and Postpenetration), Disease cycle (monocyclic, polycyclic and polyetic), Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic fungicides- Bordeaux mixture, Lime Sulphur, Tobacco decoction, Neem cake & oil	07
VII (NK)	Diseases and Control Symptoms, Causal organism, Disease cycle and Control measures of - Early & Late Blight of Potato, Black Stem Rust of Wheat, Alternaria spot and White rust of Crucifers, Red Rot of Sugarcane, Wilting of Arhar, Mosaic diseases on tobacco and cucumber, yellow vein mosaic of bhindi; Citrus Canker, Little leaf of brinjal; Damping off of seedlings. Disease management: Quarantine, Chemical, Biological, Integrated pest disease management	08
VIII (NK)	Applied Microbiology Elementary knowledge of Food fermentations and food produced by microbes, Production of amino acids, antibiotics, enzymes, vitamins, alcoholic beverages, organic acid & genetic recombinant vaccines, Mass production of bacterial biofertilizers, blue green algae, Azolla and mycorrhiza. Plant growth promoting rhizobacteria & biopesticides— <i>Trichoderma</i> sp. and <i>Pseudomonas</i> , Single cell proteins ( <i>Spirulina</i> ), Organic farming inputs, Microbiology of water, Biopolymers, Bioindicators, Biosensors, Bioremediation, Production of biofuels, Biodegradation of pollutants and Biodeterioration of materials & Cultural Property, Microbial Biofactories ( <i>E.coli</i> and Yeast) for production of recombinant proteins	08

**Suggested Readings:**

- Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
- Kumar, H.D. (1999). Introductory Phycology, Affiliated East-West, Press Pvt. Ltd. Delhi, 2nd edition
- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition Singapore, Singapore: John Wiley & Sons.
- Agrios, G.N. (1997). Plant Pathology, 4th edition, Cambridge, U.K.: Academic Press
- Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.

Continuous Evaluation Methods: Class Interaction, Quiz, Assignment and Seminar

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N. K. KOUR

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## Curriculum Teaching Plan

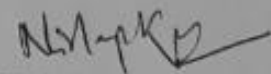
### Department of Botany

Programme: B.Sc.	Year: First	Semester: First
Name of Faculty: Mrs. Nirlep Kour (NK), Dr. Amita Sharma (AS), Dr. Garima Malik (GM), Mrs. Sanyogita Kumari (SK)		
Course Title: Techniques in Microbiology & Plant Pathology	Credits: 02	
Course Code: B040102P	Core Compulsory	
Max. Marks: 25+75	Practical	
<p>Course Outcome: After the completion of the course the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.</li> <li>• Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.</li> <li>• Practical skills in the field and laboratory experiments in Microbiology &amp; Pathology.</li> <li>• learn to identify Algae, Lichens and plant pathogens along with their Symbiotic and Parasitic associations.</li> <li>• Can initiate his own Plant &amp; Seed Diagnostic Clinic</li> <li>• Can start own enterprise on microbial products</li> </ul>		
Unit	Topics	No. of Lectures: 60hrs
I	INSTRUMENTS & TECHNIQUES 1. Laboratory safety and good laboratory practices 2. Principles and application of Laboratory instruments-microscope, incubator, autoclave, centrifuge, LAF, filtration unit, shaker, pH meter. 3. Cleaning and Sterilization of glasswares 4. Preparation of media- Nutrient Agar and Broth 5. Inoculation and culturing of bacteria in Nutrient agar and nutrient broth 6. Preparation of agar slant, stab, agar plate	07
II	BACTERIAL IDENTIFICATION 1. Isolation of bacteria. 2. Growth curve of bacteria 3. Identification of bacteria. 4. Staining techniques: Gram's, Negative, Endospore, Capsule and Cell Wall. 5. Cultural characteristics of bacteria on NA. 6. Pure culture techniques (Types of streaking).	08
III	MYCOLOGICAL STUDY: 1. Identification of fungi by lactophenol cotton blue method. <i>Rhizopus</i> , <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Peziza</i> , <i>Ustilago</i> , <i>Puccinia</i> ; <i>Fusarium</i> , <i>Curvularia</i> , <i>Alternaria</i> . 3. Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus. 4. Lichens: crustose, foliose and fruticose specimens.	08
IV	PHYCOLOGY: 1. Type study of algae and Cyanobacteria- <i>Nostoc</i> , Chlorophyceae - <i>Chlorella</i> , <i>Volvox</i> , <i>Oedogonium</i> , and <i>Chara</i> ; Rhodophyceae - <i>Polysiphonia</i>	07
V	EXPERIMENTAL PLANT PATHOLOGY 1. Preparation of fungal media (PDA) & Sterilization process. 2. Identification; Pathological specimens of Brown spot of rice, Bacterial blight of rice, Loose smut of wheat, Stem rot of mustard, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia. Few viral and bacterial plant diseases.	08
VI	PRACTICALS IN APPLIED MICROBIOLOGY-1 1. Isolation of nitrogen fixing bacteria from root nodules of legumes. 2. Microscopic observations of root colonization by VAM fungi.	08
VII	PRACTICALS IN APPLIED MICROBIOLOGY-2 1. Wine production. 2.	08

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	Isolation of lactic acid bacteria from curd. 3. Isolation of lipolytic organisms from butter or cheese. 4. Immobilized bacterial cells for production of hydrolytic enzymes. 5. Enzyme production and assay cellulase, protease and amylase. 6. Immobilization of yeast. 7. Isolation of cellulolytic and anaerobic sulphate reducing bacteria. 8. Isolation and characterization of acidophilic, alkalophilic and halophilic bacteria.	
VIII	1. Cultivation of <i>Spirulina</i> , & <i>Chlorella</i> in lab for biofuel 2. Mushroom cultivation for Protein	06
Suggested Readings:		
<ul style="list-style-type: none"> <li>• Pandey, B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.</li> <li>• Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.</li> <li>• Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.</li> <li>• Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand &amp; Company. Pvt. Ltd., New Delhi.</li> </ul>		
Continuous Evaluation Methods: Class Interaction, Group Discussion		

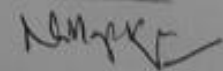


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 R.G. (P.G) College, Meerut

## Curriculum Teaching Plan

### Department of Botany

Programme: B.Sc.	Year: First	Semester: Second
Name of Faculty: Mrs. Nirlep Kour (NK), Dr. Amita Sharma (AS), Dr. Garima Malik (GM), Mrs. Sanyogita Kumari (SK)		
Course Title: Archegoniates and Plant Architecture	Credits: 04	
Course Code: B040201T	Core Compulsory	
Max. Marks: 25+75	Theory	
<p>Course Outcome: After the completion of the course the students will be able to:</p> <ul style="list-style-type: none"> <li>• Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.</li> <li>• Understanding of plant evolution and their transition to land habitat.</li> <li>• Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding the basis of plant diversity, economic values &amp; taxonomy of plants.</li> <li>• Understand the details of external and internal structures of flowering plants.</li> </ul>		
Unit	Topics	No. of Lectures: 60hrs
I (AS)	Introduction to Archegoniates & Bryophytes Unique features of archegoniates, Bryophytes: General characteristics, adaptations to land habit. Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , <i>Sphagnum</i> and <i>Funaria</i> . (Developmental details not to be included). Economic importance of bryophytes	07
II (SK)	Pteridophytes: General characteristics, Early (fossil) land plants ( <i>Rhynia</i> ) Classification (up to family) with examples, Heterospory and seed habit, stelar evolution, economic importance of Pteridophytes Comparative study of morphology, anatomy and reproduction of <i>Selaginella</i> , <i>Equisetum</i> and <i>Azolla</i> .	08
III (GM)	Gymnosperms Classification and distribution of gymnosperms; Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, their examples with special reference to <i>Cycas</i> , <i>Ginkgo</i> , <i>Pinus</i> , <i>Ephedra</i> , structure and reproduction; Economic importance	08
IV (GM)	Palaeobotany General account of Cycadofilicales, Bennettitales, Pentoxylales and Cordaitales; Geological time scale; Brief account of process of fossilization & types of fossils and study techniques	08
V (NK)	Angiosperm Morphology Morphology and modifications of roots, stem, leaf and bud. Types of inflorescences; flowers, flower parts, fruits and types of placentation; Definition and types of seeds.	07
VI (AS)	Plant Anatomy: Meristematic and permanent tissues. Organs (root, stem and leaf). Apical meristems & theories on apical organization. Secondary growth - Root and stem- cambium (structure and function) annual rings. Periderm. Anomalous secondary growth - <i>Bignonia</i> , <i>Boerhaavia</i> , <i>Dracaena</i> , <i>Nyctanthes</i>	07
VII (SK)	Reproductive Botany Plant Embryology, Structure of microsporangium, microsporogenesis, Structure of megasporangium and its types, megasporogenesis, Structure and types of female gametophyte, Types of	08

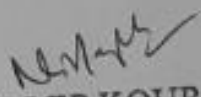
  
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	pollination, Methods of pollination, Germination of pollen grain, Structure of male gametophyte, Fertilization, Structure of dicot and monocot embryo, Endosperm, Double fertilization, Apomixis and Polyembryony.	
VIII (NK)	Palynology: Pollen structure, pollen morphology, pollen allergy, Applied Palynology: Basic concepts, Palaeopalynology, Aeropalynology, Forensic palynology, Role in taxonomic evidences.	07

**Suggested Readings:**

- Gangulee H. S. and K. Kar 1992. College Botany Vol. I and II. (New Central Book Agency)
- Rashid A (1999) An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi.
- Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
- Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co London
- Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
- E.J.Eames. Morphology of Vascular Plants. Standard University Press
- Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.

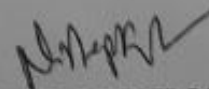
Continuous Evaluation Methods: Class Interaction, Quiz, Assignment and Seminar

  
**NIRLEP KOUR**  
 Incharge Botany Department  
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## Curriculum Teaching Plan

### Department of Botany

Programme: B.Sc.	Year: First	Semester: Second
Name of Faculty: Mrs. NirlepKour (NK), Dr. Amita Sharma (AS), Dr. Garima Malik (GM), Mrs. Sanyogita Kumari (SK)		
Course Title: <b>Land Plant Architecture</b>	Credits: 02	
Course Code: B040202P	Core Compulsory	
Max. Marks: 25+75	Practical	
<p>Course Outcome: After the completion of the course the students will be able to:</p> <ul style="list-style-type: none"> <li>• The students will be made aware of the group of plants that have given rise to land habit and the flowering plants. Through field study they will be able to see these plants grow in nature and become familiar with the biodiversity.</li> <li>• Students would learn to create their small digital reports where they can capture the zoomed in and zoomed out pictures as well as videos in case they are able to find some rare structure or phenomenon related to these plants.</li> <li>• Develop an understanding by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense.</li> <li>• Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding plant diversity, economic values &amp; taxonomy of lower group of plants.</li> <li>• Understand the composition, modifications, internal structure &amp; architecture of flowering plants for becoming a Botanist.</li> </ul>		
Unit	Topics	No. of Lectures: 60hrs
I	Bryophytes: <i>Marchantia</i> - morphology of thallus, W.M. rhizoids and scales, V.S. thallus through Gemma cup, W.M. gemmae (all temporary slides), V.S. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides). <i>Sphagnum</i> - morphology, W.M. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L.S. capsule and protonema.	08
II	Pteridophytes: <i>Lycopodium</i> : Habit, stem T. S. strobilus V. S., <i>Selaginella</i> : Habit, rhizophore T. S, stem T. S, axis with strobilus, V.S. of strobilus, Megasporophyll and microsporophyll. <i>Equisetum</i> - Habit, rhizome and stem T.S. and V. S. of strobilus. <i>Azolla</i> – Habitat & its structure	07
III	Gymnosperms 1. <i>Cycas</i> – seedling, coralloid root and coralloid root T. S., T. S. of leaflet and Rachis. micro and megasporophyll, male cone V. S., microsporophyll T. S. entire and V. S. of ovule. <i>Pinus</i> - Branch of indefinite growth, spur shoot, T. S of old stem and needle R.L.S and T. L. S. of stem, male and female cone, V.S. of male and female cone. 2. <i>Ephedra</i> : Habit, stem T. S (young and mature), leaf T. S, male and female strobilus, V. S. of male and female cone, ovule V. S. and seed.	08
IV	Palaeobotany 1. Morphology of <i>Rhynia</i> and fossils gymnosperms & other groups.	06
V	Angiosperm Morphology 1. To study monopodial and sympodial branching. 2. Inflorescence types- study from fresh/ preserved specimens 3. Study of ovules (permanent slides/ specimens/photographs)-types (anatropous, orthotropous, amphitropous and campylotropous)	08



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Incharge Botany Department

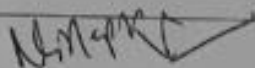
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VI	Plant Anatomy: Normal & Anomalous secondary thickening - <i>Rignonia</i> , <i>Dracaena</i> , <i>Boerhaaviadiffusa</i> , <i>Nyctanthes</i> Study of primary and secondary growth in the root and stem of monocots and dicots by section cutting and permanent slides. Study of internal structure of dicot and monocot leaves. Study of structure of stomata	08
VII	1. Structure of anther, microsporogenesis and pollen grains 2. Structure of ovule and embryo sac development (through slides) 3. Study of embryo development in monocots and dicots 4. Study of pollen morphology of the following plants - <i>Hibiscus</i> , <i>Vinca</i> , <i>Balsam</i> , <i>Ixora</i> , <i>Crotalaria</i> , <i>Bougainvillea</i> by microscopic observation.	08
VIII	Commercial Uses and Production technology 1. Azolla production 2. Production technology of Resins 3. Production and propagation of Ornamental Pteris, Cycadales, Coniferales for landscaping.	07

Suggested Readings:

- Pandey, BP and Trivedi, P.S. 1997. Botany Vol. I(10th edition). Vikas Publishing House.
- Pandey, BP; Misra; Trivedi, P.S. 1997. Botany Vol. II. Vikas Publishing House.
- Pandey, BP and Chadha. 1997. Botany Vol. III. Vikas Publishing House
- Santra, SC and Chatterjee. 2005. College Botany Practical Vol. I. New Central Book Agency (P) Ltd.
- Kumar, S and Kashyap, A.S.. 2003. Manual of Practical Algae. Campus Books International, New Delhi
- Bendre, A.M. and Kumar A text book of Practical Botany. Vol I,II., Rastogi Pub. Meerut.
- Suresh Kumar, Amar Singh Kashyap Manual of Practical Algae.. Campus Books Internet, New Delhi.
- Santra, SC. 2005. College Botany Practical Vol. II. New Central Book Agency (P) Ltd.

Continuous Evaluation Methods: Class Interaction, Group Discussion

  
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 P.G. College, Meerut



old -

B.Sc II year (Annual) session - 2021-22.

✦ Mrs. Sanyogita Kumari - Paper I and paper II

Unified Syllabus of Botany for U.P. State Universities

(B.Sc. I, II, & III year) Paper code - I. 201  
Effective from July 2012

Theory Paper's duration is of Three hours and duration of practicals is Four hours

II. 202  
Practical - 501

B.Sc. I Year		Max. Marks
Papers	Title of Paper	
Paper I	Diversity of Viruses, Bacteria & Fungi	50
Paper II	Diversity of Algae, Lichens, & Bryophytes	50
Paper III	Diversity of Pteridophytes & Gymnosperms	50
Practical	Practical Syllabus based on theory papers	50
B.Sc. II Year		Max. Marks
Papers	Title of Paper	
Paper I	Diversity of Angiosperms: Systematics, Development & Reproduction <b>B 201</b> ✓	50
Paper II	Cytology, Genetics, Evolution & Ecology <b>B 202</b> ✓	50
Paper III	Plant Physiology and Biochemistry <b>B 203</b>	50
Practical	Practical Syllabus based on theory papers <b>501</b>	50
B.Sc. III Year		Max. Marks
Papers	Title of Paper	
Paper I	Plant Resource Utilisation, Palynology, Pathology and Biostatistics	50
Paper II	Molecular Biology & Biotechnology	50
Paper III	Environment Botany	50
Practical	Practical Syllabus based on theory papers	50

At least one Field trip in B.Sc. II is compulsory.

- 202 code & 501 code. *Sanyogita Kumari*

- B.Sc. I - B-101
- N - 1/2 B-101, 1/2 B-301
- A - 1/2 B-203, B-302 (1/2)
- G - B-103 (1/2) + B-203 (1/2) B-302 (1/2)
- S - B-101 1/2, B-201 1/2, B-201 1/2 B-301 1/2
- Ge - B-103 (1/2) + T<sub>1</sub> - B-102 1/2
- Ma - B-101 (1/2) Bae T<sub>1</sub> - B-202 (1/2)
- An - B-302 (1/2) T<sub>2</sub> - B-302 (1/2)
- B-101 (1/2)
- B-302 (1/2)

B.Sc. II year

$\frac{1}{2}$  +

Paper - I: Diversity of Angiosperms: Systematics, Development & Reproduction M.M. 50

### Unit - I

#### Systematics

Principles of classification, Binomial nomenclature; comparative study of different classification systems, viz. Linnacus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist.

Herbarium techniques and important Botanic Gardens.

### Unit - II

Taxonomic study of following families and their economic importance:

Dicots: Nymphaeaceae, Nelumbonaceae, Ranunculaceae, Malvaceae, Bombacaceae, Brassicaceae, Cucurbitaceae, Rosaceae, Leguminosaceae, Myrtaceae, Rutaceae, Apiaceae, Apocynaceae, Solanaceae, Convolvulaceae, Cuscutaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Asteraceae, Rubiaceae, Euphorbiaceae, and Amaranthaceae.

Monocots: Cyperaceae, Poaceae, Arecaceae, Liliaceae.

### Unit - III

External morphology of vegetative and floral parts; modifications – phyllodes, cladodes, and phylloclades.

Menstems-kinds study of tissue system - epidermal, ground, and vascular.

Anatomy of roots, stems, and leaves. Cambium - its function and anomalies in roots and stems; root-shoot transition.

### Unit - IV

Structure and development of male and female gametophytes – microsporogenesis, microgametogenesis, megasporogenesis, and megagametogenesis, embryo sac types. Double fertilization development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

## Curriculum Teaching Plan

### Department of Botany

Programme: B.Sc.	Year: Second	Semester: Annual
Name of Faculty: Dr. Garima Malik (GM) and Dr. Amita Sharma (AS)		
Course Title: Plant Physiology and Biochemistry	Credits:	
Course Code: B-203	Core Compulsory	
Max. Marks: 50	Theory	
Course Outcome: After the completion of the course the students will be able to		
<ul style="list-style-type: none"> <li>• Understand the role of Physiological and metabolic processes for plant growth and development.</li> <li>• Learn the symptoms of Mineral Deficiency in crops and their management.</li> <li>• Assimilate Knowledge about Biochemical constitution of plant diversity</li> </ul>		
Unit	Topics	No. of Lectures: 60
I (GM)	Plant and water relationship, colligative properties of water. Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables. Mineral nutrition: Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.	15
II (AS)	Photosynthesis and Chemosynthesis: photosynthetic pigments, O <sub>2</sub> evolution, photophosphorylation, CO <sub>2</sub> fixation – C-3, C-4 and CAM plants. Respiration: aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs' cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanideresistant respiration. Lipid biosynthesis and its oxidation.	15
III (GM)	Nitrogen metabolism: atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation, Growth: general aspects of phytohormones, inhibitors-auxins, kinetin, gibberellins, and ethylene: action and their application; photoperiodism and vernalization. Germination, growth movements, abscission and senescence.	15
IV (AS)	Biomolecules: Classification, properties and biological role of carbohydrates, Protein and lipids. Chemistry of nucleic acids, vitamins. Discovery and nomenclature. Characteristics of enzymes, concepts of holoenzyme, apoenzyme, coenzyme and cofactors. Regulation of enzyme activity, Mechanism of action. Bioenergetics. Laws of thermodynamics, concept of Gibb's free energy and high energy compounds.	15
Suggested Readings:		
<ul style="list-style-type: none"> <li>• Salisbury, F.B. &amp; Ross, C.W. Plant Physiology (4th ed.), 1992, Wadsworth Publishing Company.</li> <li>• Mukherjee, S. &amp; Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.</li> <li>• Panday, S.N. &amp; Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.</li> <li>• Lehninger Principles of Biochemistry. Sixth Edition. 2013. David L. Nelson, Michael M. Cox. Freeman, Macmillan.</li> <li>• Verma, SK. Plant Physiology and Biochemistry. S. Chand &amp; Sons, New Delhi.</li> </ul>		
Continuous Evaluation Methods: Class Interaction and Oral Test		

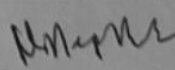
*Nirlep Kour*

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NIRLEP KOUR  
Botany Department  
R.G. P. S. D. College, Meerut

## Curriculum Teaching Plan

### Department of Botany

Programme: B.Sc.	Year: Third	Semester: Annual
Name of Faculty: <b>Dr. Garima Malik (GM)</b> and <b>Dr. Amita Sharma (AS)</b>		
Course Title: <b>Molecular Biology &amp; Biotechnology</b>	Credits:	
Course Code: B-302	Core Compulsory	
Max. Marks: 50	Theory	
Course Outcome: After the completion of the course the students will be able to:		
<ul style="list-style-type: none"><li>• Understand nucleic acids, organization of DNA in prokaryotes and Eukaryotes. DNA replication mechanism, genetic code and transcription process.</li><li>• Know about Processing and modification of RNA and translation process, function and regulation of expression.</li><li>• Knowledge gained through theoretical classes will help students to understand various priority areas of IPR, Molecular signaling and biotechnology.</li></ul>		
Unit	Topics	No. of Lectures: 60
I (AS)	Nucleic acid as genetic material, nucleotides, structure of nucleic acids, properties of genetic code, codons assignments, chain initiation of codons mechanism of protein synthesis and its regulation.	15
II (AS)	Replication of DNA in prokaryotes and eukaryotes, gene expression and regulation. Hormonal control and second messengers Ca <sup>2+</sup> , Cyclic AMP, IP <sub>3</sub> etc.	15
III (GM)	Introduction to biotechnology, recombinant DNA technology, biotechnology and healthcare, IPR issues.	15
IV (GM)	Plant tissue culture, methods of gene transfer, transgenic plants, microbial and environmental biotechnology.	15
Suggested Readings:		
<ul style="list-style-type: none"><li>• P.K. Gupta. Biotechnology And Genomics. Rastogi Publications, 7th Reprint (1<sup>st</sup> Edition): 2016-2017</li><li>• A. J. Nair. Basics of Biotechnology- Laxmi Publications, New Delhi.</li><li>• S S Purohit and S K Mathur; Biotechnology-Fundamentals and Application- Agrobotanica, India.</li><li>• Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab, Press, Pearson Pub.</li><li>• Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley &amp; Sons. Inc.</li></ul>		
Continuous Evaluation Methods: Class Interaction and Oral Test		

  
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Botany Department

Meerut

## Curriculum Teaching Plan

Department of Botany

Programme: B.Sc.	Year: III	Semester: 2021-22
Name of Faculty: NIRLEP KOUR		
Course Title: Plant Res. Utiliz., Palynology, Pl. Patho. Credits: 6 Credits		
Course Code: B-301	& Biostat	Core Compulsory Yes
Max. Marks: 50 M	Theory	

Course Outcome:

- ① • To explore medicinal plants & other economic uses of plants in a sustainable way
- ② • Plant Pathology - prediction & preventions.
- ③ • Palynology of local plants
- ④ • Statistical Analysis of data & biodiversity

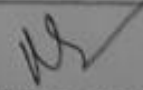
Unit	Topics	No. of Lectures:
I	Centres of Diversity, concepts of Plant Breeding, Sustainable Development	10
II	Oils, Spices & beverages, fiber -	10
III	medicinal, petio plants of Uttarpradesh	10
IV	Etymology of diseases, TMV, CMV	10
V	Yellow vein mosaic of bhindi, citrus canker,	10
VI	Potato scab, Little leaf of brinjal,	
VII	damping off, late blight, red rot	
VIII	Palynology & Statistics	10+10=20

Suggested Readings:

- Economic Botany - B. P. Pandey, e-contents also suggested
- Economic Botany - O. P. Sharma.
- Plant Breeding - B. D. Singh
- Plant Pathology - Dr. R. S. Singh, D. H. C. Dubey
- Palynology - Dr. P. K. K. Nair.

Continuous Evaluation Methods: Test and Presentation Assignments

*(Signature)*

  
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## Curriculum Teaching Plan

Department of Botany

Programme: B.Sc. Practicals	Year: III Year	Semester: 2021-22
Name of Faculty: NIRLEP KOUR		
Course Title: B.Sc. Botany Practical	Credits: 4 Credits	
Course Code: B-601	Core Compulsory: Yes	
Max. Marks: 50	Theory: Practical	

Course Outcome:

- ① Hand on Practice for Biochemical tests of Proteins, Carbohydrates & lipids.
- ② Detailed identification of Plant Resources & their Utilization
- ③ Ecology & Environmental botany based awareness through vegetation study
- ④ Palynology & statistical problems.

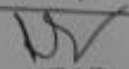
Unit	Topics	No. of Lectures.
I	Identification & comment upon economic use of plants	8
II	Biotechnology Exercise	8
III	Etiology of a disease	8
IV	Pollen study	4
V	Biostatistics	5
VI	Qualitative tests	5
VII	Plant Excursion (Datnyali Herbal Garden, Haridwar)	1 Day
VIII		

Suggested Readings:

- Practical Botany - O.P. Sharma
- Practical Botany - Bendre & Kumar
- Practical Botany - II - B.P. Pandey
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Continuous Evaluation Methods: Test and Presentation, Rehearsals, Spotting



  
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## Curriculum Teaching Plan

Department of Botany

Program: <u>M.Sc Botany</u>	Year: <u>2021-22</u>	Semester: <u>I<sup>st</sup> SEM.</u>
Name of Faculty: <u>Dr. Madhu Malik</u>		
Course Title: <u>Biology and diversity of Algae</u>	Credits: _____	
Course Code: <u>H-1003</u>	Core Compulsory: _____	
Max. Marks: <u>50</u>	Theory: _____	

Course Outcome:

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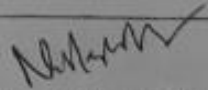
Unit	Topics	No. of Lectures:
I ✓	Classification, Algal pigments, Thallus organisation, Economic Imp.	10
II ✓	comparative study of Chlorophyceae, Xanthophyceae, Bacillariophyceae.	10
III ✓	comparative study of Phaeophyceae, and Rhodophyceae with reference to -	10
IV		
V	- Range of str. of plant body	
VI	- Range of mode of reproduction	
VII	- Variation in life cycles.	
VIII		

Suggested Readings:

- Algae - B.R. Vashishta
- College Botany, Harendra Chandra Gargulee.
- Ashok Kar.
- College Botany - B.P. Pandey.

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Curriculum Teaching Plan

Department of Botany

Program:	M.Sc - Botany	Year:	2021-22	Semester:	II - Sem
Name of Faculty:	Dr. Madhu Malik				
Course Title:	Cell and mole. Bio. of plants				
Course Code:	H-2022	Credits:			
Max. Marks:	50	Core Compulsory:			
Course Outcome:	Theory:				

Course Outcome:

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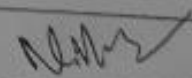
Unit	Topics	No. of Lectures:
I		
II		
III		
IV ✓	Nucleic Acids, its biosynthesis,	
V ✓	DNA damage & repair, genetic code.	10
VI	• Protein synthesis in Prokaryotes and Eukaryotes. • control of gene expression at transcription and translation level.	10
VII		
VIII		

Suggested Readings:

- Cell and molecular Biology - De Robertis
- Cytology, genetics, evolution and ecology - P.K. Gupta
- Cytology - Veer Bala Rastogi
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Continuous Evaluation Methods: Test and Presentation

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## Curriculum Teaching Plan

Department of Botany

Program: <u>M.Sc</u>	Year: <u>2021-22</u>	Semester: <u>II</u>
Name of Faculty: <u>Dr. Madhu Malik</u>		
Course Title: <u>Genetics, Cytogenetics, Plant Breeding</u>		
Course Code: <u>(H-2003)</u>	Credits:	
Max. Marks: <u>50</u>	Core Compulsory:	
	Theory:	

Course Outcome:

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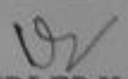
Unit	Topics	No. of Lectures:
I ✓		
II ✓		
III ✓		
IV ✓		
V ✓		
VI ✓		
VII ✓		
VIII ✓		

Suggested Readings:

- Cell and Molecular Biology - De Robertis
- Cytology, Genetics and Evolution and Ecology - P.K. Gupta
- Genetics and Molecular Biology - P.K. Gupta
- Essentials of cytology - C.B. Powell

Continuous Evaluation Methods: Test and Presentation

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# paper: Genetics, Cytogenetics and Plant Breeding.

## Unit - I

10 Hours

### Genetics:

1. Mendel's Laws of inheritance and modified ratios.
2. Allelic and non allelic interaction of genes.
3. Multiple alleles: alleles, coat colour in rodents, blood groups in Humans, self incompatibility.

## Unit - II

10 Hours

4. Linkage and crossing over: chromosome mapping, linkage groups, mechanism of chromosome pairing and synaptonemal complex.
5. Sex determination in man, *Drosophila* and plants.
6. Maternal effects and Extra-nuclear inheritance.

## Unit - III

10 Hours

7. Biochemical genetics, concept of gene.
8. Structural changes in chromosomes: Deficiency, duplication (meiotic pairing & phenotypic effects), Inversions, translocations, (meiotic pairing, Chromosome disjunction), multiple translocations.
9. Numerical changes in chromosomes and Haploidy:
  - a) Euploidy/Polyploidy : Classification, production, role in evolution, utility in crop improvement.
  - b) Aneuploidy : Trisomics, tetrasomics, monosomy, multिसomy-meiotic behaviours, breeding behavior.
  - c) Apomixis : Cytogenetic basis and types of Apomictic reproduction

## Unit - IV

10 Hours

10. Mutation: Types of mutations, spontaneous and induced mutations, Physical and chemical mutagens, gene mutations, induction and detection of mutation, mutation by transposons.
11. Concept of gene: gene structure and expression; gene fine structure, cis-trans test, Biochemical genetics, introns.

## Unit - V

10 Hours

### Plant breeding:

12. Methods of plant breeding.
13. Genetic basis of inbreeding, hybridization and heterosis, exploitation of hybrid vigour.
14. Plant breeding work done in India with special reference to potato, maize, rice, wheat, sugarcane and cotton.

*Madhu Malvi*

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R.G. (P.G) College, Nagpur

## Curriculum Teaching Plan

Department of Botany

Program: <u>M.Sc</u>	Year: _____	Semester: <u>- III</u>
Name of Faculty: <u>Dr. Madhu Malik</u>		
Course Title: <u>phyto chemistry and Metabolism</u>	Credits: _____	
Course Code: <u>H-3002</u>	Core Compulsory: _____	
Max. Marks: <u>50</u>	Theory: _____	

Course Outcome:

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Unit	Topics	No. of Lectures:
I		
II		
III ✓	Photosynthesis, Carbon Assimilation, biosynthesis of starch and sucrose	10
IV ✓	Glycolysis, TCA cycle, ETC and ATP synthesis	
V	Pentose phosphate pathway, glyoxylate cycle, alternative oxidase system	10
VI		
VII		
VIII		

Suggested Readings:

- Biochemistry - Lehninger.
- Plant Physiology - V. Verma.
- Voet and Voet - Biochemistry
- Plant Physiology and Biochemistry - S.K. Verma.

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## Curriculum Teaching Plan

Department of Botany

Programme: <u>M.C.C.</u>	Year: <u>III</u>	Semester: <u>III</u>
Name of Faculty: <u>Dr. Madhu Malic</u>		
Course Title: <u>Elementary Biotech</u>	Credits:	
Course Code: <u>H-3004</u>	Core Compulsory	
Max. Marks: <u>50</u>	Theory	

Course Outcome:

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Unit	Topics	No. of Lectures:
I ✓		10
II ✓		10
III ✓		10
IV ✓		10
V ✓		10
VI ✓		10
VII ✓		10
VIII ✓		10

Suggested Readings:

- Molecular Biotechnology Bernard R. Glick
- Biotechnology, Fundamentals and Application J. Pasternak
- A Text Book of Biotechnology S.S. Purshitt
- Biotechnology - Purshitt
- Biotechnology - B.D. Singh

Continuous Evaluation Methods: Test and Presentation

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Course, XII:

Elementary Biotechnology

50 Hours

Unit - I

10 Hours

1. Definition, Basic concepts, Principles and scope of Biotechnology.
2. Recombinant DNA technology, basic concept in genetic engineering, tool and techniques of recombinant DNA technology.
3. Enzymology of genetic engineering: Restriction enzymes, DNA ligase, Polymerase etc.

Unit - II

10 Hours

4. Cloning vehicles: Plasmids, Cosmids, Lambda phage, Charon phage, shuttle vectors,  $2\mu$  DNA plasmids, yeast plasmids.
5. Gene cloning: principles and techniques, choice of vectors, DNA synthesis and sequencing, Analysis and expression of cloned genes in host cells, Polymerase chain reaction (PCR), RFLP, DNA finger printing (Southern and Northern blotting), gene therapy, Genetic counselling.
6. Gene libraries: mRNA isolation, cDNA synthesis, cloning and amplification of gene libraries, Genomic DNA libraries, YACs, BACs Transposable elements, techniques of gene mapping and chromosome walking.

Unit - III

10 Hours

7. Transgenic (Genetically modified) Plants: Genetic engineering of plants, Aims, strategies for development of transgenic plants (with suitable examples, *Agrobacterium* - the natural genetic engineer, T-DNA and transposon mediated gene-tagging, chloroplast mediated transformation and its utility,
8. Intellectual Property Right (IPR), possible ecological risk and bioethics.

Unit - IV

10 Hours

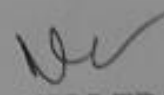
9. Plant cell and Tissue culture: General introduction, history, scope, cell and tissue culture techniques.
10. Design and functioning of tissue culture laboratory.
11. Cell proliferation measurements, cell viability testing, culture media preparation and cell harvesting methods, concepts of cellular differentiation and totipotency.

Unit - V

10 Hours

12. Somatic hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitation of protoplast research.
13. Application of plant tissue culture: clonal propagation, artificial seed, production of hybrids and somaclones, organ culture, production of secondary metabolites, natural products, cryopreservation and germplasm conservation.

*Madhur Malhotra*



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Course XIII: Modern Phytotechniques and Biostatistics 50 Hours

Unit I 10 Hours

Statistical methods

1. Classification of data: frequency distributions; graphic and diagrammatic representation of data: histograms, frequency polygons, frequency curve, ogive; bar diagrams, pie diagrams
2. Measures of central tendency: mean, mode, median; their merits and demerits
3. Measures of dispersion: Mean deviation, standard deviation and coefficient of variation.

Unit II 10 Hours

4. Simple correlation, coefficient and regression,
5. Principle of experimental designs, randomized block and latin square designs, analysis of variance (ANOVA).
6. Tests of significance: t-tests,  $\chi^2$  test for goodness of fit.

Unit III 10 Hours

Basic Botanical techniques:

7. Different types of stains, their preparation and uses: Safranin, fast green, hematoxylin, iodine, cotton blue, crystal violet, ruthenium red, Janus green, Gram's stains, Acetocarmine
8. Microtomy: dehydration, clearing and embedding of material, section cutting, dewaxing.
9. Collection and preparation of herbarium sheets; preservation and storage of plant materials

Unit IV 10 Hours

Biophysical methods

10. Instrumentation, principle and Methods of fractionation- Cell sorting, Chromatography, Electrophoresis, Centrifugation, X-ray diffraction

Unit V 10 Hours

Methods of quantitative analysis-

11. Spectrophotometry, MS, NMR, ESR, ORD/CD spectrometers,
12. Radioisotopic methods: Geiger Muller & Liquid Scintillation Counters.
13. Immunological methods: immunodiffusion, immuno-electrophoresis, crossed immuno-electrophoresis, counter-RIA, ELISA, Immunoblotting

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## Curriculum Teaching Plan

### Department of Botany

Programme: <u>M.C.</u>	Year: <u>2021-22</u>	Semester: <u>IV</u>
Name of Faculty: <u>Dr Madhu Malik</u>		
Course Title: <u>Biodiversity, Conservation</u>	Credits:	
Course Code: <u>(H-415D2) and Plant Resources</u>	Core Compulsory	
Max. Marks: <u>50</u>	Theory	

Course Outcome:

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Unit	Topics	No. of Lectures:
I ✓	Biodiversity - Factors responsible for Biodiversity.	10
II	GMOs, types of pollution, Introduced Species, Industrial Ag. and forestry	
III ✓	Biodiversity at World Level.	10
IV	Ecosystem Diversity in India	
V	Species Diversity	
VI		
VII		
VIII		

Suggested Readings:

- Ecology and Environment - P. D. Sharma.
- Environmental Botany - Satish Kumar.
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Continuous Evaluation Methods: Test and Presentation

Madhu Malik

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## Curriculum Teaching Plan

### Department of Botany

Program: M.Sc. (Botany)	Year: First	Semester: First
Name of Faculty: Dr. Anupama Singh		
Course Title: Angiosperm Taxonomy, Plant Resources		
Course Code: 201101	H-1001	Credits:
Max. Marks: 50		Core Compulsory:
		Theory:

Course Outcome:

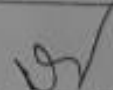
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Unit	Topics	No. of Lectures:
I	1. History 2. ICBN, Bot. Garden, herbarium 3. Taxonomic Evidences	10 Hours
II	1. Sps. Concept 2. classification 3. APG System	10 Hours
III	1. Structure & Phylogeny in Dicots - 17 Families	10 Hourly
IV	Monocotyledons -	
V		
VI		
VII		
VIII		

Suggested Readings:

- Diversity of Angiosperms - Singh, Pandey and Jain
- Plant Taxonomy - Saxena & Saxena
- Taxonomy of Angiosperms - B.P. Pandey
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Continuous Evaluation Methods: Test and Presentation

  
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## Curriculum Teaching Plan

### Department of Botany

Program: M.Sc (Botany)	Year: First	Semester: First
Name of Faculty: Dr. Anubama Singh		
Course Title: Biology + Diversity of Virus + Bacteria		
Course Code: H-1002	Credits:	
Max. Marks: 50	Core Compulsory:	
	Theory:	

Course Outcome:

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Unit	Topics	No. of Lectures
I	1. History of Microbiology 3. Classification	10 Hours
II	2. Isolation, Purification & Cultivation of vi	
III	1. Viruses	2.5 Hours
IV	1. Phytoplasm 2. Virus, Viroid, Prions, Retrovirus	10 Hours
V	Air, water soil microbes	10 Hours
VI	Microbes in Control of Pollution   Microbial enzyme Nanobiotechnology	
VII		
VIII		

Suggested Readings:

• Microbiology - Prescott, Harley, Klein

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Continuous Evaluation Methods: Test and Presentation

  
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## Curriculum Teaching Plan

### Department of Botany

Program: M.Sc (Botany)	Year: First	Semester: Second
Name of Faculty: Dr. Krupama Singh		
Course Title: Anatomy & Reproduction in Angiosperm		Credits:
Course Code: H-2004	Core Compulsory:	
Max. Marks: 50	Theory:	

Course Outcome:


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Unit	Topics	No. of Lectures:
I	1. Shoot Development, leaf meristem 2. Root D "	10 Hours
II	1. Epidermal Str.   3. xylem   5. Nodal Anatomy 2. Phloem   4. Vascular cambium	10 Hours.
III	1. Floral Organ   3. Female Gametophyte 2. Megasporangium   4. Anther	10 Hours
IV	1. Pollen-Ristil Interaction   2. Sexual Incompatibility	10 Hours
V	1. Polyembryony   3. Embryogenesis   5. seed 2. Endosperm   4. Fruit Growth & dev.   anatomy	
VI		6. Apomix- is 10 Hours
VII		
VIII		

Suggested Readings:

- Anatomy Book - B.P. Pandey
- The Embryology of Angiosperms - S.S. Bhojwani, S.P. Bhatnagar
- P.K. Dantu
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## Curriculum Teaching Plan

### Department of Botany

Program: M.Sc (Botany)		Year: First	Semester: Second
Name of Faculty: Dr. Anupam Singh			
Course Title: Cell & Molecular Biology		Credits:	
Course Code: H-2002		Core Compulsory:	
Max. Marks: 50		Theory:	

**Course Outcome:**

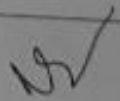
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Unit	Topics	No. of Lectures:
I	1. Cell Structure   3. Cell envelope 2. Microscopy	10 Hours
II	1. Plant cell inclusions   3. Chromatin 2. Nucleus, Nucleolus      organisation	10 Hours.
III	1. Ribosomes, Dictyo, Lysosomes, ER, etc.	5 Hours.
IV		
V		
VI		
VII		
VIII		

**Suggested Readings:**

- 1. Cell & Molecular Biology - De Robertis
- 2. Cell Biology, Genetics, De Robertis
- Molecular Biology - P.S. Verma
- V.K. Agarwal

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## Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: Second	Semester: Third
Name of Faculty: Dr. Anupama Singh		
Course Title: Plant-Soy-Water Relation		
Course Code: H-300	Credits:	
Max. Marks: 50	Core Compulsory:	
	Theory:	

Course Outcome:


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Unit	Topics	No. of Lectures:
I	1. Fundamental of Plant Cell   3. Macro-micro nutrition 2. Absorption of water   4. Ion absorption	10 Hours.
II	1. Transpiration   3. Stress Physiology 2. Ascent of Sap	10 Hours.
III	1. Plant Hormones - Auxin, Gibberellin, Cytokinin 2. Hormone Receptors, Cell Signaling	10 Hours.
IV	1. Plant Hormones - ABA, Ethylene, Ascorbic acid 2. Sensory Photo biology   3. Photoperiodism	10 Hours.
V	1. Dormancy   3. Endogenous Rhythms 2. Seed Germination   4. Plant movement	10 Hours.
VI	5. Ageing & Senescence	
VII		
VIII		

Suggested Readings:

- Plant Physiology & Biochemistry - S.K. Verma
- Textbook of Plant Physiology - V. Verma
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Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: Second	Semester: Third
Name of Faculty: Dr. Anupama Singh		
Course Title: Phytochemistry & Metabolism	Credits:	
Course Code: H-3002	Core Compulsory:	
Max. Marks:	Theory:	

Course Outcome:

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Unit	Topics	No. of Lectures:
I	1. Thermodynamics 2. Buffer, pH Scale, redox etc	10 Hours.
II	3. Sto. & function of ATP 4. Forces of Macromolee.	5 Hours.
III	1. Enzymes	
IV		
V	Nitrogen & Sulphur Metabolism Secondary metabolites	10 Hours
VI		
VII		
VIII		

Suggested Readings:

- Principles of Biochemistry
- - Lehninger
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## Curriculum Teaching Plan

Department of Botany

Program: M.Sc (Botany)	Year: Second	Semester: Forth
Name of Faculty: Dr. Anupama Singh		
Course Title: Environmental Biotechnology		
Course Code: H-4006	Credits:	
Max. Marks: 50	Core Compulsory:	
	Theory:	

Course Outcome:


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Unit	Topics	No. of Lectures:
I	1. Pollution & Pollutant 2. Role of Plants in Pollution Management	10 Hours
II	1. Climate change	10 Hours.
III	1. Ecosystem Stability 2. Environment & Energy	10 Hours.
IV	1. Ecological Management	10 Hours
V	1. Phytoremediation	10 Hours.
VI		
VII		
VIII		

Suggested Readings:

- Biotechnology - B. D. Singh
- Biotechnology - Fundamentals & Application by S. S. Purohit
- Prescott - Biotechnology - by M. Prescott, John P. Harley et. al.
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Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: 2021-22.	Semester: 1st Semester.
Name of Faculty: DR. GEETA SINGH		
Course Title: Biology & diversity of Pteridophytes, Gymnosperms & Palaeobotany	Credits:	
Course Code: H-1004	Core Compulsory:	
Max. Marks: 50	Theory:	

Course Outcome: Develops understanding about the classification of different

- Pteridophytes & Gymnosperms, as well as their importance
- → Develop conceptual skills of identification of pteridophytes & Gymnosperms.
- → Gain knowledge of Palaeobotany (Fossil plants).
- → Develop practical skill to identify vascular plants through permanent series preparation

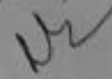
Unit	Topics	No. of Lectures:
I		10 hours
II		10 hours.
III		10 hours.
IV		10 hours.
V		10 hours.
VI		
VII		
VIII		

Suggested Readings:

- Sangulee, Das, & Dutta, College Botany (1997), New Central Book Agency, Calcutta, (India)
- Sharma, O.P. "Gymnosperms" (2013), Pragati Prakashan, Meerut (India)
- Veshuhta, B.R., Sinha, A.K., Kumar, S. Chand. & Company Ltd. (2016)
- Rom Nagar, New Delhi

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Bendre Ashok, Practical Botany, Vol I (2015-16) Rasraji Publication Meerut (India).

  
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Course - IV: Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany 50 Hours

Pteridophytes: Unit - I 10 Hours

1. Classification of Pteridophytes; specific characters of important classes.
2. Salient features, comparative organography, systematics, reproduction and Phylogeny of the following:
  - a. Psilopsida: Psilophytales (*Rhynia*, *Horneophyton*) and Psilotales (*Psilotum*, *Tmesipteris*).
  - b. Lycopsidea: Protolepidodendrales (*Protolepidodendron*), Lepidodendrales (*Lepidodendron*, *Stigmaria*), Lepidospermales (*Lepidocarpon*) and Isoetales (*Isoetes*).
  - c. Sphenopsida: Hyeniales (*Calamophyton*), Sphenophyllales (*Sphenophyllum*) and Calamitales (*Calamites*).
  - d. Pteropsida: Coenopteridales - A general account. Ophioglossales (*Ophioglossum*, *Botrychium*), Marattiales (*Marattia*, *Angiopteris*), Osmundales (*Osmunda*), Filicales (*Cyathea*, *Dryopteris*, *Pteridium*), Marsileales (*Marsilea*), Salviniiales (*Salvinia*, *Azolla*) and Indian Fossils.

Unit - II 10 Hours

3. Telome concept.
4. Stellar system and evolutionary tendencies.
5. Heterospory and evolution of seed habit.
6. Apogamy, apospory, parthenogenesis.
7. Soral evolution in Pteridophytes.
8. Alternation of generations.

Unit - III 10 Hours

Gymnosperms:

9. Classification and distribution of gymnosperms with special reference to India. Study of morphology, structure and life history as illustrated by the following and indicated in the practical work.
  - a. Pteridospermales: Palaeozoic and Mesozoic group with reference to Lyginopteridaceae (*Lyginopteris*), Medullosaceae (*Medullosa*), Glossopteridaceae and Caytoniaceae.
  - b. Bennettitales: Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.
  - c. Cycadales: A detailed account including distribution of living Cycads.
  - d. Pentoxylales: A general account.
  - e. Cordaitales: A general account of Cordaitaceae and Poroxylaceae.
  - f. Ginkgoales: *Ginkgo*.
  - g. Coniferales: *Abies*, *Cedrus*, *Cryptomeria*, *Cupressus*, *Podocarpus*, *Cephalotaxus* and

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- Araucaria.*
- h. Taxales: A general account.
  - i. Ephedrales, Welwitschiales and Gnetales: A general account.

Unit - IV

10 Hours

10. Evolutionary tendencies in Gymnosperms.
11. Economic importance of Gymnosperms.

Unit - V

10 Hours

Paleobotany:

12. Geological areas and distribution of plants in geological time scale.
13. Types of Fossils, Process of fossilization and fossil preservation methods.
14. Techniques of study of fossils.
15. Distribution of fossils in India

*Samir*

## Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: 2021-22	Semester: IIIrd Semester
Name of Faculty: Dr. Geeta Singh	Credits:	
Course Title: Fungal Biodiversity & Elementary Plant Pathology H-2001	Core Compulsory:	
Max. Marks: 50	Theory:	

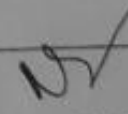
Course Outcome:

- Develop understanding about the classification & different classes of fungi.
- Develop conceptual skills to identify diseases of different classes.
- Economic importance of fungi as well as lichens.
- Preparation of slides i.e. development of practical skills.

Unit	Topics	No. of Lectures:
I		10 hours
II		10 hours
III		10 hours
IV		10 hours
V		10 hours
VI		
VII		
VIII		

- Suggested Readings:
- Sharma, P.D., The Fungi (2016-17), 2nd Edition, Rastogi Publications, Meerut
  - Sharma, P.D. Plant Pathology (2016-17), 2nd Edition, Rastogi Publications, Meerut (India)
  - Bendre Ashok, Practical Botany, Vol I (2015-16) Rastogi Publications, Meerut (India).

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Course - V:

Fungal Biodiversity and Plant Pathology

50 Hours

Unit - I

10 Hours

1. General characters of fungi, cell structure and nutrition.
2. Range of Thallus organization in fungi.
3. Unique aspects of (i) fungal cells, (ii) molecular biology of fungi
4. Types of reproduction in fungi.
5. Classification of fungi as proposed by Ainsworth (1973) Alexopoulos, Mims & Blackwell (1996). Recognition of Fungi as a separate kingdom; splitting of the fungi (Fungi and allied organisms into three kingdoms- Protista, Chromista and Fungi.
6. Nutrition and growth in Fungi including factors affecting fungal growth.
7. Differentiation in fungi: control of i) Dimorphism. ii) conidiation. iii) mating (with the help of Sex hormones).
8. Heterothallism, Heterokaryosis, parasexuality and physiological specialization in Fungi.

Unit - II

10 Hours

9. A general account and affinities of the following groups with special reference to systematic position, structure and reproduction of organisms mentioned hereunder:
  - A. The Fungi belonging to kingdom Protozoa  
Myxomycota (myxomycetes): *Stemonites*, *Ceratiomyxa*,  
Plasmodiophoromycota (Plasmodiophorales) *Plasmodiophora*.
  - B. The Fungi belonging to Kingdom Chromista  
Oomycota: *Saprolegnia*, *Phythium*, *Phytophthora*, *Albugo*,
  - C. The Kingdom Fungi
    - a. Chytridiomycota: *Synchytrium*,
    - b. Blastocladiomycota: *Allomyces*, *Coelomomyces*
    - c. Zygomycota: *Saksanaea*, *Pilobolus*, *Entomophthora*
    - d. Ascomycota: *Taphrina*, *Phyllactinia*, *Erysiphae*, *Neurospora*, *Peziza*
    - e. Basidiomycota: *Puccinia*, *Uromyces*, *Hemilia*, *Melampsora*, *Tilletia*, *Ustilago*
    - f. Anamorphic fungi (Deuteromycotina): With reference to their telomorph, also wherever possible; *Cercospora*, *Helminthosporium*, *Curvularia*, *Alternaria*, *Fusarium*, *Colletotrichum*, *Aspergillus*, *Penicillium*.

Unit - III

10 Hours

10. Fungal interactions: I. Role of antibiotics, hyphal interference, Mycoparasitism, Commensalism,  
II. Mycorrhizae, Lichens (Structure, types, reproduction, importance).

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*Araucaria.*

- h. Taxales: A general account.
- i. Ephedrales, Welwitschiales and Gnetales: A general account.

**Unit - IV**

**10 Hours**

- 10. Evolutionary tendencies in Gymnosperms.
- 11. Economic importance of Gymnosperms.

**Unit - V**

**10 Hours**

**Paleobotany:**

- 12. Geological areas and distribution of plants in geological time scale.
- 13. Types of Fossils, Process of fossilization and fossil preservation methods.
- 14. Techniques of study of fossils.
- 15. Distribution of fossils in India

*Jongla*

## Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: 2021-22	Semester: III <sup>rd</sup> Semester
Name of Faculty: DR. GEETA SINGH		
Course Title: Plant Ecology & Phytogeography	Credits:	
Course Code: H-3003	Core Compulsory:	
Max. Marks: 50	Theory:	

Course Outcome:

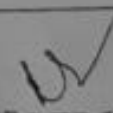
- To aware about Environmental factors as well as hazardous.
- To aware about to store water as utilization purpose through technique.
- aware about Recycling of wastes.

Unit	Topics	No. of Lectures:
I		10 hours
II		10 hours
III		10 hours
IV		10 hours
V		10 hours.
VI		
VII		
VIII		

Suggested Readings:

- Sharma P.D. (2014), Ecology & Environment, 12th Edition, Rastogi Publications, Meerut (India)
- Bhatia, K.N. (2016), A Treatise on Ecology, 12th Edition, Pradip Publication, Talanda (India)
- Sharma, O.P. (2016), Practical Botany-II, Pragati Edition, Meerut

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Course XI:

Plant Ecology and Phytogeography

50 Hours

Unit - I

10 Hours

1. Ecological factors (light, air, water, topographic, edaphic, biotic)
2. Ecological concepts of species: Genecology and Ecological niche.
3. Population Ecology: Basic concepts, characteristics of population and population structure.
4. Community Ecology: Composition, characters, structure, origin and development of community: methods of study of structure of community.

Unit - II

10 Hours

5. Ecological succession: Process concept and trends. Climax. (Xerosere, hydrosere)
6. Ecosystem Ecology: Structure and functions, with example of a natural and artificial ecosystem, Energy flow in ecosystem.
7. Production Ecology: Measurement methods and productivity in different ecosystems.

Unit - III

10 Hours

8. Preliminary Knowledge of I.B.P. (International Biological Programme), M.A.B (Man and Biosphere Programme).
9. Pollution: Kinds of pollution (Air, Water, Soil and Noise) and green house gases, Ozone hole, and global warming.

Unit - IV

10 Hours

10. Recycling of waste: Biogas, utilization and disposal of organic wastes and inorganic wastes,
11. Biodiversity and It's conservation.
12. Biogeochemical cycles of C,N,P,S, and Hydrological cycle, Nutrient sources, Nutrient budgets in terrestrial communities and aquatic communities.
13. Soil erosion and conservation, rainwater harvesting, chipko movement, van mahotsava, Afforestation, reforestation.

Unit - V

10 Hours

Phytogeography

14. Principles of phytogeography, vegetation types and Phytogeographical regions of India. Age and area hypothesis, continental drift, endemism, Hot spots, Plant exploration. Invasion and introduction.
15. Remote sensing: Concepts, principles, processes, tools, techniques in acquisition of R.S. data. Application in ecological and meteorological research

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## Curriculum Teaching Plan

### Department of Botany

Program: M.Sc. (Botany)	Year: 2021-22	Semester: IV <sup>th</sup> Semester
Name of Faculty: DR. GEETA SINGH		
Course Title: Biodiversity & Plant Resources	Credits:	
Course Code: H-402	Core Compulsory:	
Max. Marks:	Theory:	

#### Course Outcome:

- Develop understanding of diversity of Plants through
- Conservation
- To aware about natural disasters.
- To study about Institutes related to biodiversity
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Unit	Topics	No. of Lectures:
I		
II ✓		10 hours
III		
IV ✓		10 hours
V ✓		10 hours
VI		
VII		
VIII		

#### Suggested Readings:

- Sharma, P. D. (2014), Ecology & Environment, 12<sup>th</sup> Edition, Rastogi Publications, Meerut (U.P.)
- Kumar, Sakshi (2019), Environmental Botany, First Edition, Pragati Edition, Meerut (U.P.)

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Course XVID: Biodiversity Conservation and Plant Resources 50 Hours

Unit - I 10 Hours

1. Biodiversity: Definition; factors responsible for determination of Biodiversity; Climate change.
2. Pollution of soil, water and atmosphere.
3. Introduced species.
4. Industrial Agriculture & forestry.
5. Genetically Modified Organisms (GMOs).
6. Over-exploitation of plants and animal species.

Unit - II 10 Hours

7. Levels of Biodiversity: Genetic, Species, Ecological, Evolutionary and Agrobiodiversity.
8. Types of Biodiversity: (Diversity Indices)- Alpha( $\alpha$ ), Beta ( $\beta$ ), Gamma( $\gamma$ ) Diversity.
9. Global Biodiversity Crisis: causes and consequences.
10. Conservation of Biodiversity
  - a) In situ Strategy : National parks, Wild life sanctuaries, biosphere reserves and world heritage sites.
  - b) Ex-situ Strategy : By seeds, reclamation, Afforestation, tree Plantation, seed banks, gene banks, cryobanks
  - c) Restoration or Rehabilitation of Endangered species.

Unit - III 10 Hours

11. Biodiversity at world level: Biodiversity at global and country level, wild plant wealth.
12. Ecosystem diversity in India: Desert, forest, Grassland ecosystem, wetland, Mangroves.
13. Species Diversity: Endemic species, cultivated plants/ Agro- diversity, Endangered plants.

Unit - IV 10 Hours

14. Loss of Biodiversity:
15. Threats to Biodiversity:
  - a) Casual factors of threat - Developmental pressure, encroachment, exploitation, human induced disaster, Management of natural and human resources, political and policy issues.
  - b) Threat to Ecosystem, species and genetic Diversity.Categories of threats : Endangered, Vulnerable, Rare and Threatened
16. Natural disaster: floods, earthquake, cyclone, landslides, Disaster management.

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Unit - V

10 Hours

6. Plant resources, Concept, Status and Concern
7. Basic concepts of local plant diversity and its economic importance
8. World centres of primary diversity of domesticated plants
9. General account of activities of BSI, NBPGR for conservation and non-formal conservation efforts

*Samir*

## Curriculum Teaching Plan

Department of Botany

Program: M.Sc. (Botany)	Year: 2021-22	Semester: IV <sup>th</sup> Semester
Name of Faculty: DR. GEETA SINGH		
Course Title: Diversity in Plants, Thus Organ	Credits:	
Course Code: 2 Evaluation H- 8004	Core Compulsory:	
Max. Marks:	Theory:	

**Course Outcome:**

- General account of different organizations & functions of important Institutes related to diversity of plants
- Develop understanding of Economic values of cereals, legumes as well as others prescribe in syllabus.

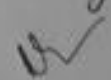
Unit	Topics	No. of Lectures:
I		10 hours
II		10 hours
III		10 hours
IV		10 hours
V		10 hours
VI		10 hours
VII		
VIII		

**Suggested Readings:**

- Pandey, B.P., Economic Botany (2014), S. Chand & Company Ltd, New Delhi (India)
- Misra, S.P. & Pandey (S.N. Choudhary) Essential Environmental Studies, Anur Book Pvt. Ltd, New Delhi (India)

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Course XV D: Diversity in Plants, their origin and evolution 50 Hours  
Unit - I 10 Hours

Sustainable Development:

1. Global movement for sustainability
2. People's mandate on sustainable development
3. Strategies for sustainable development
4. Contribution of telecommunication and information technology to sustainability
5. Social perspectives for sustainable development
6. Political perspectives for sustainable development
7. Concept of circular economy

Unit - II 10 Hours

Origin of Agriculture :

8. Meaning of Agriculture, Development of Agriculture
9. Origin of cultivated plants, Indo-Burmese Centre of Origin,
10. Contribution of Vavilov,
11. Domestication of crop plants
12. Plant introduction

Unit - III 10 Hours

Green revolution:

13. Benefits and adverse consequences, beyond green revolution
14. Plants as Avenue trees: Selection of avenues and avenue trees, planting schemes
15. Plants as Pollution control agents: Tolerance of plants to different pollutants

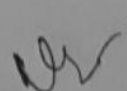
Unit - IV 10 Hours

Origin, evolution and cytotaxonomy of

16. Cereals and millets (wheat, paddy, bajra and jowar),
17. Legumes (peas, gram, soybean, black gram, lentil and cowpea),
18. Sugarcane and starches (beetroot, potato, sweet potato,),
19. Origin of Forage and fodder crops.

Unit - V 10 Hours

20. A general account of non-wood forest products (NWFPs) such as bamboos, gum, tannins, dyes, resins and beverages.
21. A general account of the organizations and functions of Indian Council of Agricultural Research (ICAR). Council of Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT)

  
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