



**Assam University  
Silchar**

**Curriculum**  
*for*  
**Four Year Under Graduate Programme**  
*in*  
**BOTANY**  
*under*  
**National Education Policy – 2020**  
**w.e.f.**  
**Academic Session 2023-24**



**Assam University, Silchar**  
**NEP 2020 FYUGP Course Curriculum (Botany)**  
**Course Structure**

Sem	DSC	DSM - 1	DSM - 2	IDC	SEC
I	<b>BOT:DSC-101 (3)</b> Microbiology	<b>BOT:DSM-101 (3)</b> Biodiversity(Microbes, Cryptogams & gymnosperms)	-	<b>BOT:IDC-101 (3)</b> Gardening and Nursery Management	<b>BOT:SEC-101 (3)</b> Medicinal Plants & Herbal Technology
	<b>BOT:DSC-102 (3)</b> Phycology and Mycology				
II	<b>BOT:DSC-151 (3)</b> Cell Biology	-	<b>BOT:DSM-151 (3)</b> Angiosperm Morphology and Taxonomy	<b>BOT:IDC-151 (3)</b> Biodiversity Conservation	<b>BOT:SEC-151 (3)</b> Mushroom cultivation
	<b>BOT:DSC-152 (3)</b> Practical – I				
III	<b>DSC-201 (4)</b> Archegonite/Vascular Cryptogams	<b>BOT:DSM-201 (4)</b> Plant anatomy and embryology	-	<b>BOT:IDC-201 (3)</b> Plants and Traditional Knowledge	<b>BOT:SSEC-201 (3)</b> Horticulture
	<b>BOT:DSC-202 (4)</b> Genetics, Molecular Biology and Plant Breeding				



IV	<b>BOT:DSC-251 (4)</b> Economic Botany	<b>BOT:DSM-251 (3)</b> Practical	<b>BOT:DSM-252 (3)</b> Plant Physiology	-	-
	<b>BOT:DSC-252 (4)</b> Plant Systematics				
	<b>BOT:DSC-253 (4)</b> Practical - II				
V	<b>BOT:DSC-301 (4)</b> Advance morphology and taxonomy	<b>BOT:DSM-301 (3)</b> Plant Biochemistry	<b>BOT:DSM-302 (3)</b> Plant Ecology and environmental Biology	-	-
	<b>BOT:DSC-302 (4)</b> Plant Physiology				
	<b>BOT:DSC-303 (4)</b> Practical - III				
VI	<b>BOT:DSC-351 (4)</b> Ecology and Phytogeography	-	<b>BOT:DSM-351 (4)</b> Practical		
	<b>BOT:DSC-352 (4)</b> Plant Metabolism and Biochemistry				
	<b>BOT:DSC-353 (4)</b> Plant Biotechnology				
	<b>BOT:DSC-354 (4)</b> Practical - IV				



VII	<b>BOT:DSC-401 (4)</b> Reproductive biology of angiosperm	<b>BOT:DSM-401 (4)</b> Cell & Molecular Biology			
	<b>BOT:DSC-402 (4)</b> Plant Pathology				
	<b>BOT:DSC-403 (4)</b> Ethnobotany, Biostatistics and Bioinformatics				
	<b>BOT:DSC-404 (4)</b> Practical - V				
VIII	<b>BOT:DSC-451 (4)</b> Practical with Research (Practical)	-	<b>BOT:DSM-451 (4)</b> Applied Botany		
	<b>BOT:DSC-452 (4)</b> Applied Botany				
	<b>BOT:DSC-453 (4)</b> Biodiversity and climate change				
	<b>BOT:DSC-454 (4)</b> Analytical techniques in plant science				

Note- Figures in the parenthesis represent credits assigned to the paper



## Marks Distribution

<b>DSE, DSM and IDC Papers:</b> All theory papers will have 70% External evaluation and 30% internal evaluation. In practical papers, the marks distribution will be as follows:			<b>SEC papers</b>	
Description	Marks		Marks	
	External Assessment (A)	Internal Assessment (B)	Theory	50
Major experiment	28	15	Practical	30
Minor experiment	21	6	Internal	20
Viva-voce	14	6	Total	100
Record and submission	7	3	* Marks distribution is as given in the previous column marked (B)	
Total	70	30		



## SEMESTER - I

### BOT: DSC-101

Course Title: **Microbiology**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course Objective:** *To study the diversity and complexity of microbial world and its applications*

#### **Unit-I: General Microbiology**

History of microbiology, the discovery of viruses and different groups of microorganisms (from prokaryotes to eukaryotes); status of microorganisms in the living world, different groups of microorganisms, nutritional groups of microorganisms, microbial nutrition and growth (growth curve, factors affecting growth, control), sterilization methods, culture media types and preparations for bacteria, fungi and micro algae; Antibiotics and their mode of actions, Vaccines.

#### **Unit-II: Virology and Bacteriology**

Viruses: Virus stature, classification (Baltimore), general structure and replication; short accounts of viroids and prions; Structure of T-phages and TMV; methods of isolation of plant viruses, economic importance.

Bacteria: General characteristics, types including mycoplasmas, spheroplasts and actinomycetes; cell and cell wall structures, classification, reproduction, and economic importance. Study of the genera: *Streptomyces*, *E. coli*, *Bacillus*, *Lactobacillus*, *Agrobacterium*, *Rhizobium* and *Pseudomonas*.

#### **Unit-III: Agricultural Microbiology**

Microorganisms in soil, role of microorganisms in Nitrogen cycle, Carbon cycle and Sulphur cycle in nature. Plant growth promoting bacteria, rhizosphere (microorganisms, positive and negative roles), and phyllosphere. Mycorrhiza- types and their role in agriculture and horticulture; Mechanism of biological Nitrogen fixation; Humus, microbial pesticides and herbicides.

#### **Unit-IV: Food and Industrial Microbiology**

Microbial spoilage of foods, preservation of foods, food poisoning, pasteurization of milk. Fermentation, Solid-state and liquid-state fermentations, batch and continuous fermentation, bioreactors, microbial production of enzymes, alcohol (Ethanol), antibiotics (Penicillin and Streptomycin) and organic acids (acetic acid, citric acid and lactic acid).

#### **Unit-V: Water, Environmental and Medical Microbiology**

Water micro-flora, role of microbes in sewage and domestic waste water treatment systems, determination of BOD and COD of water samples, microorganisms as indicator of water quality, tests for coliforms.



Bioremediation of contaminated soil, enumeration of microorganisms in air, control of air born microorganisms; biogas production; microbes in biodegradation of hydrocarbons.

Microbial diseases (Aspergillosis, Tuberculosis, Tetanus, Gonorrhoea, Syphilis, Leprosy), causes and preventive measures; probiotics.

*Course Outcome: The course will provide comprehensive overview on microbial world and its applications in diverse fields.*

### **Suggested Readings:**

1. Bagyaraj, D. J. & Rangaswami, G. (2007): 2<sup>nd</sup> edition, Agricultural Microbiology. PHI Learning Pvt. Ltd.
2. Banerjee, A. K. & Banerjee, N. (2008): Fundamentals of Microbiology and Immunology. New Central Book Agency (P) Ltd. Kolkata
3. Biswas, S. B. & Biswas, A. (1996): An Introduction to Viruses, 4<sup>th</sup> edition, Vikas Publishing House Pvt. Ltd. New Delhi.
4. Dubey, R. C. & Maheshwari, D. K. (2005): A Textbook of Microbiology. S. Chand & Company Ltd. New Delhi.
5. Pelezar, M. J. (2001): Microbiology. 5<sup>th</sup> edition, Tata McGraw-Hill Co., New Delhi.
6. Power, C. B. & Dagainawala, H. F. (2010): General Microbiology, Vol.-I & II. Himalaya Publishing House, Mumbai.
7. Pyatkin, K. & Krivoshein, Y. (1982): Microbiology with Virology and Immunology. MIR Publishers, Moscow.
8. Reddy, S. M.; Girisham, S.; Babu, G. N. & Reddy, B. V. (2017): Applied Microbiology (Agricultural, Environmental, Food and Industrial Microbiology). Scientific Publishers, Jaipur.

## **BOT: DSC-102**

Course Title : **Phycology and Mycology**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course Objective:** *To study the diversity, cellular organisation and its application*

### **Unit-I: Algae**

General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food, flagella; methods of reproduction; Classification: criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); Significant contributions of important Phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.

### **Unit-II: Divisions of Algae**

Characteristics; Ecology and distribution; range of thallus organization; Cell structure and reproduction of Cyanophyta and Xanthophyta. Morphology and life-cycle of *Nostoc* and *Vaucheria*. Characteristics; Occurrence; Range of thallus



organization; Cell structure; Reproduction of Chlorophyta. Morphology and life-cycles of *Chlamydomonas Volvox*, *Oedogonium*, *Coleochaete*, *Chara*. Evolutionary significance of *Prochloron*. Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction of Phaeophyta & Rhodophyta. Morphology and life-cycles of *Ectocarpus* and *Polysiphonia*.

### **Unit-III: Fungi and its Associations**

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification (Ainsworth). Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza- their types, and significance.

### **Unit-IV: Major divisions of Fungi**

Characteristic; Ecology and significance; Thallus organization; Reproduction; Life cycle with reference to *Synchytrium*, *Rhizopus*.

Life cycle and classification with reference to *Saccharomyces*, *Aspergillus*, *Penicillium*, *Alternaria* & *Fusarium*,. General characteristics (asexual and sexual fruiting bodies); Heterokaryosis and parasexuality;

General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia*, *Ustilago* (symptoms), *Agaricus*;

General characteristics; Status of Slime molds, Types of fruiting bodies. General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora*, *Albugo*.

### **Unit-V: Applied Mycology**

Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology. Mushroom cultivation.

**Course Outcome:** *The course will provide detailed understanding of algae and fungi*

### **Suggested Readings**

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4<sup>th</sup> edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9<sup>th</sup> Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson
6. R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8<sup>th</sup> edition.
7. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4<sup>th</sup> edition.
8. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press,
9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.





## **BOT: DSM-101**

Course Title: **Biodiversity (Microbes, Cryptogams & gymnosperms)**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course Objective:** *To study the biodiversity of microbes, algae, bryophytes, pteridophytes and gymnosperms*

### **Unit-I: Microbes**

Viruses - Characteristics and economic importance, T Phage Virus and TMV, Lytic and Lysogenic cycle.

Bacteria - Characteristics and economic importance, Cell structure, Reproduction of bacteria- vegetative, asexual and recombination (Conjugation, Transformation and Transduction).

### **Unit-II: Algae**

General characteristics; Classification, Ecology and occurrence, Economic importance, Range of thallus organization and Reproduction. Morphology and life cycle of *Nostoc*, *Volvox*, *Voucheria*, *Chara* and *Ectocarpus*.

Significant contributions of Phycologists - F.E. Fritsch, G. M. Smith and M.O.P. Iyenger.

### **Unit-III: Fungi & Lichens**

General characteristics; Classification, Economic importance of Fungi; Reproduction; Morphology and life cycle of *Rhizopus*, *Penicillium* and *Puccinia*, Symbiotic association – Lichens and its economic importance; General account and significance of Mycorrhiza.

### **Unit-IV: Bryophytes**

Unique characters of archegoniates and alternation of generation.

Bryophytes - General characteristics; Adaptation to land habit, Classification (upto orders) Ecology and Economic importance; Evolution of sporophyte; Morphology and life cycle of *Marchantia*, *Anthoceros* and *Polytrichum*.

### **Unit-V: Pteridophytes and Gymnosperms**

Pteridophytes - General characteristics; Classification (upto orders) and economic importance; Reproduction; Heterospory and seed habit; Stelar organization; Early land plants - *Rhynia*; Morphology and reproduction of *Lycopodium* and *Selaginella*.

Gymnosperma - General characteristics; classification and economic importance; Morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Gingko* and *Gentum*

**Course Outcome:** *The course will highlight the diversity of microbial world along with cryptogams and gymnosperms.*

### **Suggested Readings:**

1. Lee, R. E. (2008). Phycology. Cambridge University Press, Cambridge



2. Acharya, B. C. and Mishra B. K. (2019). Plant Biodiversity – as per CBCS Syllabus, Kalyani Publishers.
3. Bhattacharya, Hait and Ghosh (2017). A Text Book of Botany: Vol. 1 & Vol 2. New Central Book Agency (P) Ltd.
4. Mishra, B. K. and Dash N (2019). A Text Book of Microbiology and Phycology – as per CBCS Syllabus, Kalyani Publishers.
5. Mishra, B. K. and Dash N (2019). An Introduction to Mycology and Phytopathology – as per CBCS Syllabus, Kalyani Publishers
6. Singh, Pandey and Jain (2018). A Text Book of Botany – ARCHEGONIATE (Bryophyta, Pteridophyta and Gymnosperms), Rastogi Publications.
7. Vashishta, B. R. (2017). Botany for Degree Students – Algae. S. Chand Publishing.
8. Vashishta, B. R. (2017). Botany for Degree Students – Fungi. S. Chand Publishing.
9. Vashishta, B. R. (2017). Botany for Degree Students – Bryophyta. S. Chand Publishing.
10. Vashishta, B. R. (2017). Botany for Degree Students – Pteridophyta. S. Chand Publishing.
11. Vashishta, B. R. (2017). Botany for Degree Students – Gymnosperms S. Chand Publishing

## **BOT: IDC-101**

Course Title: **Gardening and Nursery Management**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course Objective:** *To study the multi-faced aspects of gardening and nursery*

### **Unit-I: Gardening Introduction**

History of gardening in India, Scope of gardening in India, Routine garden operations (Soil sterilization, Soil laying, sowing of seed, Shading, pinching, deshooting, disbudding, defoliation, bending, mulching, topiary, training and pruning, de-suckering, staking, mowing, ranking, earthing up, manuring, watering, insect-pest and disease control). Mother plant. Garden types, general feature and styles. Garden adornments

### **Unit-II: Nursery and Garden Management**

Definition, objectives and scopes of gardening; Types of gardening: Landscape, home gardening, Kitchen Garden. Orchards, Terrace gardening, etc.; Concept of Public Parks and Botanical Gardens; Selection of Plant Materials and designing of gardens-computer-aided designing. Gardening operations and management practices: soil layering, manuring, watering, sowing of samplings, Management and control of weeds ad pests and harvesting operations, storage and Marketing strategies.

### **Unit-III: Structures of Nursery and Gardens**

Green house technology (Definition, advantages, factors affecting growth of plants in green house, classification); Polyhouse (Definition, site selection, types, advantages); Lath house; glass house, shed house, cold frame, hotbed, bottom heat, propagation frames, net house, mist propagation unit, Humidifier,



#### **Unit-IV: Plant Propagation**

Sexual, vegetative and artificial methods of plant propagation (Cutting, layering, Budding and grafting). Micro propagation. Seed structure and Seed Dormancy. Concepts of plant growth regulators: Types, trade names and application methods. Rooting media (Peat moss, Vermiculite, Perlite, Sand and Bark). Techniques of growing and propagation of Epiphytes (Orchids, Aroids and Ferns) and Hydrophytes. Study of cultivation processes and harvesting of different vegetables and fruits-Brinjal, Potato, Tomato, Lady's finger, Cabbage, Cauliflower, beans, Pumpkin, Mango, Banana, etc. Role of plant growth regulators used in Gardening and Nurseries.

#### **Unit-V: Landscaping of Public Places, Indoor Gardening and Famous Gardens in India**

General recommendations of Landscaping, Landscaping of Highways, Home Landscaping/Residential Landscaping, Landscaping of public parks and Landscaping of Educational institutes.

Indoor Gardening: Definition, areas suitable for placing indoor plants, factors affecting growth of indoor plants, pot plants, foliage plants, Hanging Baskets, Terrariums, Vertical gardens, Dish garden and Bonsai. Plants suitable for landscaping and Indoor Gardening (Flowering annuals, Herbaceous perennials, ornamental shrubs, Ornamental climbers, Ornamental trees, Bulbous plants, Palms and Cycads).

Shalimar Garden (Kashmir), Lal Bagh (Bengaluru), Rashtrapati Bhavan Garden (New Delhi), Brindavan Garden (Mysore), Yadvindra Garden (Pinjore), Indian Botanic Garden (Howrah), The Ramoji Film City Garden (Hyderabad), Tulip Garden (Srinagar).

***Course Outcome:** The course will help to empower students to take up gardening and nursery management as career option.*

#### **Suggested readings**

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.



## **BOT: SEC-101**

Course Title: **Medicinal Plants & Herbal Technology**

Credits: 3

Contact hours: 60

Marks: 100

### **THEORY**

Credits: 2

Contact hours: 30

Marks: 50

(All units are of equal credits)

**Course objective:** *To study the use of medicinal plants in improving human life*

#### **Unit-I: Traditional Systems of Medicine**

Brief history of use of medicinal herbs; Indigenous system of medicines-Ayurveda (History, origin, panchamahabhutas, saptadhatu, tridosha and rasayana), plants used in ayurvedic treatments, Methods of preparation of asava, arishta, gutikas, churna, leham and bhasmas; Unani (History, concept, Umoor-e-tabiya) and Siddha (Origine, basis, plants used in Siddha medicine), medical terms.

#### **Unit-II: Medicinal Plants and their Conservation; Application of Natural Products**

Local Medicinal plants, Concept of endangered taxa, Endangered and endemic medicinal plants of India, Red list criteria; *In situ* and *Ex situ* conservation of medicinal plants, brief account of CIMAP; Application of natural products to certain diseases-Jaundice, cardiac, infertility, diabetics, blood pressure, memory loss, rheumatism and skin diseases.

#### **Unit-III: Pharmacognosy**

Systematic position, distinguishing features and uses of following herbs in curing various ailments- Tulsi, Ginger, Fenugreek, Indian Goose berry, Ashoka, Arjun; Future of pharmacognosy. Herbs as health food (Alfa alfa, Chicory, Garlic, Ginseng, Ashwagandha and Spirulina).

#### **Unit-IV: Phytochemistry and Analytical Pharmacognosy**

Active principles and methods of their testing of medicinal herbs, Drug adulteration (types), methods of drug evaluation, WHO guidelines for the assessment of herbal medicines, phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids and phenolic compounds).

#### **Unit-V: Patenting and Regulatory Authorities of Natural Products**

Definition of common terms-Patent, IPR, Traditional Knowledge, Farmer's right, Breeder's right, Bioprospecting, and Biopiracy. Turmeric patent and Neem patent; Drugs Technical Advisory Board (DTAB), Plant based medicinal and aromatic industries and institutions in India; Good manufacturing practice (GMP) of Indian system of medicine

**Course outcome:** *The course will provide a comprehensive understanding on the importance of medicinal plants and herbal technology in health care.*



### **Suggested Readings**

1. Anonymous (1948-66): Wealth of India, Raw Materials, 7 Vols, CSIR, New Delhi.
2. Anonymous (1992): The use of Traditional Medicine in Primary Health Care. WHO, AITBS Publishers and Distributors, New Delhi.
3. Anonymous (1994): The Useful Plants of India. Publications & Information Directorate, CSIR, New Delhi.
4. Arora, P & Arora, V. (2019): A Text Book of Herbal Drug Technology. S. Vikas & Company (Medical Publishers) India, Jalandhar.
5. Chopra, R. N.; Nayar, S. L. and Chopra, I. C. (1956): Glossary of Indian medicinal Plants, C S I R, New Delhi.
6. Jain, S. K. (1994): Medicinal Plants. 5<sup>th</sup> edition. NBT, New Delhi.
7. Laxman, P. (2015): Patenting in India: Policy, Procedure and Public Funding. I K International Publishing House. New Delhi.
8. Mukerji, B. (1953): The Indian Pharmaceutical Codex, New Delhi.

### **SEC-101: PRACTICAL**

Credit: 1

Contact Hours: 30

Marks: 30

1. Survey and collection of medicinal plants used by local communities.
2. Categorization medicinal plants as per the disease criteria.
3. Preparation of plant material for extraction process.
4. Preparation of crude plant extracts by maceration techniques.
5. Preparation of crude plant extracts by Soxhlet apparatus.
6. Method of recovery of crude plant extracts.
7. Qualitative estimation of crude plant extracts
8. Quantitative estimation of plant extracts
9. TLC profiling of plant extracts
10. Study of antimicrobial activity of plant extracts



## SEMESTER - II

### BOT: DSC-151

Course Title: **Cell Biology**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course objective:** *To study the cellular organisation of prokaryotic and eukaryotic organisms*

#### **Unit-I:**

Cell: Historical background of Cell Biology; Broad Classification of Cell Types (in Prokaryotes and Eukaryotes); Cell as basic unit of life; Cell Theory; Pre-cellular evolution and artificial creation of cell; Characteristic features of cell types: Mycoplasma (PPLO); Viroids; Prions; Archaeobacteria and Eubacteria; Eukaryotic microbes; Ecological amplitude of cell in high altitude, arctic, hot spring, arid, brackish and fresh water.

#### **Unit-II:**

Structure and function of cell organelles: Cell wall and cell membrane; Models of cell membrane; role of various membrane proteins, lipids and carbohydrates; role of channels and pumps in cellular transport and signaling; Cytoskeleton and Cytosol; Golgi-bodies; Endoplasmic reticulum; Ribosomes; Lysosomes; Peroxisomes; Endosymbiotic Theory: Mitochondria and Chloroplast.

#### **Unit-III:**

Ultrastructure and function of Nucleus: composition of nucleus; Nucleic acids: DNA and RNA-composition, structure of DNA; A, B and Z forms of DNA; Replication of DNA, Denaturation of DNA, DNA polymerases; Different types of RNA and their role.

#### **Unit-IV:**

Cell Division and its regulation: Cell cycle; cell-cell interaction; cell locomotion (amoeboid, flagellar and ciliary), Muscle and nerve cell; Cell Senescence and Programmed Cell Death; Apoptosis; Cell differentiation; Biology of cancer; Cell Division: Mechanisms of Mitosis and Meiosis; Role of Centromere, Kinetochore and Spindle apparatus.

#### **Unit-V:**

Techniques in cell biology: Microscopy: Principles of Light and Electron microscopy - TEM and SEM; Phase contrast and fluorescence microscopy; Principles of Chromatographic techniques- Paper chromatography, TLC, Column chromatography; HPLC; Autoradiography and its applications; Centrifugation.



**Course Outcome:** The course will provide a detailed understanding of cellular organisation of prokaryotic and eukaryotic organism.

### **Suggested Readings**

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

## **BOT: DSC-152**

Course Title: **Practical – I (Lower Cryptogams and cell Biology)**

Credits: 3

Contact hours: 60

Marks: 100

(All units are of equal credits)

**Course objective:** To study the cellular organisation of lower cryptogams and other eukaryotes

### **Unit-I: Microbes**

Models of virus – T Phage, Lytic & lysogenic cycle from photograph  
Study of bacterial reproduction- binary fission, Conjugation and endospores from temporary/permanent slides/ photographs.

Gram staining techniques in bacteria through Curd/ Root nodules.

Preparation of media- nutrient agar and broth

### **Unit-II: Algae**

Identification and study of vegetative / reproductive structures of the following genera through temporary preparation of slides / permanent slides –

Cyanobacteria: *Nostoc* / *Anabaena*

Chlorophyceae: *Chlamydomonas*, *Chlorella*, *Volvox* and *Chara*;

Xanthophyceae: *Voucheria*;

Bacillariophyceae: *Pinnularia*;

Phaeophyceae: *Ectocarpus* / *Sargassum*;

Rhodophyceae: *Polysiphonia* / *Batrachospermum*.

### **Unit-III: Fungi & Lichen**





Identification and study of vegetative / reproductive structures of the following genera through temporary preparation of slides (by Lactophenol Cotton Blue methods) – *Rhizopus*, *Penicillium*, *Ustilago* and *Puccinia*.  
Study of Crustose, Foliose and Fruticose Lichen.

#### **Unit-IV: Cell Biology**

Study of plant cell with the help of epidermal peel mount of Onion / Rhoecy / Crinum  
Cytochemical staining of DNA-feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.  
Measurement of cell size by the technique of micrometry.  
Counting the cells per unit volume with the help of haemocytometer.  
Study of phenomenon of plasmolysis and deplasmolysis  
Study of effect of organic solvent and temperature on membrane permeability.  
Study different stages of Mitosis and Meiosis.

#### **Unit-V: Viva / Practical Record Books / Field study.**

Botanical Excursion: visit to institute of microbial technology / visit to local vegetation to understand about lower cryptogams and submission of excursion report.  
Viva-voce covering entire syllabus by External Examiners  
Submission of Practical Record Books.

**Course outcome:** *The course will provide a detailed picture of cellular organisation of lower cryptogam and eukaryotes.*

### **BOT: DSM-151**

Course Title: **Angiosperm Morphology and Taxonomy**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course objective:** *To study the morphological features and classification of angiosperms*

#### **Unit-I: Morphology**

Study of modified roots, stems and leaves, phyllotaxy, inflorescence types (including special types); evolution of inflorescence, aestivation and placentation, flower as a modified shoot, types of fruits; floral formula, floral diagram, structure of fruits and seeds. Role of Morphology in taxonomy.

#### **Unit-II: Introduction to Plant Taxonomy**

Definition and components of plant taxonomy (Identification, Classification and nomenclature); taxonomic literature; Herbarium and its preparation, role of herbarium, major herbarium of the world, central national herbarium; botanical gardens and their role, major herbarium of the world and India, A J C Bose Indian Botanic Garden; Flora and its contents, Flora of Assam and Flora of British India; Taxonomic keys;





taxonomic evidences from morphology, palynology, cytology, phytochemistry and molecular data; taxonomic hierarchy. Writing of plant description.

### **Unit-III: Botanical Nomenclature**

Binomial nomenclature; ICN, its principles and rules, ranks and names, typification, author citation, effective and valid publication, rejection of names, principles of priority, naming of new taxon, naming of hybrids.

### **Unit-IV: Classification**

History, types of classification-artificial, natural and phylogenetic; Bentham and Hooker system, Engler and Prantl system and Tathkajan system of classifications.

Numerical taxonomy and cladistics; characters, character weighting and coding; cluster analysis; phenograms, cladograms.

### **Unit-V: Angiosperm Families**

Distinguishing characters, range of vegetative and floral characters and economically important plants of Magnoliaceae, Asteraceae, Solanaceae, Lamiaceae, Euphorbiaceae, Moraceae, Orchidaceae, Liliaceae, Musaceae and Poaceae. Flower morphology of Orchids.

*Course outcome: The course will give a comprehensive understanding of morphological features of angiosperms and direct the taxonomic datasets of angiosperms.*

### **Suggested Readings**

1. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3<sup>rd</sup> edition.
2. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2<sup>nd</sup> edition.
4. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
5. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.
6. Jain, S. K. & Rao, R. R. (1977): A handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers. New Delhi.
7. Singh, G. (2012): Plant Systematics, Theory and Practice. 3<sup>rd</sup> edition. Chaman Enterprises, New Delhi.
8. Stace, C. A. (1989): Plant Systematics and Biosystematics. 2<sup>nd</sup> edition. Cambridge University Press. Cambridge. UK.
9. Vasishta, P. C. (1974): Taxonomy of Angiosperms. 2<sup>nd</sup> edition. R. Chand & Co. New Delhi.



## **BOT: IDC-151**

Course Title: **Biodiversity Conservation**

Credits: 3

Contact hours: 45

Marks: 100

(All units are of equal credits)

**Course objective:** *To study the conservation and management of biodiversity*

### **Unit-I:**

General account: Definition of biodiversity, levels of biodiversity, soil types of India, Climate change; global warming; ozone layer depletion; acid rain and their impact on human communities, agriculture and food security; climate of India, climatic regions of India, diverse flora of India, diverse fauna of India, measuring biodiversity: alpha, beta and gamma diversity.

### **Unit-II:**

Global biodiversity: genetic diversity, species diversity, ecosystem diversity; keystone species, biodiversity in tropics, conservation of biodiversity; ecology and economy, bioethics and conservation, IUCN Red Data Book, Red List categories; Causes of extinction; Endemism.

### **Unit-III:**

Biodiversity of India: Value of Indian biodiversity, Indian biodiversity under serious threat, causes of threats; Hotspots of Indian biodiversity; Germplasm and diversity, In situ conservation; Ex situ conservation; Sustainability, Bioethics and tribal population; Sustainable development rights; India as a mega-biodiversity Nation.

### **Unit-IV:**

Protected areas: Status of biodiversity conservation, National Parks, Sanctuaries, Biosphere reserves, Biodiversity act, Biopiracy, International efforts for conservation of biodiversity; Mangrove conservation; Wildlife protection act; Forest protection act; Convention on Biological Diversity (CBD); The Biodiversity Act (2002); National Environmental Policy (2004).

### **Unit-V:**

Biogeographical regions: Endemism; Floristic regions of India; Vegetation of India (Forest vegetation and grassland vegetation); Indian desert; Western Ghats; The Islands, North-East India; Aims and objectives of Environmental Education; Environmental Impact Assessment (EIA); Role of important NGOs in Environmental protection in India; India's initiative for mitigating climate change.

**Course outcome:** *The course will provide a comprehensive overview on the conservation and management aspects of biodiversity and the importance of biodiversity conservation in the era of climate change.*

### **Suggested Readings:**

1. Sharma, P.D. (2014): Ecology and Environment. 13th Edition, Rastogi Publications, Meerut, India.



2. Sodhi, N. S.; Raven, P.H.; Gibson, L. (2013): Conservation Biology: Voices from the Tropics. John Wiley
3. Gleeson, B. and Low, N. (eds.) (1999): Global Ethics and Environment, London, Routledge.
4. Asthana, D.K. and Asthana M. (2010): A textbook of Environmental studies (For undergraduate students), S. Chand and Company Ltd., Ram Nagar, New Delhi.
5. Singh, J.S; Singh S.P. and Gupta S. R. (2008): Ecology and Environmental Science. S. Chand and Company Ltd., Ram Nagar, New Delhi

## **BOT: SEC-151**

Course Title: **Mushroom Cultivation**

Credits: 3

Contact hours: 60

Marks: 100

### **THEORY**

Credits: 2

Contact hours: 30

Marks: 50

(All units are of equal credits)

**Course objective:** *To study the diverse aspects of mushroom cultivation and its economic and medicinal values*

### **Unit-I: History of Mushroom Cultivation**

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

### **Unit-II: Cultivation Techniques**

Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication

### **Unit-III: Mushroom bed Preparation**

Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low-cost technology, composting technology in mushroom production.

### **Unit-IV: Storage and Nutrition**

Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

### **Unit-V: Food Preparation**

Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.



**Course outcome:** *The course will provide the basis to understand the diverse aspects of mushroom cultivation and its importance.*

### **Suggested Readings**

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.

## **SEC-151: PRACTICAL**

Credit: 1

Contact Hours: 30

Marks: 30

1. Survey of edible mushroom available in this region.
2. Collection of required materials for mushroom cultivation.
3. Pure culture: Medium, sterilization, preparation of spawn
4. Mushroom bed preparation with paddy straw
5. Mushroom bed preparation with sugarcane trash.
6. Mushroom bed preparation with maize straw
7. Preparation compost for mushroom cultivation.
8. Storage techniques for mushroom.
9. Nutritional analysis of mushroom
10. Preparation of food item with mushroom.