

**UNIVERSITY OF MADRAS**  
**B.Sc. DEGREE COURSE IN PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**  
**SYLLABUS WITH EFFECT FROM 2020-2021**

**BPB-DSC01**

**CORE-I: PLANT DIVERSITY-I: PHYCOLOGY AND ALGAL BIOTECHNOLOGY**

L	T	P	Cr
6	0	0	5

**Learning outcomes:**

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

- Increase the awareness and appreciation of human friendly algae and their economic importance.
- Conduct experiments using skills appropriate to subdivisions.
- Understand core concepts and fundamentals of various levels of algal growth.
- Translate various algal technologies for benefit of the ecosystem.
- Demonstrate algal growth in different types of natural water.
- Analyze emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.

**UNIT - I**

Introduction, general characteristics, major classes, range of thallus structure, life cycle patterns and economic importance of algae. Classification of algae - Fritsch (1945) system.

**UNIT- II**

Range of thallus structure, reproduction and life history of the following: Anabaena, Nostoc, Spirulina, Scenedesmus, Caulerpa, Chara and Diatoms.

**UNIT- III**

Internal structure of thallus; morphology, reproduction and life-cycle of Sargassum and Gracilaria.

**UNIT- IV**

Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.

## UNIT- V

Resource potential of algae - Application of algae as fuel, food (fish, poultry and animals), agriculture and, pharmaceutical. Phycoremediation, Sewage disposal and waste treatment of industrial effluent.

### References:

1. Vashishta B.R., Sinha A.K and Singh V.P. 2008. Botany for Degree Students. Algae. S Chand and Co, New Delhi.
2. Sahoo, D. 2000. Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
3. Sambamurty, A.V.S.S. 2015. A Textbook of Algae. S Chand. New Delhi.
4. Sharma, O.P. 2011. Diversity of Microbes and Cryptogams/Algae. Tata Mc Graw Hill Education Private Ltd, New Delhi.
5. Dinabandhu Sahoo and B.D. Kaushik. 2012. Algal Biotechnology and Environment. I.K. International, New Delhi.
6. Mihir Kumar Das. 2010. Algal Biotechnology. Daya Publishing House, New Delhi.
7. Vashishta, P.C. 2014. S.Chand & Company Ltd, New Delhi.
8. Ian Morris. 1977. An introduction to the algae. Hutchinson & Co (Publishers) Ltd. London.
9. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
10. Hoek, C. Van, D. 1999. An Introduction to Phycology. Cambridge University Press.
11. Bold, H.C and Wynne, M.J. 1985. Introduction to the Algae. Prentice Hall of India, New Delhi.
12. Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press.
13. Round, FE. 1984. The Ecology of Algae. Cambridge University Press.
14. Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York

### Web Resources:

1. <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
2. <https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327>
3. <https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678>

4. <https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh>
5. <https://www.wileyindia.com/a-textbook-of-algae.html>
6. <https://www.kobo.com/in/en/ebook/algae-biotechnology>
7. <https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/>

### **BPB-DSC02**

## **CORE-II: PLANT DIVERSITY-I: PHYCOLOGY AND ALGAL BIOTECHNOLOGY**

### **PRACTICAL- I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

#### **Learning outcomes:**

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

- To study the internal organization of algae.
- To learn the range of thallus organization in various algae.

#### **Phycology**

1. Identifying types of algal mixture.
2. Microscopic observation of vegetative and reproductive structures of Anabaena, Nostoc, Spirulina, Scenedesmus, Caulerpa, Chara, Diatoms, Sargassum and Gracilaria through temporary preparations and permanent slides.
3. Field visit/trip to collect algal specimens.

#### **Algal Biotechnology**

1. Cultivation of algae: Composition of media (Freshwater algae): BG11 (Blue Green) medium, Bold Basal (BB) medium (Demonstration only).
2. Microalgae culture techniques - Inoculation of microalgae (Demonstration only) Estimation of biomass.
3. Immobilization of algal cells with alginate.
4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
5. Phycoremediation experiments (Demonstration only).

6. Visit to nearby industry actively engaged in algal technology.

**BPB-DSC03**

**CORE-III: PLANT DIVERSITY-II: MYCOLOGY, PHYTOPATHOLOGY AND  
FUNGAL BIOTECHNOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>6</b>	<b>0</b>	<b>0</b>	<b>5</b>

**Learning outcomes:**

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

- Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
- Demonstrate skills in laboratory, field and glass house work related to mycology and plant pathology.
- Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies
- Identify the common plant diseases, according to geographical locations and devise control measures.
- Analyze emerging areas of Fungal Biotechnology for identifying agricultural applications and pharmaceutical applications.

**UNIT - I**

Occurrence, characteristics, thallus organization, mode of nutrition and reproduction in fungi. Classification by Alexopolus (1962) and economic importance.

**UNIT - II**

Structure, reproduction and life histories of the following:

Zygomycotina: Mucor

Ascomycotina: Saccharomyces, Peziza

Basidiomycotina: Agaricus, Puccinia

Deuteromycotina: Cercospora

**UNIT - III LICHENS:**

General characteristics, Thallus organization (Usnea), types, reproduction. Economic and ecological importance of Lichens.

#### **UNIT - IV Phytopathology:**

General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases. General characters of Bacteria and Viruses.

Bacterial diseases – Citrus canker and Bacterial wilt of Banana

Viral diseases – Tobacco Mosaic and Vein clearing of Papaya

Fungal diseases – Blast disease in rice and Tikka disease.

#### **UNIT - V Fungal Biotechnology**

Cultivation of mushrooms – Pleurotus. Fungi in agriculture application: Fungal biofertilizers and biopesticides, Production of industrially important products from fungi-organic acids (citric acid), enzymes (protease) applications of fungi in pharmaceutical products. Production of antibiotics (Penicillin) and vitamins (Vitamin B-complex and Vitamin B-12).

#### **References:**

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.
6. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons (Asia) Singapore.
7. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
8. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.
9. Dilip K. Arora. 2003. Handbook of Fungal Biotechnology. CRC Press book.
10. Mahendra Rai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.
11. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
12. Burnett, J.H. 1971. The fundamentals of Mycology. ELBS Publication, London.

13. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.
14. Mehrotra, R.S., Aneja, K.R. 1990. An Introduction to Mycology , New Age International Pub, New Delhi.
15. Webster, J. 1970. Introduction to fungi , Cambridge university press ,London.
16. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
17. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology , Tata MaGraw Hill Publishing House, New Delhi.

**Web Resources:**

1. <https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFF>
2. <http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html>
3. <http://www.freebookcentre.net/Biology/Mycology-Books.html>
4. <https://www.kobo.com/us/en/ebook/introduction-to-fungi>
5. <http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html>
6. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)  
<https://doi.org/10.1201/9780203027356>

**BPB-DSC04**

**CORE-IV: PLANT DIVERSITY II: MYCOLOGY, PHYTOPATHOLOGY AND FUNGAL BIOTECHNOLOGY - PRACTICAL-II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

Learning Outcomes:

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

- To study the internal organization of fungi.
- To learn the range of thallus organization in various fungi.

**Mycology**

1. Microscopic observation of vegetative and reproductive structures of Mucor, Peziza, Saccharomyces, Agaricus, Puccinia and Cercospora through temporary preparations and permanent slides.
2. Protocol for mushroom cultivation.

## **Lichens**

Morphology and of anatomy of thalli (Usnea). Study of thallus and reproductive structures (apothecium) through permanent slides.

Economic importance of Lichen - Dye and perfume.

Phytopathology

Herbarium specimens of the following diseases:

- 1) Citrus canker
- 2) Bacterial wilt of Banana
- 3) Tobacco Mosaic viruses
- 4) Vein clearing in Papaya
- 5) Blast disease in rice
- 6) Tikka disease of groundnut

## **Fungal Biotechnology**

1. Culture media for fungi: Potato dextrose agar medium (PDA) and Sabouraud Dextrose Agar (SDA) (Demonstration only).
2. Inoculation techniques for fungal culture (Demonstration only).
3. Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (Trichoderma), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.
4. Visit to fungal biotechnology laboratories.

### **BPB-DSC05**

#### **CORE-V: PLANT DIVERSITY-III: BRYOPHYTES AND PTERIDOPHYTES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>6</b>	<b>0</b>	<b>0</b>	<b>5</b>

Learning outcomes:

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

- Able to understand the morphology of Bryophytes and Pteridophytes.
- Develop critical understanding on variations in gametophyte and sporophyte, anatomy and reproduction of Bryophytes and Pteridophytes.
- Understanding of plant evolution and their transition to land habitat.

- Exhibit the proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes and Pteridophytes.

### **UNIT- I**

General characters of Bryophytes, classification (Watson, 1963) (up to family), range of thallus organization, alternation of generation, Evolution of Bryophyte, Economic importance of Bryophytes.

### **UNIT- II**

General characters of Hepaticopsida, Anthocerotopsida and Bryopsida. Morphology, anatomy and reproduction of Marchantia, Anthoceros and Funaria (need not study developmental aspects).

### **UNIT- III**

General characters of Pteridophytes, classification (Reimer, 1954) (up to family), Apogamy, apospory, homospory, heterospory and seed habit. Origin and evolution of Pteridophytes.

### **UNIT- IV**

Morphology, anatomy and reproduction of Lycopodium, Selaginella, Adiantum and Marsilea (need not study developmental aspects).

### **UNIT- V**

Stelar evolution, sporangial organization and evolution in Pteridophytes. Fossil types – Calamites and Lepidocarpon. Economic importance of Pteridophytes.

### **References:**

1. Eames, A. 1963. Morphology of lower vascular plant, McGraw Hill, Chennai.
2. Pandey B.R. 1977. A text book of Botany, Pteridophytes and Gymnosperms, K. Nath & Meerut.
3. Parihar. N.S. 1967. An introduction of Embryophyta, Vol.III – Pteridophyta, Central book depot, Allahabad.
4. Smith, G.M. 1955. Cryptogamic Botany, Volume-II– McGraw Hill, Chennai
5. Sporne, K.L. 1976. Morphology of Pteridophytes, 4th edition, B.I. Publication. Chennai.
6. Vashista.P.C. 1971. Botany for Degree students: Pteridophyta. S.Chand & Co. New Delhi.
7. Watson, E.V. 1963. The structure and Life of Bryophytes. Hutchinson & Co, UK.
8. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.



9. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
10. Puri, P. 1980. Bryophytes. Atma Ram and Sons, New Delhi.
11. Sporne, K.R. 1991. The Morphology of Pteridophytes. B.I. Publ. Pvt. Ltd. Chennai.
12. Vashistha, P.C., Sinha, A.K., Kumar, A. 2010. Pteridophyta. S. Chand. Delhi, India.
13. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. 2005. Biology. Tata McGraw Hill, New Delhi.
14. Vashishta, P.C. 2014. Botany for Degree Students Bryophytes. Chand & Company Ltd, Delhi, Ed.
15. Sharma, O.P. 2006. Pteridophyta. Tata McGraw-Hill Education, New York.

**Web Resources:**

1. <http://www.bryocol.mtu.edu/>
2. <https://www.amazon.in/Introduction-Bryophytes-Alain-Vanderpoorten-ebook/dp/B007NFWQK>
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
5. [http://www.bsiervis.nic.in/Database/Pteridophytes-in-India\\_23432.aspx](http://www.bsiervis.nic.in/Database/Pteridophytes-in-India_23432.aspx)
6. <http://www.botany.ubc.ca/bryophyte/mossintro.html>
7. [https://books.google.co.in/books/about/Botany\\_for\\_Degree\\_Pteridophyta.html?id=sJu0V VaeTIUC&redir\\_esc=y](https://books.google.co.in/books/about/Botany_for_Degree_Pteridophyta.html?id=sJu0V VaeTIUC&redir_esc=y)
8. <http://www.eeb.uconn.edu/people/goffinet/Classificationmosses.html>
9. <https://www.vitalsource.com/products/introduction-to-bryophytes-alain-vanderpoorten-v9780511738951?duration=perpetual>

**BPB-DSC06**

**CORE-VI: PLANT DIVERSITY-III : BRYOPHYTES AND PTERIDOPHYTES**

**PRACTICAL-III**

L	T	P	Cr
0	0	4	2

Learning outcomes:

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

- To learn the range of thallus organization in various Bryophytes and Pteridophytes.

- To study the internal organization of Bryophytes and Pteridophytes.

### **Bryophytes**

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophytes genera included in the theory syllabus.

- a) Marchantia b) Anthoceros c) Funaria (need not study developmental aspects).

### **Pteridophytes**

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophytes genera and fossils included in the theory syllabus.

- a) Lycopodium b) Selaginella c) Adiantum and d) Marsilea (need not study developmental aspects).

Study the following fossil members: a) Calamites and b) Lepidocarpon through permanent slides.

## **BPB-DSC07**

### **CORE-VII: PLANT DIVERSITY-IV: GYMNOSPERMS, PALEOBOTANY AND EVOLUTION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>6</b>	<b>0</b>	<b>0</b>	<b>5</b>

Learning outcomes:

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

- Demonstrate an understanding of Gymnosperms and Paleobotany.
- Develop critical understanding on morphology, anatomy and reproduction of Gymnosperms.
- Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Gymnosperms.
- Analyze the anatomy and reproduction of Gymnosperms along with their ecological and economical importance.

### **UNIT - I**

General characters and Classification of Gymnosperms (Sporne, 1954) (up to family). Wood structure and economic importance of Gymnosperms.

## **UNIT - II**

Morphology, anatomy and reproduction of Cycas, Pinus and Cupressus (excluding developmental details).

## **UNIT - III**

Introduction to fossils and fossilization processes such as compression, casts, molds, petrification, impressions and coal balls. Radiocarbon dating. Geological time scale – era, period, epoch. Contribution of Birbal Sahni.

## **UNIT - IV**

Study of the following fossils: Pentoxylon and Williamsonia.

## **UNIT - V**

Evolution - origin of life, chemosynthetic theory - evidences (any five). Theories of evolution - Darwin, Lamarck and De veries, modern synthetic theory. Variation - analysis and sources, adaptive radiation, Concept of species - Allopatric and sympatric.

### **REFERENCES:**

1. Sporne, K.R. 1954. Morphology of Gymnosperms, Hutchinson University Library.
  2. Gupta, M.N. 1972. The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.
  3. Vashista, P.C. 1976. Gymnosperms, S.Chand & Co. New Delhi.
  4. Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi.
  5. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi.
  6. Stewart, W.N and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
  7. Raup, D.M and Steven, M. Stanley. 2004. Principles of paleontology. San Francisco: W.H. Freeman, 1971.
1. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India.
  2. Anil Kumar. 2006. Gymnosperms. S. Chand & Company Pvt. Ltd. New Delhi.
  3. Bhatnagar S.P and Alok Moitra. 2013. Gymnosperms. Publisher: New Age International Pvt Ltd Publishers. New Delhi.
  4. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
  5. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York.

6. Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.

**Web Resources:**

1. [https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir\\_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false](https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false)
2. [https://books.google.co.in/books/about/Botany\\_for\\_Degree\\_Gymnosperm\\_Multicolor.html?id=HTdFYFNxnWQC&redir\\_esc=y](https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y)
3. <https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC>
4. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
5. <https://www.palaeontologyonline.com/>
6. <https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ>
7. <https://trove.nla.gov.au/work/11471742?q&versionId=46695996>
8. <http://www.freebookcentre.net/Biology/Evolutionary-Biology-Books.html>.

**BPB-DSC08**

**CORE-VIII: PLANT DIVERSITY-IV: GYMNOSPERMS, PALEOBOTANY AND EVOLUTION-PRACTICAL-IV**

L	T	P	Cr
0	0	4	2

Learning outcomes:

- To study the internal organization of Gymnosperms and Paleobotany.

**Gymnosperms**

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Cycas, Pinus and Cupressus.

**Paleobotany**

Study the following fossil members: a) Pentoxylon and b) Williamsonia through permanent slides.

**Evolution**

Photograph of evolution scientists.

## BPB-DSC09

### CORE-IX: PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

L	T	P	Cr
5	0	0	4

Learning outcomes:

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

- Classify Plant systematics and recognize the importance of herbarium and virtual herbarium.
- Evaluate the important herbaria and botanical gardens.
- Interpret the rules of ICN in botanical nomenclature.
- Assess terms and concepts related to Phylogenetic Systematics.
- Analyze the characters of the families according to the Bentham and Hooker's system of classification.
- Understand core concepts of economic Botany and relate its applications in human life.

#### UNIT - I

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-Types-simple and compound- phyllotaxy, modifications (phyllode, pitcher) tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - classification.

#### UNIT - II

History of Angiosperm classification – Artificial, Natural and Phylogenetic system of classification. An outline of Bentham and Hooker system of classification, an overview of APG Classification. Herbarium technique–collection, pressing, drying, mounting and preservation of plant specimens, digital herbarium. Botanical Survey of India. Botanical nomenclature–rules, typification and author citation.

#### UNIT- III

Study of the following families based on the natural system and their economic importance: Nymphaeaceae, Meliaceae, Anacardiaceae, Rutaceae, Rhamnaceae, Capparidaceae, Cucurbitaceae and Apocyanaceae,

#### **UNIT - IV**

Study of the following families based on the natural system and their economic importance: Boraginaceae, Solanaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Liliaceae, Cannaceae, Poaceae.

#### **UNIT - V**

Source, cultivation method (brief) and the extraction/processing of the economically important products of the following – Cereal (Rice), Pulses (Black gram), Sugar (Sugarcane), Beverage (Coffee), Oil seed (Groundnut), spices (Cardamom), essential oil (Rose), natural rubber and timber plants (Teak) and Fibre (Cotton).

#### **References:**

1. Lawrence, G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Porter, C.L. 1982. Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi
3. Rendle, A.B. 1980. The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4. Pandely, B.P. 1987. Taxonomy of Angiosperms.
5. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
6. Harborne, J.B and Turner, B.L. 1984. Plant Chemosystematics, Acad. Press, London.
7. Lawrence, G.H. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
8. Samuel, B.J and Arlene, E.L. 1987. Plant Systematics, Mc Graw Hill Inc. New York
9. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
10. Grant, W.E. 1984. Plant Biosystematics. Academic Press, London.
11. Harrison, H.J. 1971. New Concepts in Flowering Plant Taxonomy. Rieman Educational Book Ltd., London.
12. Heslop-Harrison, J. 1967. Plant Taxonomy -English Language Book Soc. & Edward Arnold Pub. Ltd. U.K.
13. Heywood, V.H and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
14. Jones, A.D. and Wilbins, A.D. 1971. Variations and Adaptations in Plant Species. Hiemand & Co. Educational Books Ltd. London.

15. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-Hill Book Co., New York.
16. Nordenstam, B., El Gazaly, G and Kassas, M. 2000. Plant Systematics for 21st Century. Portlant Press Ltd., London.
17. Solbrig, O.T. 1970. Principles and Methods of Plant Biosystematics. The MacMillan Co-collier-MacMillan Ltd., London.
18. Solbrig, O.T and Solbrig, D.J. 1979. Population Biology and Evolution, Addison-Wesley Publicating Co. Ind USA.
19. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
20. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
21. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
22. Hutchinson, J. 1973. The Families of Flowering plants , Oxford University press, London.
23. Gamble, J.S., Fisher, L.E.F.1967. The Flora of The presidency of Madras (Vol-III) BSI, Calcutta
24. Davis, P.H and Heywood, V.M. 1965. Principles of Angiosperm Taxonomy, Oliver and Boyd Edinburgh.

**Web Resources:**

- 1.[https://books.google.co.in/books/about/Plant Taxonomy 2E.html?id= px\\_WAwHiZIC&redir https://books.google.co.in/books/about/Plant Taxonomy and Biosystematics.html?id=VfQnuw\\_h3bw8C&redir\\_esc=y\\_esc=y](https://books.google.co.in/books/about/Plant_Taxonomy_2E.html?id=px_WAwHiZIC&redir_https://books.google.co.in/books/about/Plant_Taxonomy_and_Biosystematics.html?id=VfQnuw_h3bw8C&redir_esc=y_esc=y)
- 2.[https://books.google.co.in/books/about/PLANT\\_TAXONOMY\\_2E.html?id=Roi0lwSXFuUC &redir\\_esc=y](https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFuUC&redir_esc=y)
- 3.[https://books.google.co.in/books/about/Plant\\_Taxonomy.html?id=0bYs8F0Mb9gC&redir\\_esc =y](https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y)
- 4.[https://books.google.co.in/books/about/Economic\\_Botany.html?id=2ahsDQAAQBAJ&redir\\_esc=y](https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y)
- 5.[https://books.google.co.in/books/about/Textbook\\_Of\\_Economic\\_Botany.html?id=XmZfJO\\_J Hv8C&redir\\_esc=y](https://books.google.co.in/books/about/Textbook_Of_Economic_Botany.html?id=XmZfJO_JHv8C&redir_esc=y)
6. [https://books.google.co.in/books/about/Plant\\_Taxonomy.html?id=uWg76rCqA68C](https://books.google.co.in/books/about/Plant_Taxonomy.html?id=uWg76rCqA68C)
7. <https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592>

8. <https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-eBook>.

**BPB-DSC10**

**CORE-X: PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC  
BOTANY- PRACTICAL-V**

L	T	P	Cr
0	0	4	2

Learning outcomes:

- On completion of this course, the students will be able to:
- To understand the relevance of molecular techniques in plant systematics.
- To study the classical taxonomy with reference to different parameters.

**PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY**

1. Morphology of root, stem and leaf modification, types of inflorescence.
2. Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.
3. Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.
4. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family.
5. Twenty (20) Herbarium sheets, field notebook and bonafide record to be submitted.
6. Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.
7. Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 5 days under the guidance of faculties.

**BPB-DSC11**

**CORE-XI: PLANT ANATOMY AND EMBRYOLOGY**

L	T	P	Cr
5	0	0	4

Learning outcomes:

- On completion of this course, the students will be able to:
- Understand the fundamental concepts of plant anatomy and embryology.
- Analyze and recognize the various organs of plant and understand the secondary growth.



- Evaluate the structural organization of flower and the process of pollination and fertilization.

### **UNIT - I**

Cell wall - structure, and function. Tissues - Definition, types - Simple tissue system - parenchyma, collenchyma and sclerenchyma (fibers and sclereids). Complex tissue system - xylem and phloem. Meristem: definition, structure, function and classification. Apical organization and theories: Apical cell theory, Histogen theory and Tunica-Corpus theory. Root apex: Histogen theory and Korper-Kappe theory.

### **UNIT - II**

Primary structure of root and stem (Dicot and monocot). Epidermal tissue system: epidermis, cuticle, trichome, bulliform cells, periderm and silica cells. Ground tissue systems: cortex, endodermis, pericycle, pith and pith rays. Vascular tissue systems: different types of vascular bundles and their arrangement in root and stem. Nodal anatomy: leaf trace, leaf gap, branch trace and branch gap-types.

### **UNIT - III**

Secondary thickening in monocots and dicots, Secondary thickening in monocot and dicot root. Anomalous secondary growth of stem- Boerhaavia, Nyctanthes and Dracaena. Leaf - anatomy of dicot and monocot leaf. Periderm structure and development: Phellem, Phellogen, Phelloderm, Rhytidome and lenticels. Stomatal types.

### **UNIT - IV**

Structure and development of anther - development of male gametophyte. Ovule: Structure of mature ovule, types of ovules; female gametophyte- megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (Polygonum type); Organization and ultra structure of mature embryo sac.

### **UNIT - V**

Double fertilization and triple fusion. Endosperm and its types - free nuclear, cellular, helobial, endosperm haustoria. Polyembryony - types, apomixis, parthenogenesis and parthenocarpy. Seed structure and its importance.

### **References:**

1. Esau, K. 1985. Anatomy of Seed Plants –John Willey.
2. Cutter, E.G. 1989. Plant Anatomy – Part I – Addison – Wesley Publishing Co..

3. Maheswari, P.1991. An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
4. Swamy, B.G.L and Krishnamoorthy. K.V.1990. From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
5. Bhojwani, S.S and Bhatnagar,S.P. 1987. Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd.,
6. Bhojwani, S.S and Bhatnagar, S.P. 1994. Embryology of Angiosperms, Vikas.
7. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
8. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
9. Fageri, K and Van der Pijl, L. 1979. The Principle of Pollination Ecology. Pergamon Press, Oxford.
10. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
11. Waisel, Y., Eshel, A and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York.
12. Shivanna, K.R and Johri, B.M. 1995. The Angiosperm Polien : Structure and Function. Wiley Eastern Ltd.. New York.
13. Dickison, W.C. 2000. Integrative Plant Anatomy. Harcourt Academic Press, USA.
14. Fahn, A. 1974. Plant Anatomy. Pergmon Press, USA.
15. Mauseth, J.D. 1988. Plant Anatomy. The Benjammin/Cummings Publisher, USA.
16. Evert, R.F. 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. Any local/state/regional flora published by BSI or any other agency.
17. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
18. Vimla Singh and Alok Abhishek. 2019. Plant Embryology and Experimental Biology. Educational Publishers and Distributors. New Delhi.
19. Pandey, B.P.2015. Plant Anatomy S. Chand Publ. New Delhi.
20. Bhatnagar,S.P., Dantu, P.K, Bhojwani, S.S. 2014. The Embryology of Angiosperms 6th edition Vikas Publishing House. Delhi.

21. Swamy, B.G.L and Krishnamurthy,K.V.1980. From flower to fruit .Tata McGraw Hill Co. Pvt. Ltd, New Delhi.

**Web Resources:**

1. [https://www.amazon.in/PLANT-ANATOMY-EMBRYOLOGY-BIOTECHNOLOGY-ebook/dp/B07H5JYFBJ/ref=asc\\_df\\_B07H5JYFBJ/?tag=googleshopdes-2](https://www.amazon.in/PLANT-ANATOMY-EMBRYOLOGY-BIOTECHNOLOGY-ebook/dp/B07H5JYFBJ/ref=asc_df_B07H5JYFBJ/?tag=googleshopdes-2)

2. <https://www.kobo.com/us/en/ebook/a-textbook-of-plant-anatomy>

3. <https://archive.org/details/plantanatomy031773mbp>

4. <https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG>

5. <https://www.worldcat.org/title/embryology-of-angiosperms/oclc/742342811>

6. [https://books.google.co.in/books/about/Embryology\\_of\\_angiosperms.html?id=uYfwAAAAAAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Embryology_of_angiosperms.html?id=uYfwAAAAAAAJ&redir_esc=y).

**BPB-DSC12**

**CORE-XII: CELL BIOLOGY, GENETICS AND PLANT BREEDING**

L	T	P	Cr
6	0	0	5

Learning outcomes:

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

- Identify the concept that explains chemical composition and structure of cell wall and membrane.
- Study the structure and function of cells and explain the development of cells.
- Have conceptual understanding of Law's of inheritance, genetic basis of loci and alleles and their linkage.
- Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
- Develop critical understanding of the chemical basis of genes and their interactions at population and evolutionary levels.
- Develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool.
- Familiarize with the genetic basis of heterosis.
- Reflect upon the role of various non-conventional methods used in crop improvement.

## **UNIT- I**

Plant cell structure and function. Ultra structure of Prokaryotic cell and Eukaryotic cell. Chemistry, structure and function of plant cell wall. Plasma membrane, occurrence, structure. (Fluid mosaic model), chemistry, function and origin. Cell cycle, cell division, mitosis and meiosis and cytokinesis.

## **UNIT- II**

Occurrence, structure, function and origin of Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Mitochondria, Chloroplast and Micro bodies. Semi genetic autonomy of mitochondria and chloroplast. Nucleus, nuclear membrane, chromosomes, euchromatin, heterochromatin, Giant chromosomes - Polytene and Lambrush chromosomes.

## **UNIT- III**

Mendelian genetics – Monohybrid and Dihybrid cross, test cross, back cross, Mendel's Laws. Incomplete dominance - *Mirabilis jalapa*. Interaction of factors – Lethal alleles, Complementary genes, Epistasis (dominant and recessive). Multiple alleles. Polygenic inheritance. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes.

## **UNIT- IV**

Sex determination in plants. Chromosome number and structure. Polyploidy origin, types and significance. Extra nuclear inheritance and its significance. Male sterility in corn. Sex linked inheritance – Haemophilia and colour blindness, Maternal inheritance – Plastid Inheritance in *Mirabilis jalapa*. Population genetics – Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and speciation.

## **UNIT- V**

Principles involved in plant breeding. Plant introduction and acclimatization. Methods of crop improvement: selection (mass, pure line and clonal), hybridization techniques. Heterosis – Interspecific and intergeneric, causes and effects. Mutation in plant breeding, polyploidy in plant breeding and its applications. Breeding for crop improvement for paddy and sugarcane. Biotechnology in crop improvement: Transgenics – scope and limitations; Bt-Cotton.

## **References:**

1. Verma, P.S and V.K. Agarwal. 2002. Cytology. S. Chand & Co. Ltd., New Delhi-55.
2. Gardner, E.J., Simmons, M.J and Snustad, D. 1991. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.

3. Sinnott, EW., Dunn, L.L and Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co. New Delhi.
4. Brown W.V and Bertke. E.M. 1974, A text book of Cytology C.V.Mosley Co.,St. Louis.
5. Cohn.N.S.1979, Elements of Cytology, Freeman Book Co.
6. De Robritis E.D.P and DeRobrities. E.M.F.jr 1987. Cell and Molecular biology Lea and Febiger.
7. De Robertis and De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
8. Gardner, EJ., Simmons, MJ and Snustad, D. 1991. Principles of Genetics, 8th Edn., John Wiley & Sons Inc., New York.
9. Hackett, P.B., Fuchs, J.A and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques: Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.
10. Harris, N and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
11. Cooper, G.M and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C. Sinauer Associates, MA.
12. 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.
13. Klug, W.S., Cummings, M.R., Spencer, C.A. 2009. Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A.
14. Singh, R. J. 2016. Plant Cytogenetics, 3rd Edition. CRC Press, Boca Raton, Florida, USA.
15. Singh, R.J. 2017. Practical Manual on Plant Cytogenetics. CRC Press, Boca Raton, Florida, USA.
16. Lewin. 2007. Gene IX. Jones and Barlett Pub. ISBN. O 7637 52223.
17. Strickberger, M.W. 1999.Genetics.Prentice Hall of India Pvt Ltd, New Delhi.

**Web Resources:**

1. <http://www.freebookcentre.net/Biology/Cell-Biology-Books.html>
2. <https://www.us.elsevierhealth.com/medicine/cell-biology>
3. <https://www.amazon.in/Cell-Biology-Thomas-D-Pollard-ebook/dp/B01M7YAL2A>

4. [http://www.freebookcentre.net/medical\\_text\\_books\\_journals/genetics\\_ebooks\\_online\\_texts\\_download.html](http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html)
5. <https://www.us.elsevierhealth.com/medicine/genetics>
6. <https://libguides.uthsc.edu/genetics/ebooks>
7. <https://www.kobo.com/us/en/ebook/principles-of-plant-genetics-and-breeding>
8. <http://sharebooks.com/content/plant-breeding-ebooks-raoul-robinson>.

### **BPB-DSC13**

## **CORE-XIII: PLANT ANATOMY AND EMBRYOLOGY AND CELL BIOLOGY, GENETICS AND PLANT BREEDING- PRACTICAL-VI**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

Learning outcomes:

- On completion of this course, the students will be able to:
- To understand the mitotic cell division.
- To understand the various cells and tissue system in plants.
- To understand how reproduction plays a significant role in defining population structure, natural diversity and sustainability of ecosystem in a better way in plants.
- Modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation are the basic learning.
- To understand the experimental steps and methods involved in generating new varieties using classical and contemporary breeding practices

### **Anatomy**

1. Study of simple and complex (Primary and Secondary) tissues by maceration.
2. Study the internal structure of primary (young) and secondary (old) stems. Internal structure of dicot and monocot stem. Internal structure of dicot and monocot root.
3. Anomalous secondary growth in the stems of Boerhaavia, Nycthanthes and Dracaena.
4. T.S of dicot and monocot leaves.
5. Study of stomatal types.

### **Embryology**

1. T.S of (young and mature) anther (section from Datura or Cassia flower).
2. Observation of pollinia (slide only).

3. Types of ovules- Anatropous, Orthotropous, Circinotropous, Amphitropous, Campylotropous (Permanent slides).
4. Types of Endosperm - Nuclear, cellular and helobial.
5. Dissection and display of any two stages of embryo in Tridax.

### **Cell biology**

1. Study of the photomicrographs of cell organelles.
2. Ergastic substances - starch grains, aleurone grains, crystals – cystolith and raphide.
3. Study the polytene and lamp brush chromosome structure through photograph.
4. Identification of different stages of mitosis by using squash and smear techniques – Onion root tip.

### **Genetics**

1. Genetic problems – test cross, back cross and allelic interaction.
2. Construction of chromosome map – three point test cross
3. Multiple alleles problems.

### **Plant Breeding**

1. Emasculation technique.
2. To test the viability of seeds using Tetrazolium chloride.
3. Genetic models of heterosis.
4. Phenotype of heterosis (Maize).

## **BPB-DSC14**

### **CORE-XIV: PLANT ECOLOGY AND PHYTOGEOGRAPHY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

#### Learning outcomes

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

Understand core concepts of biotic and abiotic.

Classify the soils on the basis of physical, chemical and biological components.

Analysis the phytogeography or phytogeographical division of India.

Evaluate energy sources of ecological system.

Assess the adaptation of plants in relation to light, temperature, water, wind and fire.

Conduct experiments using skills appropriate to subdivisions.

## **UNIT - I**

Basic concepts, Abiotic and biotic components and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rainfall and fire. Plant succession – primary and secondary – xerosere, hydrosere. Ecological adaptation in hydrophytes, xerophytes, mesophytes and halophytes.

## **UNIT - II**

Structure, trophic organization; food chains and food web, energy flow in an ecosystem. Types of Ecosystems: pond, forest and grassland. Ecological pyramids and Biogeochemical cycles of carbon and nitrogen and phosphorus.

## **UNIT - III**

Biodiversity: Ecosystem/community, species and genetic diversity. Endemism and hotspots, Natural resources and its conservation (In situ and ex situ).

## **UNIT- IV**

Pollution: Types of pollution: Primary and secondary and their impacts: Air - Green house effect, global warming, ozone depletion, acid rain, Water, soil-causes and consequences. Remedial measures – Green building. Disaster management.

## **UNIT - V**

Phytogeography: principles - vegetation types of India – tropical evergreen forest, deciduous forest, mangrove vegetation and scrub jungle. Vegetation types of Tamilnadu.

## **References:**

1. Odum, E.P. 2005. Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. 2010. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kumar, H.D. 1990. Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
6. Krishna Iyer, V.R. 1992. Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,



7. Shukla, R.S and Chandel,PS.1990. Plant Ecology, S.Chand & Co. Pvt. Ltd.,
8. Smith,W.H. 1981. Air pollution and forest : Interactions between air contaminants and forest ecosystems.
9. Vickery, M.L. 1984. Ecology of Tropical plants, John Wiley and Sons.
10. Krishnamurthy, K.V. 2003. An advanced text book on Biodiversity - Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
12. Asthana, D.K and Meera Asthana. 2006. A text book of Environmental studies. S.Chand and Company Ltd. New Delhi.
13. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
14. IUCN. 1985. The World Conservation Strategy, IUCN, Switzerland.
15. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publications.
16. Ambasht, R.S. 2017. A textbook of plant ecology 15ed (pb 2019). CBS Publishers Distributors.

**Web Resources:**

1. <https://www.kobo.com/us/en/ebook/plant-ecology-3>.
2. <https://www.worldcat.org/title/plant-ecology/oclc/613206385>
3. [https://books.google.co.in/books/about/Plant\\_Ecology.html?](https://books.google.co.in/books/about/Plant_Ecology.html?)
4. <https://www.kopykitab.com/Plant-Ecology-by-Agrawal-AK-And-Deo-PP>
5. <http://www.freebookcentre.net/Biology/Ecology-Books.html>
6. <https://www.amazon.in/Plant-Ecology-Ernst-Detlef-Schulze/dp/354020833X>
7. <https://www.tandfonline.com/toc/tped20/current> (Plant Ecology and Diversity)
8. <https://link.springer.com/journal/11258> (Plant Ecology).

**BPB-DSC15**

**CORE-XV: PLANT BIOTECHNOLOGY AND MOLECULAR BIOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

Learning outcomes:

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

- Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.

- Develop their competency on different types of plant tissue culture.
- Assess the enzymes and vectors for genetic manipulations.
- Examine gene cloning and evaluate different methods of gene transfer.
- Critically analyze the major concerns and applications of transgenic technology.
- Differentiate the main types of prokaryotes through their grouping abilities and their characteristics.
- Evaluate the experiments establishing central dogma and genetic code.
- Gain an understanding of various steps in transcription, protein synthesis and protein modification.

### **UNIT - I**

Biotechnology – definition, history and scope. Application of plant biotechnology in various fields. Agriculture - Biofertilizers, Biopesticides. Medicine – Antibiotics (Penicillin) Recombinant vaccines, insulin and interferons. Environment – Bioremediation and Biofuel. Industry – ethanol production (yeast), citric acid production (*Aspergillus niger*) and Proteases production (*Bacillus* sps).

### **UNIT - II**

Plant tissue culture - introduction, scope and importance, concept of totipotency, aseptic techniques in plant tissue culture. Composition of media, types of media, sterilization, explant preparation and inoculation. Callus induction and micropropagation. Application of plant tissue culture in agriculture, horticulture and forestry. Synthetic seed technology.

### **UNIT - III**

Vectors; plasmid, bacteriophage, viral vectors, cosmids. Restriction enzymes. Recombinant DNA technology, gene transfer – indirect method, *Agrobacterium* mediated gene transfer. Direct method – Biolistic method. Development of transgenic plants with reference to insect resistance, Pros and cons of GM food.

### **UNIT - IV**

Nature and function of genetic materials, Nucleic acid – base pairing – Chargaff's rule, DNA – structure. Types, denaturation - renaturation. Replication of DNA in prokaryotes. RNA structure and types. DNA repair mechanism.

### **UNIT - V**

Transcription – Enzymology – RNA polymerase – classes of RNA molecules – transcription in

prokaryotes. Protein synthesis – Genetic code – characters – codons and anticodons. Gene regulation in Prokaryotes – lac operon and trp operon.

**References:**

1. Bernard R Glick and Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Jogdand, SN. 1997. Gene biotechnology, Himalaya Publishing House, New Delhi.
3. Ernst L. Winnaccker. 2002. From Genes to Clones-introduction to gene technology, VCR Pub., Weintein.
4. James, D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
5. Maniatis and Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III, Coldspring Harbor Laboratory Press, New York.
6. Old, RW and Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.
7. Purohit, S.S. 2010. Plant tissue culture, Student edition, Jodhpur.
8. Bajaj, Y.P.S. 1987. Biotechnology in agriculture and forestry. Springer – Verlag
9. Halder, T and Gadgil, V.N.1981. Plant cell culture in crop improvement. Plenum, New York.
10. Neuman, K.H., Barz, W and E. Reinhard. 1985. Primary and secondary metabolism of plant cell cultures – Springer – Verlag, Berlin.
11. Barz, W., Reinhard, E and Zenk, M.H. 1977. Plant tissue culture and its biotechnology application – Springer – Verlag, Berlin.
12. Hu, C.Y and P.J.Wang. 1984. Handbook of plant cell culture Vol.1. Mac millan, New York.
13. Bhajwani, S and Razdan, 1984. Plant tissue culture. Theory and practice.
14. Sant Saran Bhojwani, Prem Kumar Dantu. 2013. Plant Tissue Culture: An Introductory Text. Springer.
15. Verma P.S and Agarwal V.K. 2010. . Molecular Biology. S Chand Publishers.
16. Ignacimuthu, S.J. 2003. Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
17. Bhojwani, S.S and Razdan, M.K. 2004. Plant Tissue Culture, Read Elsevier India Pvt. Ltd.
18. Hammond, J.C. McGarvey and V. Yusibov. 2009. Plant Biotechnology, Springer Verlag. New York.

**Web Resources:**

1. <http://www.freebookcentre.net/Biology/BioTechnology-Books.html>
2. [https://books.google.co.in/books/about/Introduction\\_to\\_Plant\\_Biotechnology.html?id=RgQLISN8zT8C](https://books.google.co.in/books/about/Introduction_to_Plant_Biotechnology.html?id=RgQLISN8zT8C)
3. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>
4. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>
5. <https://www.worldcat.org/title/molecular-biology/oclc/1062496183>
6. <http://www.freebookcentre.net/Biology/Molecular-Biology-Books.html>
7. <https://www.amazon.in/Molecular-Biology-Multicolour-Verma-Agarwal-ebook/dp/B06XKVVWT3>

**BPB-DSC16****CORE-XVI: PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>5</b>	<b>0</b>	<b>0</b>	<b>5</b>

## Learning outcomes

- On completion of this course, the students will be able to:
- Understand water relation of plants with respect to various physiological phenomenon.
- Explain properties of nutrients and their deficiency symptoms in plants.
- Classify aerobic and anaerobic respiration.
- Explain the process and significance of photosynthesis and respiration.
- Understand the phenomenon of dormancy and germination in plants.
- Classify the enzymes and explain their structure and mechanism of action.

**UNIT - I**

Water relations: Properties of water—imbibition, diffusion, osmosis and plasmolysis-, ascent of sap, mechanism of water absorption – active and passive, apoplast and symplast pathway. Transpiration – types and factors affecting transpiration and significance. Opening and closing of stomata- mechanisms and theories of transpiration.

**UNIT - II**

Photosynthesis: Radiant energy, Photosynthetic unit, photosynthetic pigments and their role, photo systems, path of carbon in photosynthesis - Light reaction, electron transport system in the chloroplast (Z-Scheme). Dark reaction - C<sub>3</sub> cycle, C<sub>4</sub> cycle, CAM pathway, Photorespiration.

### **UNIT - III**

#### Respiration

Aerobic, Glycolysis, Krebs Cycle, Electron Transport System, oxidative phosphorylation, respiratory quotient, Anaerobic- fermentation - Respiratory quotient.

Nitrogen metabolism, Biological nitrogen fixation, nitrogen cycle.

### **UNIT - IV**

Growth: Growth – plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscisic acid) - Practical applications - Photo morphogenesis – photoperiodism – vernalization – dormancy- phytochromes.

Stress Physiology: Concepts of plant responses to stresses (water, salt, temperature).

### **UNIT - V**

Plant Biochemistry: Classification, properties and biological role of carbohydrates, proteins, lipids and nucleic acids. Enzyme – properties – classification – nomenclature of enzymes – mode of enzyme action – factors influencing enzyme action.

#### **References:**

1. Buchanan, B.B., Gruissem, W and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A and Libbenga, K.R. (eds). 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, New York, USA.
7. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
8. Salisbury, F.B and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.

9. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D and Govindjee. 1999. Concepts in Photobiology: Photosynthesis and Photo morphogenesis. Narosa Publishing House, New Delhi.
10. Taiz, L and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
11. Thomas, B and Vince-Prue, D. 1997. Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.
12. Westhoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK. Jain, JL. 1979. Fundamentals of Biochemistry, Chand & Co. Ltd., New Delhi.
13. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
14. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.
15. Conn, E and Stumpf, PK. 1979. Outline of Biochemistry Niley Easdtern Ltd., New Delhi.
16. Metz, E.T. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay.
17. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi.
18. Pandey, SN and Sinha, BK. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi.
19. Robert M. Devlin. 1970. Plant Physiology, East West Press, New Delhi.
20. Verma, V. 2008. Textbook of plant Physiology, Ane's student edition, New Delhi.

**Web Resources:**

1. <https://www.kobo.com/us/en/ebook/biochemistry-and-molecular-biology-of-plants>
2. <https://www.amazon.in/Plant-Biochemistry-Hans-Walter-Heldt-ebook/dp/B004FV4RS6>
3. <https://www.kobo.com/us/en/ebook/plant-biochemistry>
4. <https://www.kobo.com/us/en/ebook/a-textbook-of-plant-physiology-1>
5. <https://www.amazon.in/Advances-Plant-Physiology-P-Trivedi-ebook/dp/B01JP5L0YA>
6. <https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692>
7. <https://www.amazon.com/Introduction-Plant-Physiology-William-Hopkins-ebook/dp/B006R6I850>.

**BPB-DSC17**

**CORE-XVII: PLANT ECOLOGY AND PHYTOGEOGRAPHY AND  
PLANT BIOTECHNOLOGY AND MOLECULAR BIOLOGY  
& PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY-**

## PRACTICAL-VII

L	T	P	Cr
0	0	6	2

Learning outcomes:

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

1. To study the effect of various physical factors on photosynthesis.
2. To estimate the quantity and activity of various enzymes.
3. To study the principle and concepts of Phytogeography
4. To develop protocols for plant tissue culture and synthetic seed production

### **Plant Ecology and Phytogeography**

1. Study of morphological and anatomical adaptations of locally available hydrophytes, xerophytes, mesophytes and halophytes and correlate to their particular habitats.

Hydrophytes : Nymphaea, Hydrilla

Xerophytes : Nerium, Casuarina

Mesophytes : Tridax, Vernonia

Halophytes : Avicennia, Rhizophora

2. Map of the phytogeographical regions of India.
3. Quadrant study and line transect.
4. Plan for a green building.
5. Field trip to any one scrub jungle or wetland (Guindy National park/Nanmangalam Scrub jungle/Pallikaranai Marsh/Siruthavur Scrub/Vedanthangal Bird Sanctuary/Kelampakkam Marsh/Adyar Poonga).

### **Plant Biotechnology and Molecular Biology and Plant Physiology and Plant Biochemistry**

Plant Biotechnology - Demonstration

1. Sterilization techniques in plant tissue culture.
2. MS - Media preparation.
3. Explant sterilization, Callus induction, Plantlet, hardening.

### **Molecular Biology – Photographs**

1. DNA Structure
2. tRNA
3. DNA – Replication

4. DNA – Repair

5. Genetic code

### **Plant Physiology and Plant Biochemistry**

1. Determination of water potential by plasmolytic method.

2. Effect of chemicals on membrane permeability.

3. Effect of environmental factors on rate of transpiration by gravimetric method.

4. Separation of plant pigments by paper chromatography.

5. Study the rate of photosynthesis under different light intensities by using Willmott's bubble counter.

6. Study of rate of photosynthesis under different wavelengths (red & blue) of light.

7. Comparison of rate of respiration of different respiratory substrates.

8. Measurement of pH of expressed cell sap and different soils using pH meter.

9. Enzyme activity – catalase.

10. Biochemical test for carbohydrates, proteins and lipids.

### **Demonstration – Experiments**

1. Study the rate of transpiration by using Ganong's photometer

2. Demonstration of stomatal movement.

3. Induction of roots in leaves by auxins.