COURSES OFFERED BY DEPARTMENT OF BOTANY

Category-I

Botany (H) Courses for Undergraduate Programme of study with Botany as a Single Core Discipline

DISCIPLINE SPECIFIC CORE COURSE – 4: Microbiology and Plant-Microbe Interactions

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Microbiology and Plant-Microbe Interactions **BOT-DSC-4**	**4**	**2**	**0**	**2**	Nil	Nil

Learning Objective:

- To impart basic understanding about the microbial world and their interactions with plants.

Learning Outcomes:

- Understanding microbes and their roles and applications.
- Understanding about modes of reproduction of Viruses, Archaebacteria, Eubacteria
- Understand plant-microbe interaction

SYLLABUS OF BOT-DSC-4

Unit 1: Introduction **Week: 01**

Microbial world, Growth and nutrition of microbes with reference to nutritional media.

Unit 2: Viruses **Weeks: 3.5**

Discovery; Physicochemical and biological characteristics; Classification (Baltimore); General structure with special reference to viroids and prions, DNA and RNA viruses; General account and mechanism of replication, lytic and lysogenic cycle; General account of viral diseases of plants (mosaic and vein clearing disease).

Unit 3: Bacteria **Weeks: 4.5**

Discovery, General characteristics; Types - Archaebacteria, Eubacteria, Wall less forms (Mycoplasma, Phytoplasma and Spheroplasts); Cell structure; Nutritional types; Reproduction - vegetative, asexual and recombination (conjugation, transformation and transduction); General account of bacterial diseases of plants (Citrus canker, Angular leaf spots of cotton).

Unit 4: Applied Microbiology **Weeks: 02**

Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics and agriculture. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).

Unit 5: Plant-Microbe interactions **Weeks: 04**

General account of Plant-microbe interactions; Plant growth promoting rhizobacteria (PGPR); Mechanism of nitrogen fixation by Cyanobacteria and Rhizobia; Types of mycorrhizal association with plants; Ectomycorrhiza and Endomycorrhiza and their effects on plant growth.

Practicals:

1. Study of Viruses: Electron micrographs / Models - T-Bacteriophage and TMV; specimens/digital resources/ Line drawings of Lytic and Lysogenic Cycle. **(Weeks: 02)**
2. Study of Bacteria: Electron micrographs of bacteria; Types of Bacteria from temporary/permanent slides. Endospore, Binary fission, Conjugation, Root nodule through specimens/digital resources. **(Weeks: 02)**
3. Study of Plant Growth Promoting Rhizobacteria (PGPR) through specimens/digital resources (at least three). **(Week: 01)**
4. Gram staining to differentiate between Gram-positive and Gram-negative bacteria. **(Weeks: 02)**
5. Study of *Rhizobium* from root nodules of a leguminous plant. **(Weeks: 02)**
6. Isolation of *Anabaena* from *Azolla* leaves. **(Weeks: 02)**
7. Histochemical staining to observe Arbuscular Mycorrhizal Fungi (AMF) colonization in roots. **(Weeks: 02)**
8. Study of bacterial diseases (Citrus canker, Angular leaf spots of cotton) and viral diseases of plants (mosaic and vein clearing disease) through specimens/digital resources. **(Weeks: 02)**

Suggested Readings:

1. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi, Tata McGrawHill Co.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2016). Microbiology: An Introduction, Indian

edition, Pearson India Education Services Pvt. Limited, Noida, India

3. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
4. Gupta, R., Chugh, G. (2022). Plants, Microbes and Diseases 1st Edition, I.K. International Pvt. Ltd., Delhi.
5. Subba Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Additional Resources:

1. Talaro, K.P., Talaro, A. (2006). Foundations in Microbiology. McGraw Hill, New Delhi

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 5: Plant Resources and Economic Botany

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Plant Resources and Economic Botany BOT-DSC-5	4	2	0	2	Nil	Nil

Learning Objectives

The course will help students gain knowledge on:

- the economic importance of diverse plant species and train them in identifying plants of economic importance through field visit/s, live plant specimens, herbarium specimens and digital resources.
- the different plant parts and plant products such as food, fibers, medicines, oils and others).
- the processing of various plant resources and train them to identify and analyse nutrients using simple microchemical tests.

Learning outcomes:

- This course would provide students with information about the economic importance and products derived from plants and their roles in our daily lives.
- Students will learn to perform microchemical tests to study the presence of various components.
- Students will explore the regional diversity in food crops and other plants and their ethnobotanical importance.

SYLLABUS OF BOT-DSC-5

Unit 1: Introduction and Origin of Cultivated Plants **Week: 01**

Importance of Plant Resources; Vavilov's concept for the Origin of cultivated plants; Centres of Origin (Primary and Secondary); Centres of diversity, Harlan's concept of gene pools; Plant Genetic Resources and their conservation.

Unit 2: Cereals **Weeks: 02**

Wheats (Origin, Evolution of Wheats (tetra- & hexaploid), Morphology, Production, and Economic Importance of Hexaploid Wheat); Rice (Origin-Monophyletic and Polyphyletic, Production, Morphology, Comparison between *indica* and *japonica* Rice, Parboiling, Economic Importance); Other cereals: Maize, Barley, Oats, Millets (jowar, bajra, ragi) and Pseudocereals.

Unit 3: Legumes **Weeks: 1.5**

General account (Nutritive Value of Pulses, Protein Malnutrition, Lathyrism, Favism, Ecological Importance); Chick pea and Pigeon pea (Production, Morphology and Economic Importance); Other Legumes: Lentil, Cluster Bean, Lathyrus, Beans, Pea, Cowpea, Fodder legumes and Green manure crops.

Unit 4: Sugars and Starches **Weeks: 1.5**

Sugarcane (Morphology, Ratooning, Nobilization, Products and By-products); Potato (Morphology, Tuber Anatomy, Seed Tubers vs True Potato Seeds and Economic uses).

Unit 5: Spices, Condiments & Flavourings **Weeks: 1.5**

General Account (Spices, Condiments, Culinary Herbs and Essences, with examples), Importance of Spices, Clove (Morphology, Anatomy of part used and Economic Importance) and Black Pepper (Morphology, Anatomy of part used and Economic Importance). Other examples: Ginger, Turmeric, Cinnamon, Saffron, Cardamom, Chillies & Pepper, Fennel, Coriander, Cumin, Vanilla, Nutmeg.

Unit 6: Beverages **Week: 01**

Types of Beverages (Alcoholic and Non-Alcoholic) with examples; Tea and coffee (Morphology, Chemistry, Processing and Economic Importance)

Unit 7: Fibres and Fibre-yielding plants **Weeks: 1.5**

Classification of Fibres based upon their Origin (surface fibres, bast fibres, and leaf fibres, with examples); Jute (morphology, extraction and economic importance), Cotton (*Gossypium* species, morphology, processing and economic importance) Comparison between Jute and Cotton fibers. Other examples: Flax, Hemp and Coconut.

Unit 8: Oil-Yielding Plants **Weeks: 1.5**

Fatty Oils and Essential Oils, Comparison between Fatty Oils and Essential Oils; Fatty Oils (Classification with examples, keeping quality), Groundnut (Morphology and Economic Importance); Essential Oils (General characteristics, Methods of Extraction and Economic Importance, with examples). Other examples: Rapeseed & Mustard (canola), Coconut, Olive, Castor, Cottonseed, Sesame, Soybean, Linseed.

Unit 9: Medicinal and Drug-Yielding Plants **Week: 01**

Brief Account of Therapeutic Drugs with Examples; Morphology, Chemical Constituents, Economic Importance of *Cinchona, Rauwolfia, Digitalis.*

Unit 10: Fumigatory & Masticatory **Week: 01**

Tobacco **(**Morphology, species - *Nicotiana tabacum* & *N. rustica*), Processing, Products, Economic Importance and Health Hazards), *Cannabis*, *Papaver* (Morphology, Chemical constituents, Economic importance)

Unit 11: Rubber **Week: 0.5**

Para Rubber - *Hevea brasiliensis* (Morphology, Tapping of latex, Processing, Products and Economic Importance)

Unit 12: Fruits & Nuts **Week: 0.5**

Tropical & Temperate; *Citrus*, Mango, Banana, Apple, Pineapple, Papaya; Nuts: Cashew, Walnut, Almond & Pistachio.

Unit 13: Vegetables **Week: 0.5**

Common examples of root crops, leafy vegetables (herbage), fruit seed vegetables.

Practicals:

1. **Cereals**: Wheat (habit sketch, L.S/T.S. grain, W.M. starch grains, microchemical tests), Rice (habit sketch, study of paddy and grain, W.M. starch grains, microchemical tests). Millets - Pearl Millet, Finger Millet and Pseudocereals - Amaranth, Quinoa (specimens/digital resources and grains) **(Weeks: 02)**
2. **Legumes**: Chickpea, Pigeonpea (habit, fruit, seed structure, micro-chemical tests). **(Week: 01)**
3. **Sugars and Starches**: Sugarcane (habit sketch, products and by-products, Cane juice-microchemical tests); Potato (habit sketch, tuber morphology, T.S. tuber to show

localization of starch grains, W.M. starch grains, microchemical tests). **(Week: 01)**

4. **Spices**: Clove, Black pepper (habit and sections-L.S./T.S.), Saffron, Fennel (specimen/digital resources) **(Week: 01)**
5. **Beverages**: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans) **(Week: 01)**
6. **Fibres**: Jute (specimens/digital resources of *Corchorus capsularis* and *C. olitorious*, T.S. stem, test for cellulose and lignin on section of stem and fibre). Cotton (specimen, W.M. seed to show lint and fuzz; W.M. fibre and test for cellulose) **(Weeks: 02)**
7. **Oil-Yielding Plants**: Fatty Oils: Groundnut (h abit-specimen, fruit, seeds, microchemical Tests)' Coconut (habit-photograph, fruit, T.S. nut), Mustard - (habit-specimen, fruit, seeds); Essential Oils: habit sketch of Rose, Jasmine, Vetiver, Sandalwood and *Eucalyptus* (specimens/photographs)
   (Weeks: 02)
8. **Drug-Yielding plants:** Habit - Fever Bark Tree, Poppy, Foxglove and Cannabis (Specimens/ Photographs) **(Weeks: 02)**
9. **Tobacco:** *Nicotiana tabacum* and *N. rustica* (specimens/photographs), Tobacco Products **(Week: 01)**
10. **Rubber:** Para Rubber-Habit, Tapping of latex (Specimen/photograph), Rubber Products **(Week: 01)**
11. **Petro-crops:** *Saccharum officinarum* , *Jatropha* sp. **(Week: 01)**

Suggested Readings:

1. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Kochhar, S.L. (2016). Economic Botany – A Comprehensive Study, 5th Edition. New Delhi, India: Cambridge University Press.
3. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
4. Chrispeels, M.J., Sadava, D.E. (1994). Plants. Genes and Agriculture. Jones & Bartlett-Publishers.
5. Berg L. (2008). Introductory Botany: Plants, People, And The Environment, Thomson Brooks/Cole.
6. Cook F.E.M. (1995). Economic Botany: Data Collection Standard Royal Botanic Garden, Kew, Richmond.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 6: Plant Systematics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Plant Systematics BOT-DSC-6	4	2	0	2	Nil	Nil

Learning Objectives:

- The course will help students gain knowledge about the basics of plant systematics and its interrelationships with allied subject areas

Learning outcomes

On completion of the course the students will be able to:

- understand technical terminology used in plant taxonomy
- apply the terminologies to describe, identify and classify flowering plants
- search and analyse taxonomic information from internet-based scientific databases and other resources
- interpret and evaluate the concept of species and evolutionary processes in angiosperms
- comprehend and compare various systems of classifications
- recognise diversity in local/regional flora
- appreciate the significance and application of systematics in science and welfare of society

SYLLABUS OF BOT-DSC-6

Unit 1: Introduction **Week: 01**

Identification, Classification (types) and Nomenclature, Phylogeny; Major contributions - Parasara, Charaka, Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan, Bremer, MW Chase

Unit 2: Resources in Plant Identification **Week: 01**

Literature (Floras, Manuals, *Icones*, Monographs, Revisions, Journals, e-resources); Herbaria and Botanical gardens (in brief).

Unit 3: Systematics - An Interdisciplinary Science **Weeks: 02**

Relevance of palynology, cytology, phytochemistry and molecular data (cp.DNA, mt.DNA, nuclear DNA, PCR amplification, sequence data analysis); three examples from each with emphasis on application in resolving taxonomic problems - details of techniques to be excluded)

Unit 4: Botanical Nomenclature **Weeks: 2.5**

Principles and rules (ICN); Ranks and names; Principle of priority and its limitations; Concept of 'Type', Author citation, Valid publication, Rejection of names, Nomenclature of hybrids

Unit 5: Systems of Classification **Weeks: 03**

Taxonomic hierarchy; Concept of species (morphological, biological and evolutionary); Classification systems - Bentham and Hooker (up to series), Engler and Prantl (up to sub-class) and Angiosperm Phylogeny Group (APG) classification (major clades).

Unit 6: Approaches in Systematics **Weeks: 03**

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly, clades and grades).

Phenetics - Principles, Methodology, Characters; Selection of OTUs, Character weighing and Coding; Cluster analysis; Phenogram.

Cladistics - Principles, Methodology, Characters; Selection of EUs, Character weighing and Coding; Cluster analysis; Cladogram

Unit 7: Evolution of Angiosperms **Weeks: 2.5**

Concept of a primitive flower (Euanthial theory and Pseudanthial theory); Basal Living Angiosperms; Herbaceous origin; Coevolution of angiosperms with animals.

Practicals:

1. Field trip/ Visit to any herbaria/ Botanical Garden. **(Week: 01)**
2. To prepare at least five herbarium specimens and identify them using available resources (Literature, herbaria, e-resources, taxonomic keys) and classify up to family level

(according to Bentham and Hooker's classification and compare it with APG IV System in the field notebook). **(Weeks: 02)**

3. Description of taxa using semi-technical terms and identification of the families according to Bentham and Hooker's classification and compare the placement of family with APG IV System (Only placement of family according to APG IV system to be mentioned) **(Weeks: 12)**

Note: Any **twelve** families from the following list to be studied with **at least two** specimens (**or one** where limitations exist).

List of Suggested Families (*mandatory)

Acanthaceae, Amaranthaceae, *Apiaceae, Apocynaceae, *Asteraceae, *Brassicaceae, *Euphorbiaceae, *Fabaceae, *Lamiaceae, Liliaceae, *Malvaceae, Moraceae, *Poaceae, *Ranunculaceae, *Solanaceae

Suggested Readings:

1. Simpson, M. G. (2019). Plant systematics. 3rd Edition, Academic press.
2. Singh, G. (2019). Plant Systematics- An Integrated Approach. 4th edition. CRC Press, Taylor and Francis Group.
3. Stuessy, T.F. (2009). Plant Taxonomy: The Systematic Evaluation of Comparative Data, 2nd edition, Columbia University Press.
4. Taylor, D.V., Hickey, L.J. (1997). Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributors, New Delhi.
5. Pandey, A. K., Kasana, S. (2021). *Plant Systematics*. 2nd Edition. CRC Press Taylor and Francis Group
6. http://www.mobot.org/MOBOT/research/APweb/
7. Maheshwari, J. K. (1963). The flora of Delhi. Council of Scientific & Industrial Research.
8. Maheshwari, J. K. (1966). Illustrations to the Flora of Delhi. Council of Scientific & Industrial Research.
9. Harris, J. G., Harris, M. W. (2001). Plant Identification Terminology: An Illustrated Glossary. Spring Lake, Utah: Spring Lake Pub. Spring Lake, Utah.
10. Radford, A. E. (1974). Vascular plant systematics. Harper & Row Publishers, New York, London.
11. Judd, W.S., Campbell, L.S., Kellogg, E.A., Stevens, P.F., Donoghue, M.J. (2016). Plant Systematics: A Phylogenetic Approach. 4th edition. Sunderland, MA: Sinauer Associates.

Additional Resources:

1. The Angiosperm Phylogeny Group, Chase, M. W., Christenhusz, M. J.M., Fay, M. F.,

Byng, J. W., Judd, W. S., Soltis, D.E. Mabberley, D. J., Sennikov, A. N., Soltis, P. S., Stevens, P. F. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical journal of the Linnean Society 181 (1): 1–20.

2. Soltis, D. E., Bell, C. D., Kim, S., Soltis, P. S. (2008). Origin and early evolution of angiosperms. Annals of the New York Academy of Sciences 1133: 3-25.
3. Scutt, C. P. (2021). The origin of angiosperms. In Evolutionary developmental biology: a reference guide. Cham: Springer International Publishing.
4. https://www.mobot.org/MOBOT/research/APweb/treeapweb2s.gif
5. https://www.digitalatlasofancientlife.org
6. http://apps.kew.org/herbcat/navigator.do
7. https://efloraofindia.com/
8. https://powo.science.kew.org/
9. Page, R.D.M., Holmes, E.C. (1998). Molecular Evolution: A phylogenetic approach. Blackwell Publishing Ltd.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.