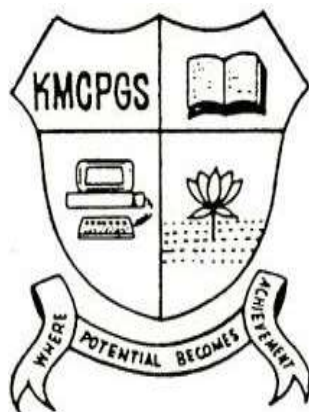


**Government of Puducherry**  
**DEPARTMENT OF BOTANY**  
**KANCHI MAMUNIVAR GOVT. INSTITUTE FOR POSTGRADUATE**  
**STUDIES AND RESEARCH**  
(An autonomous college with potential for excellence and accredited by NAAC 'B++' Grade)  
**LAWSPET, PUDUCHERRY – 605 008**  
**TEL: 0413-2251687**



## **CBCS-SYLLABUS**

### **BOTANY**

**M.Sc. (PLANT BIOLOGY AND BIOTECHNOLOGY)**

**(For Semester I - IV)**

**EFFECT FROM 2019-2020**

**SCHEME for M. Sc. Plant Biology & Biotechnology course offered under CBCS (2019-20)**

Semester	Code	Title of Paper	Hours/ Week (30)	Credits	Total Credits
S-1	PBHT101	MICROBIOLOGY AND PLANT PATHOLOGY	4	3	18
	PBHT102	PHYCOLOGY, MYCOLOGY AND BRYOLOGY	4	3	
	PBHT103	PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY	4	3	
	PBHT104	PLANT ECOLOGY	4	3	
	PBHP105	PRACTICAL-I	10	3	
	<b>PBSC106</b>	<b>SOFT CORE: Internal MICROBIAL BIOTECHNOLOGY</b>	<b>4</b>	<b>3</b>	
S-2	PBHT207	COMPUTER APPLICATIONS IN BIOLOGY AND BIostatISTICS	4	3	18
	PBHT208	PLANT ANATOMY AND EMBRYOLOGY	4	3	
	PBHT209	NANOBIOTECHNOLOGY	4	3	
	PBHT210	BIOINSTRUMENTATION	4	3	
	PBHP211	PRACTICAL-II	10	3	
	<b>PBSC212</b>	<b>SOFT CORE: External MEDICINAL BOTANY</b>	<b>4</b>	<b>3</b>	
S-3	PBHT313	ANGIOSPERM SYSTEMATICS AND ECONOMIC BOTANY	4	3	18
	PBHT314	GENETICS, PLANT BREEDING AND EVOLUTION	4	3	
	PBHT315	CELL AND MOLECULAR BIOLOGY	4	3	
	PBHT316	GENE TECHNOLOGY	4	3	
	PBHP317	PRACTICAL-III	10	3	
	<b>PBSC318</b>	<b>SOFT CORE: Internal MEDICINAL BOTANY</b>	<b>4</b>	<b>3</b>	
S-4	PBHT419	BIOCHEMISTRY AND PLANT PHYSIOLOGY	4	3	18
	PBHT420	PLANT BIOTECHNOLOGY	4	3	
	PBHP421	PRACTICAL-IV	8	3	
	PBPW422	PROJECT WORK	10	4	
	PBPV423	PROJECT VIVA	-	2	
	<b>PBSC424</b>	<b>SOFT CORE: External MUSHROOM CULTIVATION</b>	<b>4</b>	<b>3</b>	
		<b>Hard Core 17 x 3 = 51</b>			72
		<b>Soft core 07 x 3 = 21</b>			

**Soft core subjects offered to other Departments:**

**1. Medicinal Botany, 2) Mushroom Cultivation**

## **SEMESTER –I**

### **HARD CORE COURSE I**

#### **PBHT 101- Microbiology and Plant Pathology**

##### **Unit – I**

History and Scope of Microbial Diversity; General accounts of Bacteria, Cyanobacteria, Viruses, Mycoplasma, Protozoa and Fungi; Methods of sterilization; Culture and staining techniques; Preservation of microbes. Identification and classification of Bacteria and Fungi. Classification of Bacteria- Bergey's Manual.

##### **Unit – II**

Microbial Nutrition: nutritional types- autotrophy, heterotrophy-Growth of Bacteria- Growth cycle- Archaea and types, Cultural characteristics of bacteria and fungi. Bacteriological and Fungal Media. Microbial fermentation, Generation time production of Antibiotics, organic acids and vitamins; General design and applications of a Biofermentor. Nitrogen fixation – Symbiotic, non symbiotic.

##### **Unit – III**

Microbial Genetics: Mechanism of gene transfer -Vertical and horizontal gene transfer, homologous recombination. Conjugation - Types; transformation; Transduction – Types, Lysogeny and lytic cycle in bacteriophages.

##### **Unit – IV**

Plant diseases: Distribution, disease cycle, symptoms and control measures of Bacterial diseases (Citrus canker, BLB of Paddy), Viral diseases (TMV, YMV), Fungal diseases (Red rot of sugarcane, Tikka disease) and Mycoplasma disease (Little leaf of Brinjal).

##### **Unit –V**

Host parasite interaction in Plants: Recognition and entry processes of different pathogens, defence mechanism- molecular and morphological changes. Integrated Pest management. Antagonism, Biological control, Bioformulations and application Biopesticides.

##### **Practicals:**

1. Preparation of culture media – sterilization techniques- Plating technique.
2. Isolation of bacteria and fungi from air, water and soil.
3. Staining techniques (Gram staining, Negative Staining and Capsule Staining).
4. Wet mounts (hanging drop) method.

5. Estimation of acidity in milk.
6. MPN analysis of different water bodies.
7. Isolation of genomic and Plasmid DNA from fungi and bacteria.
8. Isolation and culture of *Trichoderma* and *Bacillus sp.*
10. Industrial visit to waste water treatment plant, dairy, food industry.
11. Study on Tikka disease/Red rot
12. Study on Citrus canker/BLB
13. Little leaf of brinjal.

**TEXT BOOKS:**

1. Ananthanarayan and Paniker. 2017. Textbook of Microbiology. University Press.
2. Bilgrami. K. S. and Dube, H. C. 1976. A Text Book of Modern Pathology. Vikas Publications, New Delhi.
3. Darwin Henry. 2008. Illustrated Plant Pathology, New India Publishing Agency
4. Dubey, R. C. and Maheswari, D. K. 1999. A Text Book of Microbiology, S. Chand & Company Ltd., New Delhi
5. Mehrothra, R. S. and Ashok Agarwal. 2010. Plant Pathology. Tata Mc Graw Publishing Co. New Delhi.
6. Pelczar M. J., Reid, R. D., and Chan, E. C. S. 1983. Microbiology, Tata Mc Graw Hill Publishing Co. New Delhi.
7. Prescott, L.M., J.P. Harley, and D.A. Klein. 2002. Microbiology, McGraw -Hill Publishing Company, New Delhi.
8. Rangasamy, C. Diseases of Crop Plants of India, Prentice-Hall, 1972.
9. Sanjeev Singh. 2016 Plant Pathogens and Principles of Plant Pathology. New India Publishing Agency, New Delhi
10. Sanjeev Singh. 2016. Plant Pathogens and Principles of Plant Pathology. New India Publishing Agency, New Delhi
11. Sullia, S. B. and shantharam, S. 1998. General Microbiology, Oxford & IBH Publishing Co. Pvt Ltd., New Delhi.

## REFERENCE BOOKS:

1. Agrios, G. N. 1978. Plant Pathology, 2<sup>nd</sup> Ed. Academic Press, New York.
2. Aneja K R. 1993. Experiments in Microbiology, Plant pathology and Tissue culture. Wishwa Prakashan, Wiley Eastern Ltd., New Delhi.
3. Brock biology of microorganisms. Details to be added
4. Christophe Lacomme. 2015. Plant Pathology : Techniques and Protocols. Humana Press Inc.
5. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Derek Weber, Warner Bair. 2018. Microbiology: An Introduction. Pearson.
6. Gerard J. Tortora. 2006. Microbiology: An Introduction. Benjamin-Cummings Publishing Company
7. Jacquelyn G. Black. 2004. Microbiology: Principles and Explorations. Wiley
8. Lippincott's Illustrated Reviews: Microbiology. 2012. Kluwar Academic Press
9. Marjorie Kelly Cowan. 2011. Microbiology: A Systems Approach. McGraw-Hill
10. Matthew Dickinson. 2003. Molecular Plant Pathology. Garland Science Press, London, England, United Kingdom
11. Reed, G. 1986. General Microbiology (6<sup>th</sup> Ed), Cambridge University Press, Cambridge.
12. Stainer, R. Y., Ingraham, J. I., Wheelis M. L. and Painter, P.R. 1986. General Microbiology (5<sup>th</sup> Ed.), Macmillan Press Ltd., London, pp.689.
13. Steindraus, K. H. (Ed) 1983. Hand Book of Indigenous Fermented Food, Parcel Dekker Inc., New York.
14. Thomas D. Brock, Michael T. Madigan, John M. Martinko. 2005. Brock Biology of Microorganisms. Benjamin-Cummings Publishing Company.
15. Tomos Webb. 2017. Plant Pathology. Larsen and Keller Education
16. Tortora, G. J., Funke, B. R. and Case, C.L 1995, Microbiology- An Introduction ( 5<sup>th</sup> Ed.), The Benjamin/ Cummings Publishing Company Inc., Redwood city, California, U. S. A., pp.801.

**SEMESTER-I**  
**HARD CORE COURSE II**  
**PBHT 102 -Phycology, Mycology and Bryology**

**Unit-I**

General characters of Algae. Classification of Algae- Fritsch (1935) classification, Criteria for algal classification. Cell structure, EM studies of algal cell, cell wall, flagella, chloroplast, pyrenoid, eye spot, pigments- their importance in classification. General account of thallus structure, reproduction, relationship and life cycle of important groups- Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae, Charophyceae

**Unit-II**

Economic importance of algae: Algal Biofertilizers and its role in soil fertility, algae in industry (Bio-fuel and Bio-pigments), algae as food and medicine. biological importance of phytoplanktons and water blooms, Diatomaceous earth.

**Unit-III**

General characters of fungi. Classification of fungi. Alexopolous, Mims and Blackwell(1996), ultra structure of cell, unicellular, multicellular organization, hyphal growth, cell wall composition, nutrition (saprophyte, biotrophic, symbiotic, predaceous), reproduction, heterothallism, parasexuality. General account of Myxomycota, Mastigomycota, Zygomycota, Ascomycota, Basidiomycota and Mitosporic fungi. Kinds of spores and their dispersal.

**Unit-IV**

Economic importance of fungi. Decomposition of organic matter, coprophilous fungi, lignin degrading fungi, degradation of pesticides. Role of fungi as symbionts- Lichens, Mycorrhiza- ectotrophic, orchidaceous and Ericoid mycorrhiza- their distribution and significance, Fungal Endophytes. Edible fungi.

**Unit-V**

Classification of Bryophytes- by Proskauer (1957). General account of major groups of bryophytes (Hepaticopsida, Anthoceanopsida and Bryopsida). Origin of Bryophytes. Range of thallus structure, evolution of gametophytes and sporophytes. Reproduction and life cycle. Ecological and economic importance of bryophytes

### **Practicals:**

1. Collection and study of algae:  
*Spirulina, Anabaena, Hydrodictyon, Chlorella, Enteromorpha, Closterium, Zygnema, Nitella/Chara Pinnularia, Padina, Gracilaria. Gelidium, Sargassum*  
Culture of some important algae
2. Study of the morphological characteristics and reproductive structure:  
*Albugo, Peronospora, Rhizopus, Penicillium, Alternaria, Lycoperdon, Ganoderma, Peziza, Curvularia, Aspergillus, Puccinia, Colletotrichum, Mucor*
3. Study of the morphological characteristics and reproductive structure:  
*Riccia, Marchantia, Lunularia, Anthoceros, Funaria, Sphagnum*
4. Field visit to study the diversity of Algae, Fungi and Bryophytes (Preparation & submission of tour report).

### **TEXT BOOKS**

1. Dube H.C. 2012. An Introduction to Fungi. Scientific Publishers
2. Dubey H.C. 2005. An Introduction to Fungi, (3<sup>rd</sup> Ed), Vikas Publishing House P.Ltd., New Delhi.
3. Fritch EF. 1935. The Structure and Reproduction of Algae. Tata McGraw Hill. New Delhi.
4. Kumar, H.D. 1989. Introductory Phycology- East-West press, New Delhi.
5. Sambamurthy A. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd
6. Sharma O P. 2002. Text book of Fungi (9<sup>th</sup> Ed), Tata McGraw-Hill Publishing Co Ltd., Delhi.
7. Sharma, O.P. 1986. Text book of Algae- TATA McGraw-Hill New Delhi.
8. Singh V, Pande P C and Jain D K. 2008-09. A Text Book of Botany, Rastogi Publication, Meerut.
9. Smith GM 1971. Cryptogamic Botany Vol. I & II Tata McGraw Hill, New Delhi.
10. Vashishta B R and Sinha A K. 2007. Botany for Degree student-Bryophyta S Chand & Company Ltd., New Delhi

11. Vasishtha B R , Sinha A K and Singh V P. 2007, Botany for degree students-Algae (5<sup>th</sup> Ed), S. Chand & Co. Ltd., New Delhi

### **REFERENCE BOOKS:**

#### **Phycology:**

1. Ahluwalia Amrik Singh. 2003. Phycology: Principles, Processes And Applications. Daya Publishing House
2. Bold HC and Wynne MJ. 1985. Introduction to Algae- Structure and reproduction.
3. Chapman VJ and Chapman. 1973. The Algae. ELBS and Macmillan, London.
4. Ian Morris. 1967. -An introduction to the Algae, Hutchinson Press, London.
5. James E. Graham, Lee W. Wilcox, Linda E. Graham. 2008. Algae. Pearson Prentice Hall, New Jersey.
6. Prescott GW. 1969. The Algae: A Review. Nelson.
7. Robert Edward Lee. 2018. Phycology. Cambridge University Press
8. South G. R. 2012. An Introduction to Phycology. John Wiley and Sons Ltd.

#### **Mycology**

1. Alexopolous CJ and Mims CW. 1979. Introductory Mycology. Wiley Eastern Ltd, New
2. Bessey EA. 1971. Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt Ltd,
3. Bold H.C. & others. 1980. – Morphology of Plants & Fungi – Harper & Row Public, New Delhi.
4. Burnet JH. 1971. Fundamentals of Mycology. ELBS Publications, London
5. Dorian Snyder. 2019. Introductory Mycology. Larsen & Keller Educ.
6. Frederic Edward Clements. 2018. The Genera of Fungi. Forgotten Books
7. Gwynne-Vaughan B. 2018. Fungi. Biotech Books
8. John Webster, Roland W. S. Weber. 2007. Introduction to Fungi. Cambridge University Press
9. Marcela C. Pagano. 2016. Recent Advances on Mycorrhizal Fungi (Fungal Biology). Springer
10. Michael J. Carlile, Sarah C. Watkinson. 2000. The Fungi. Academic Press New Delhi.



## **Bryology**

1. Andrew J Wood M J Oliver and David J Cove 2009. New Frontiers in Bryology. Springer-Verlag New York Inc.
2. Prem Puri 1973. Bryophytes- A Broad Perspective, Atma Ram & Sons, New Delhi.
3. Rejila S 2014. Bryophytes. LAP Lambert Academic Publishing
4. Schofield W. B. 2010. Introduction to Bryology. The Blackburn Press
5. Watson EV 1971. The structure and life of Bryophytes. Hutchinsons publications, London

## SEMESTER-I

### HARD CORE COURSE III

#### PBHT 103- Pteridophytes, Gymnosperms and Palaeobotany

##### Unit 1

Origin of land flora, colonization in terrestrial environment, Evolutionary trends in stelar organization and soral organization – Vegetative propagation – apogamy; apospory; embryogeny; homospority and heterospority – seed habit and seed evolution – Life cycle pattern.

##### Unit II

General characteristic features of Pteridophytes and Classification up to order level (Smith 1955) – Study of vegetative and reproductive characters :Psilophytales, Psilotales, Lycopodiales, Selaginellales, Isoetales and Filicales.

##### Unit III

General characteristic features of Gymnosperms and Classification up to order level (Sporne 1965) – Study of vegetative and reproductive characters of plants belonging to following orders: Cycadales, Coniferales, Taxales, Ginkgoales and Gnetales.

##### Unit IV

Fossilization and types of fossils – changes in organic and vegetation profile through the ages (geological time scale), Palaeopalynology and Carbon dating. Contributions of Indian Paleontologist - Birbal Sahni.

##### Unit V

A detailed study of the following fossils: *Psilophyton*, *Lepidodendron*, *Heterangium*, *Lagenostoma*, *Lyginopteris* and *Cordaites*.

##### Practicals

1. Study of morphology and anatomy of vegetative and reproductive characters using whole mount preparations, dissections and sections of the following plants:  
*Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum*      *Marsilea*, *Cycas*, *Pinus*,  
*Ephedra*, *Gnetum*, *Ginkgo*, *Lepidodendron*, *Cordaites*. *Lagenostoma*, *Heterangium*  
Types of fossils (Impression, Compression, Petrification)
2. A field trip to places of botanical interest to familiarize the students with different types of vegetation and fossils.

### **TEXT BOOKS:**

1. Gangulee H C and Kar A K. 1993. New Print. College Botany Vol II. New Central Book Agency, Kollatta.
2. Parihar N. S. 2019. An Introduction to Embryophyta Pteridophytes. Surjeet Publication
3. Sambamurthy A. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd
4. Sharma O.P. 2008. Pteridophyta. McGrawhill
5. Stewart. 2005. Paleobotany and the Evolution of Plants. Cambridge University Press
6. Vasistha P C, Sinha A K and Anil Kumar 2009. Botany for Degree students- Pteridophyta. Chand S & Company Ltd., New Delhi
7. Vasistha P C, Sinha A K and Anil Kumar 2009. Botany for Degree students- Gymnosperm. S Chand & Company Ltd., New Delhi.
8. Veer Bala Rastogi 2017. Organic Evolution (Evolutionary Biology). Medtech

### **REFERENCE BOOKS:**

1. Andrews, H.N. 1961. Studies in Palaeobotany. John Wiley & Sons, New York.
2. Arnold, C.A. 1947. An introduction to Palaeobotany. McGraw-Hill, New York, London.
3. Bierhost, D.W. 1947. Morphology of Vascular Plants. The MacMillan, New York, London.
4. Bower, F.O. 1908. The Origin of Land flora. The MacMillan, New York, London.
5. Chamberlain, C.J. 1934. Gymnosperms – Structure and Evolution, Chicago.
6. Coulter, J.M. and Chamberlain, C.J. 1917. Morphology of Gymnosperms, Chicago.
7. Deevoryas, T. 1962. Morphology and evolution of fossil plants. Holt, Rinehart & Winston, New York.
8. Eames, A.J. 1936. Morphology of Vascular Plants – Lower groups. McGraw Hill, New York, London.
9. Smith, G.M. 1955. Cryptogamic Botany Vol.II McGraw-Hill, New York, London.
10. Sporne, K.R. 1962. The Morphology of Pteridophytes Hutchinson University Library, London.
10. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson Univ. Library, London.

11. Sporne K. R. 2018. *The Morphology of Pteridophytes; The Structure of Ferns and Allied Plants (New Edition)*. Franklin Classics
12. Watson, J. 1953. *An Introduction to the study of fossil plants*, London.

**SEMESTER- I**  
**HARD CORE COURSE IV**  
**PBHT 104-Plant Ecology**

**Unit I**

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Habitat and Niche: Concept of habitat and Niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

**Unit II**

Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

**Unit III**

Ecosystem Ecology: Ecosystem structure; ecosystem function. Energy flow and mineral cycling (C.N.P.); primary production and decomposition; structure and functions of ecosystems; terrestrial (forest, grassland) and aquatic (fresh water, marine and eustarine). Environmental pollution, global environmental change.

**Unit IV**

Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies; concept of metapopulation- demes and dispersal, interdemec extinctions, age structured populations.

**Unit V**

Biodiversity and Conservation : Principles of conservation, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves). Biodiversity: status, monitoring and documentation, major drives of biodiversity change;

Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

### **Practicals**

1. Qualitative and quantitative analysis of vegetation.
2. Anatomical adaptation.
3. Analysis of soil samples (pH, EC, organic Carbon).
4. Analysis of water samples (pH, dissolved Oxygen).
5. Visit to places of ecological importance, submit a report (12 pages)

### **TEXT BOOKS:**

1. Jonathan Turk and Amos Turk. 1984. Environmental Science IIIrd Ed, CBS College Publishing, USA.
2. Madhab Chandra Dash and Satya Prakash Dash, 2009. Fundamental of Ecology IIIrd Ed, McGraw Hill Publishing Company Ltd, New Delhi.
3. Michael J. Crawley. 2013. Plant Ecology. Wiley India Pvt Ltd. Shukla R.S. Chandel P.S. 2010. Ecology and Utility of Plant. S Chand and company
4. Prithipal Singh. 2010. An Introduction of Biodiversity. Ane Books Pvt. Ltd., New Delhi.
5. Subrahmaniam N S & Sambamurthy A.V.S.S., 2006. Ecology. II Ed, Narosa Publishing House Pvt. Ltd. New Delhi, India
6. Trivedi R N, 2001. A textbook of Environmental Sciences, Anmol Publications Pvt. Ltd. New Delhi.

### **REFERENCE BOOKS:**

1. Agarwal Kd. 2001. Environmental Biology. Nidhi Publications. Bikaner.
2. Chapman and Rees. 1988. Ecology, Principles and Applications, Cambridge University Press, UK.
3. Clive Koelling. 2016. Functional Plant Ecology. Syrawood Publishing House
4. Clive Koelling. 2017. Plant Ecology: Systems and Processes. Callisto Reference
5. Jadhav and Bhosale 1995. Environmental Protection and Laws. Himalaya Pub. House, New Delhi.
6. Jude Boucher. 2010. Plant Ecology: Concepts and Applications. Syrawood Publishing House
7. Keddy Paul A. 2017. Plant Ecology. Cambridge University Press

8. Lydia Cervantes. 2010. Plant Ecology. Apple Academic Press Inc.
9. Miller TG. Environmental Science, Wadsworth Publishing Co.
10. Odum, EP. 1971. Fundamentals of Ecology, Saunders, Philadelphia.
11. Trivedi and Goel. Introduction to air pollution. Techno-Science Publication.
12. Wanger. Environmental Management. W.B. Saunders Co. Philadelphia.

## SEMESTER-I

### SOFT CORE I

#### PBSC 106-Microbial Biotechnology

##### Unit- I

**Fermentation process:** Fermentation media; inoculum preparations; scale up of fermentation, submerged and solid state fermentation; multiple fermentations; continuous fermentations, fermentor design.

##### Unit- II

**Microbial Products:** Antibiotics viz., production of penicillin fermentation; anaerobic fermentation; alcohol production, Baker's yeast & probiotics.

##### Unit -III

**Biomolecules:** vitamins viz., Vitamin B<sub>12</sub>, Riboflavin, vitamin A; Plant hormone (Gibberellin) production.

##### Unit-IV

Biopesticides & biofertilizers- production and applications, use of algal & fungal inoculants to improve crop growth. Sewage treatment and Biogas production.

##### Unit -V

**Enzymes and acid products:** Production of amylases, proteolytic enzymes, pectinase; production of acetic acid, citric acid and alpha-ketoglutaric acid fermentation.

##### Practicals:

1. Preparation of fermentation media – sterilization techniques.
2. Screening and Identification of Antibiotic producing microbes.
3. Demonstration of different types of bio-fermentor.
4. Staining techniques for fungi and bacteria.
5. Production of alcohol from yeast and grape.
6. Production of organic acid viz., acetic acid.
7. Production of metallic nanoparticles from fungi.
8. Visit to wine, pharmaceutical and food industries.



**TEXT BOOKS:**

1. Anandan A. 1989. An Introduction to Industrial Microbiology.
2. Casida Jr L. E. 1996. Industrial Microbiology, New Age International (P) Ltd., New Delhi.
3. Patel, A. H. 2005. Industrial Microbiology. Macmillan India Limited, New Delhi.
4. Ratul Saikai. 2008. Microbial Biotechnology. New India Publishing Agency.
5. Singh B. D. 2015. Biotechnology: Expanding Horizons. Kalyani Publications.
6. Verrall, M. S. and Hudson M. J. 1990. Separation for Biotechnology, Ellis Horwood Ltd.

**REFERENCE BOOKS:**

1. Elsa Cooper. 2019. Microbial Biotechnology: Methods and Applications. Callisto Reference.
2. Lee Yuan Kun. 2006. Microbial Biotechnology: Principles And Applications. World Scientific Publishing Co Pte Ltd.
3. Neha Srivastava. 2019. New and Future Developments in Microbial Biotechnology and Bioengineering: From Cellulose to Cellulase: Strategies to Improve Biofuel Production. Elsevier.
4. Pepler, H. J. and Pertman, D. 1979. Microbial Technology. Vols. 1 and 2, Academic Press, New York.
5. Prescott, L. M., J. D. Hardley and D. A. Klein, 1990. Microbiology, WEB Mc Graw hill.
6. Thatoi H N. 2019. Microbial Biotechnology. Alpha Science International, Ltd.
7. Thoma G. T. 1977. Industrial Microbiology. Dowden Hutchinson & Ross Inc., Pennsylvania.

**SEMESTER –I**  
**SOFT CORE IA**  
**PBSC 106A- Forest Ecology**

**Unit-I**

**Silviculture:** General Silvicultural Principles: ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests, Silviculture – systems: Clear felling, uniform shelter wood selection, coppice and conversion systems - establishment and rehabilitation of degraded mangrove formations

**Unit-II**

**Agroforestry:** Agroforestry - scope and necessity; role in the life of people and domestic animals and in integrated land use, planning especially related to (i) soil and water conservation; (ii) water recharge; (iii) enhancing bio-diversity, medicinal and other flora and fauna.

**Unit-III**

**Social/Urban Forestry:** Objectives, scope and necessity; peoples participation. **JFM (Joint Forest Management)** – principles, objectives, methodology, scope, benefits and role of NGOs (Non Govt Organization).

**Unit-IV**

**Soil, Environment and Biodiversity Conservation:** Forests Soils, Soil conservation - definition, types - wind and water erosion; conservation and management of eroded soils/areas, wind breaks, shelter belts; sand dunes; Role of forests in conserving soils

**Unit-V**

**Forest Ecology and Legislation:** Environment components and importance, Principles of conservation Impact of deforestation; forest fires. Forest types in India. Role of afforestation and forest regeneration in absorption of CO<sub>2</sub>. Indian Forest Policy of 1990; Forest Conservation Act, 1980; Wildlife Protection Act 1972.

### **TEXT BOOKS:**

1. Adrian Newton, Forest Ecology and Conservation (1<sup>st</sup> Ed) Oxford University Press.
2. Agarwal S K. Fundamentals of Ecology, APH Publishing.
3. Burton V. Barnes, Donald R. Zak, Shirley R. Denton, Stephen H., Spurr. 1998. Forest Ecology (4<sup>th</sup> Ed) Wiley
4. Champion and Seth. 1935. A revised survey of the forest types of India, Manager of Publications.
5. Champion and Seth, 1968. General silviculture for India, Govt. of India Publication Branch, Dept, of Print. And Stationary.
6. James P. Kimmins, 1998. Forest Ecology (3<sup>rd</sup> Ed) Benjamin-Cummings Publishing company.
7. Kimmins J.P., 1997. Forest Ecology: A Fountation for Sustainable Management, Prentice Hall, 2<sup>nd</sup> Ed.

### **REFERENCE BOOKS:**

1. Lal, A B. 1961. Silvicultural systems and forest management, Kishore Publishers.
2. Lal A B, 1976. Indian Silviculture, publisher Kishore.
3. Puri G S. 2000. Forest Ecology, Oxford & IBH Publishing, ISBN: 8120403649
4. Sharad Singh Negi, 1989. Forest types of India, Nepal, and Bhutan, Periodical Expert Book Agency.
5. Singh G.B., Forest Ecology in India (1st) South Asia Books.
6. Stephen Spurr. 1998. Forest Ecology JR Rudol Barnes ,Denton John Wiley & Sons .
7. Troup R S. 1921. The Silviculture of Indian Trees, The Clarendon press.

**SEMESTER-II**  
**HARD CORE COURSE I**

**PBHT 207- Computer Applications in Biology and Biostatistics**

**Unit I**

**Fundamental knowledge of computers** – Basic components of computers – CPU, Input – Output devices, keyboard, mouse and scanner, printers, data storage and retrieval, hard disc, floppy disk, CD ROM, Types of computers, Hardware and Software

**Unit II**

**Operating systems:** Introduction to operating systems – Windows/Linux; concept of data, types of data and data structures. **Computer Networking:** Fundamentals of networking: OSI reference model, TCP/IP, topologies and protocols. Network security.

**Unit III**

**Introduction to Bioinformatics;** Overview of Bioinformatics resources on the web – NCBI/EBI/EXPASY. Biological databases: Nucleic acid sequence databases, Genbank/EMBL/DDBJ; Protein sequence databases – UniProtKB. Multiple sequence alignment – CLUSTALW and Phylogenetics. Database on bibliography. Application of software with special reference to Taxonomy.

**UnitIV**

**Biostatistics:** Measures of Central Tendency- Mean, Median, Mode- Measures of Dispersion- Quartile deviation, Mean deviation, Standard deviation- Coefficient of Variation. Probability distributions: Binomial distribution, Poisson distribution , Normal distribution.

**Unit V**

Correlation and Regression: Definition, types and significance. Chi-square test: Characteristics and applications. Tests of significance: Null hypothesis and alternate hypothesis, Student's t- test, F-test,  $X^2$ - test; ANOVA – one way and two way analysis of variance. Basics of SPSS, applications of SPSS.

**Practicals:**

1. Windows utilities
2. Computer presentation with graphics, working with formulae and functions, graphs,(SPSS).
3. Browsers and various search engines
4. E-mail, designing and creation of web pages.
5. Genbank databases using ENTREZ search engine.
6. Preparation of powerpoint presentation.
7. NCBI-BLAST Sequence analysis.

**TEXT BOOKS:**

1. Alexis Leon, Mathews Leon. Fundamentals of Information Technology. Leon Press, Chennai & Vikas Publishing House Pvt Ltd. Delhi.
2. Baxevanis A. D. et al. 2005. Current Protocols in Bioinformatics, Wiley Publishers
3. Bryan Bergeron. 2015. Bioinformatics Computing. Pearson Education India
4. Cynthia Gibas, Per Jambeck. 2001. Developing bioinformatics computer skills
5. David W. Mount, 2001. Bioinformatics Cold Spring Harbor Laboratory Press.
6. Education ISBN 81-297-0044-1
7. Krane D.E. and Raymer M.L, 2003. Fundamental concepts of Bioinformatics, Pearson O'REILLY publication.16
8. Pevzner P. A. 2004. Computational Molecular Biology, Prentice Hall of India Ltd.
9. Rajaraman V. 2001. Fundamentals of Computers, Publisher: Phi Learning.
10. Rajaraman. Fundamentals of Computer. <sup>4th</sup> Edition. Prentice Hall India.
11. Sandhu S G. 2012. Bioinformatics and its Applications. Pragn Publications

### **REFERENCE BOOKS:**

1. Bernhard Haubold. 2009. Introduction to Computational Biology: An Evolutionary Approach. Springer
2. Gibas Cynthia, Jambeck P. 2001. Developing bioinformatics in computer skills. O'Reilly & Associates Inc. Shroff Publishers,
3. Ka-Chun Wong. 2016. Computational Biology and Bioinformatics. Taylor & Francis
4. Kutti, C and Tata McGraw Hill, 1995. Unix programming: a conceptual perspective.
5. Mount David W. Bioinformatics: Sequence and Genome analysis: Cold Spring Harbor
6. Regan Knight. 2017. An Introduction to Bioinformatics. Larsen and Keller Education
7. Tanenbaum Andrew S. 2003. Computer Networks 4<sup>th</sup> edition; Prentice Hall.

**SEMESTER- II**  
**HARD CORE COURSE II**  
**PBHT 208-Plant Anatomy and Embryology**

**Unit I**

**Basic Concepts of Anatomy-** Theories of Organization of meristems in stem and root, Differentiation of Xylem and Phloem Tissues; Structure and Function of Vascular Cambium and Cork-cambium; Cambial activity and wound healing; Secondary and Anomalous Secondary growth in stem and root of plants; Wood types and structures.

**Unit II**

**Morphogenesis in Stem and Root:** Organization of Shoot and Root Apical meristems; Nodal anatomy; Shoot and Root developments in plants; Lateral roots and Root Hairs.

**Unit III**

**Morphogenesis in Leaf and Flower-** Leaf development, Phyllotaxy, Epidermis Development- Trichomes and Stomata Development; Leaf anatomy (Dicot and Monocot) Flower Development- Organization of Floral meristems and Flower development in Plants (*Arabidopsis*).

**Unit IV**

**Basic Plant Embryology-** Microsporogenesis and Development of Male gametophyte; Megasporogenesis and Development of Female gametophyte, Pollination and Double fertilization in plants; Development of Embryo and Endosperm in plants.

**Unit V**

**Advanced or Applied Embryology-** Polyembryony, Apomixis, Sexual incompatibility in plants; Cellular Totipotency and Regeneration; Production of Somatic embryo and haploid embryos; Synthetic Seed production; Genetics of Zygotic and Somatic embryogenesis.

**Practicals**

1. Isolation and microscopic examination of pollen grains and pollinium.
2. Isolation and dissection of embryo.
3. Micro-preparation of SAM in Dicot and Monocot.
4. Micro-preparation of RAM in Dicot and Monocot.
5. Pollen Germination and Test- *Datura* sp., *Catharanthus* sp.
6. Anomalous structure of stem of *Boerhaavia*, *Nyctanthes*, *Achyranthes*

7. TS / LS showing initiation of lateral roots.
8. T.S. of dicot and monocot leaf.
9. Observation of permanent slides/micropreparations/photographs/charts/specimens etc of the following Anthers, Ovules, Embryo-sacs, different stages of embryo, Endosperms, SAM, RAM, Seeds

**TEXT BOOKS:**

1. Annie Ragland . 2014. Plant Anatomy & Microtechniques. Saras Publication
2. Bhatnagar. 2014. The Embryology of Angiosperms. Vikas Publishing Company
3. Bhojwani S S. and Bhatnagar S P. 1999. The Embryology of Angiosperms, (4<sup>th</sup> revised and enlarged Ed) Vikash Publishing House Pvt, Ltd. New Delhi
4. Hema Sane. 2014. Plant Anatomy and Embryology. Vision publications
5. Maheswari P. 1997. An Introduction to the Embryology of Angiosperms, Tata McGraw Hill Publishing company Ltd., New Delhi.
6. Pandey B. P. 2006. Plant Anatomy. S. Chand and Company
7. Pandey S N. and A Chadha A. 2007. Plant Anatomy and Embryology, Vikash Publishing House Pvt. Ltd. New Delhi.
8. Sharma H P. 2009. Plant Embryology (Classical and Experimental) Narosa Publishing House Pvt. Ltd. India

**REFERENCE BOOKS:**

1. Annie Ragland. 2010. Developmental Botany & Experimental Embryology. Saras Publication
2. Hennig, Lars; Köhler, 2010. Plant Developmental Biology: Methods and Protocols”, Claudia (Eds.), 1st Edition., Humana Press
3. Katherine Esau. 2006. Anatomy of Seed Plants. Wiley
4. Lyndon R. F. 1990. “ Plant Development the cellular basis” Unwin Hyman, London,
5. Pua, Michael R. Davey, 2009. Plant Developmental Biology - Biotechnological Perspectives: Volume 1”, Eng Chong Publisher: Springer.
6. Roy. 2010. Plant Anatomy. New Central Book Agency
7. Sachs T. 1991. Patterns formation and plant tissue” Cambridge University Press.



8. Stephen H. Howell; Molecular genetics of Plant Development” Cambridge University Press.

**SEMESTER- II**  
**HARD CORE COURSE III**  
**PBHT 209-Nanobiotechnology**

**UNIT-I**

**Introduction:** Introduction and History of nanotechnology, definition and concept of Nanotechnology, Nanoscience, Nanobiotechnology, and Green nanotechnology. Nanoscale properties (Electrical, Optical, Chemical and quantum effects) and commercial importance of nanoparticles.

**UNIT-II**

**Production of nanoparticles.** Bottom-up and top-down approaches. A brief introduction to the major methods of nanoparticle preparation - mechanical methods-Grinding (High energy ball milling), Physical methods (Inert gas condensation), Chemical method (Sol - gel technique), Biological nanoparticles production (green synthesis) - plants and microorganisms. Observation and characterization of nanoparticles (UV-VIS, FTIR, SEM, TEM, AFM, XRD, EDX).

**UNIT-III**

**Nanostructures:** Properties of Nanostructures-Carbon based nanostructures - Carbon Nanotubes (CNT), Fullerenes (C<sub>60</sub>), graphene. Metal-based Nanostructures (Gold, silver, and Iron Oxide Nanoparticles), Polymer-based Nanostructures (Dendrimers). Nanomachines.

**UNIT-IV**

**Applications of Nanotechnology:** Nanotechnology in Agriculture -Precision farming, Smart delivery system –Nanofertilizers: Nanourea and mixed fertilizers, Nanopesticides, Nano-seed Science. Nanotechnology in Food industry – Nanopackaging for enhanced shelf life -Smart/Intelligent packaging. Food processing and food safety and bio-security. Nanomedicine and Drug delivery system:

**UNIT-IV**

**Health and Environmental impacts of Nanotechnology:** Ethical Issues in Nanotechnology: With special Reference to Nanomedicine. Nanotechnology and Future Socio-economic Challenges.

**Practicals:**

1. Synthesis of Nanoparticles using plants
2. Synthesis of Nanoparticles using microorganisms.
3. UV-Vis. Spectral analysis of nanoparticles.
4. Evaluation of antimicrobial activity of synthesized nanoparticles.
5. Evaluation of synergistic activity of nanoparticles with antibiotics and other drugs.
6. SEM /TEM analysis & observations of synthesized nanoparticles.
7. Nanoparticle size analysis-EDX/Xray diffraction

### **TEXT BOOKS:**

1. Brown P. J. and Stevens K. 2007. Nanofibers and Nanotechnology in Textiles. Woodhead Publishing Limited, Cambridge.
2. Chaudry Q., Castle L. and Watkins R. 2010. Nanotechnologies in Food. RSC Publications,
3. Fulekar. MH. 2015. Nanotechnology-Importance and Applications. IK. International Publishing House Pvt. Ltd. New Delhi.
4. Lynn J. Frewer, Willehm Norde, Fischer R. H. and Kampers W. H, Wiley-VCH Verlag. 2011. Nanotechnology in the Agri-food sector.
5. Rakesh Rathi. Er. Chand S. 2018. Nanotechnology-Technology Revolution of 21<sup>st</sup> Century. and Company Limited.
6. Subbiah Balaji, 2010. Nanobiotechnology. MJP. Publishers, Chennai-5.

### **REFERENCE BOOKS:**

1. Chad A Mirkin and Christof M. Niemeyer (Eds), 2007. Nanobiotechnology - II More concepts and applications. Wiley VCH.
2. Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor). 2004. Nanobiotechnology: Concepts, Applications and Perspectives, Wiley Publishers.
3. Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor). 2004. Nanobiotechnology: Concepts, Applications and Perspectives. Wiley VCH.
4. Fernando López-Valdez, Fabián Fernández-Luqueño. 2018. Agricultural Nanobiotechnology: Modern Agriculture for a Sustainable Future. Springer.
5. Liu and Shimohara, 2007. Bio molecular computation for Bio nanotechnology, Artech House- London.
6. Mahendra Rai, Jayanta Kumar Biswas. 2019. Nanomaterials, Ecotoxicity, Safety, and Public Perception. Springer.
7. Mark Ratner and Daniel Ratner, Nanotechnology: A Gentle Introduction to Next Big Idea, Low Price edition, Third Impression, Pearson Education.
8. William Illsey Atkinson, Nanotechnology, JAICO Publishing House, Second Impression-2008.

**SEMESTER – II**  
**HARD CORE COURSE IV**  
**PBHT 210- Bioinstrumentation**

**Unit I**

Microscopy: Principles of Light Microscopy, Magnification, Resolving power. Phase Contrast Microscopy, Fluorescence Microscopy. Electron Microscopy: TEM and SEM. Foldscope. Camera Lucida, Ocular and Stage micrometer. Photomicrography. Microtechniques: Microtomes – Rotary and Sledge, Fixatives (FAA) and Staining(single, double).Types of mounting media.

**Unit II**

Centrifuge – Basic principles of sedimentation, RCF, Sedimentation coefficient. Types of Centrifuges – Analytical and Ultracentrifuges. pH meter – principle, electrodes, working of a pH meter.

**Unit III**

Chromatography – paper, TLC, column, GLC, HPLC. Electrophoresis –Gel electrophoresis, Agarose/SDSPAGE. Immunoelectrophoresis – applications.

**Unit IV**

Spectrophotometer – Absorbance and Transmittance, Beer-Lambert's Law, Visible and UV spectrophotometers. Atomic Absorbance Spectrometer, Flame photometer.

**Unit V**

Radio isotopic techniques – radioisotopes, Half-life, Applications of tracer techniques in Biology, Measurement of radioactivity – GM and Scintillation counters. Autoradiography.

**Practicals:**

1. Separation of proteins by gel electrophoresis.
2. Estimation of proteins by Lowry's et al method.
3. Preparation of a standard curve for protein (BSA).
4. Preparation of buffers using a pH meter.
5. pH of various soil and water samples.
6. Training the students to use UV-VIS Spectrophotometer.
7. Demonstration of Column Chromatography.
8. TLC – separation of pigments and amino acids.
9. Calibration of a microscope using ocular and stage micrometers.

**TEXT BOOKS:**

1. Arumugam and Kumaresan V. 2015. Biophysics and Bioinstrumentation. Saras Publications
2. Gurumani N. 2011. Research methodology: For Biological Sciences, MJP Publishers, New Delhi.
3. Jain J L. 2005. Fundamentals of Biochemistry, 6<sup>th</sup> Ed. S Chand & Co Ltd. New Delhi.
4. Jeyaraman, J. 1972. Techniques in Biology, Higginbothams Pvt. Ltd, Madras.
5. Prasad and Prasad ,Outlines of Microtechnique, Emkay Publications, Delhi.
6. Rastogi S C. 2003. Biochemistry, Tata McGraw Hill Pvt. Ltd. New Delhi.
7. Reddy. 2017. Instrumentation and Control Systems. McGraw Hill Education
8. Sabari Ghosal. Anupama Awasthi. 2018. Fundamentals of Bioanalytical Techniques and Instrumentation. PHI Learning
9. Satyanarayan V and Chakrapani. 2006. Biochemistry. Books and Allied (p) Ltd. Kolkata.
10. Veerakumari L. 2009. Bioinstrumentation. MJP Publishers, New Delhi.

**REFERENCES:**

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.B. and Layzell, D.B. 1997. Plant Metabolism (2<sup>nd</sup> Edn.) Longman, Essex, England.
2. Khandpur R S. 2015. Handbook of Analytical Instruments. McGraw Hill Education

3. Moore, T. C. 1989. Biochemistry and Physiology of Plant Hormones, Springer Verlag, New York, USA.
4. Philip Sheeler and Bianchi – Cell and Molecular Biology.
5. Veerakumari, L. 2009. Bioinstrumentation, [www.mjpublishers.com](http://www.mjpublishers.com)
6. Voet and Voet. 1992. Biochemistry, John wiley and Sons, New York, USA.
7. Webster. 2007. Bioinstrumentation. Willy

**SEMESTER – II**  
**HARDCORE COURSE IVA**  
**PBHT 210 A- Environmental Biotechnology**

**Unit I**

**Introduction:** The environment- soil, water and air. Pollution and climate change, it's causes. non-conventional energy resources- biogas production, methane and hydrogen production. Recycling of waste products- composting/Vermicomposting.

**Unit II**

**Source and treatment of polluted water and effluents:** Biological treatment of sewage- characteristics of sewage and objective in sewage treatment- Activated sludge process- Trickling filters- Anaerobic digestion. Treatment of industrial effluents.

**Unit III**

**Soil and air pollution and their treatment:** soil pollution by xenobiotics. Degradation of xenobiotics- pathways of phenol, pentachlorophenol and polychlorinated biphenyl degradation. Purification of polluted air.

**Unit IV**

**Bioremediation:** Introduction. Types (Bioaugmentation, Biostimulation). *Ex situ* and *in situ* bioremediation. Phytoremediation.

**Unit V**

Pollution of water bodies by heavy metals and pesticides-their removal by biosorption. Removal of oil spills by using microbes, Superbug. Biomineralization- bioleaching- metal transformation-biofilms and biocorrosion. Pollution by radionuclides.

**Practicals**

1. Composting techniques (Vermi-composting).
2. Demonstration of Biogas production.
3. Demonstration of bioreactor.

4. Visit to nearby sewage treatment plant.
5. Visit to industries to show air purification units and mechanism.
6. Estimation of BOD and COD-Demonstration.
7. Water quality parameters and standards-Demonstration.

**TEXT BOOKS:**

1. Dubey. 2004. A text book of Biotechnology. S. Chand & Company Ltd. New Delhi.
2. Gupta P K. 2004. A Handbook of Soil, Fertilizer and Manure. Agrobios, India.
3. Murugesan A G and Rajakumari C R. 2005. Environmental Science and Biotechnology Theory and Techniques, NJP Publishers, Chennai, India.
4. Sharma J L and Buldini P L. 1994. A Dictionary of Pollution, CBS Publishers & Distributers (P) Ltd. New delhi.
5. Sharma. 2005. Environmental Microbiology. Narosa Publishing House Pvt. Ltd. New Delhi.
6. Trivedy R K. 1989. Pollution management in Industries Environmental Publications, India.

**REFERENCE BOOKS:**

1. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited.
2. Joseph C Daniel. 1996. Environmental aspects of microbiology. Britixh Sun Publication.
3. Raina Maier, Pepper, Gerba. 2000. Environmental Microbiology. Academic Press, UK.
4. Robert Leo Smith. 1986. Elements of Ecology IInd Ed, Haper & Row Publishiers, New York.



**SEMESTER - II**  
**SOFT CORE COURSE I**  
**PBSC 212- Medicinal Botany**

**Unit 1**

Pharmacognosy - Definition and scope — History – Scheme for pharmacognostic studies of a natural drug – Indian Systems of medicine: Ayurveda, Siddha, Yoga, Unani, Homeopathy, Traditional botanical knowledge, Ethnobotany and Folklore medicines – AYUSH.

**Unit II**

Medicinal plants – Methods of cultivation, factors affecting cultivation, use of Biofertilizer, pest control. Collection, Harvesting, Drying, Packaging and storage of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. Methods of cultivation of *Aloe vera* and *Ocimum* (Tulsi).

**Unit III**

Tissue culture of endangered medicinal plants- Role of tissue culture in the improvement of medicinal plants – Different types of drug adulteration and substitution – Microscopic analysis and phytochemical evaluation of crude drugs.

**Unit IV**

Biological source, geographical distribution, morphology of useful part, active principles and therapeutic value of the following drugs: Fox glove (*Digitalis purpurea*), Myrobalan (*Terminalia chebula*), Neem (*Azadirachta indica*), Turmeric (*Curcuma* sp.), Asafoetida (*Ferulla asafoetida*), Ginger (*Zingiber officinale*), Lemon grass (*Cymbopogon citratus*), Clove (*Eugenia caryophyllata*), Vinca (*Catharanthus roseus*).

**Unit V**

Extraction of Bioactive compounds, (Solvent extraction and microwave assisted extraction), Isolation and Characterization of bioactive compounds by Chromatographic techniques (TLC and HPLC), FTIR and NMR.

**Practicals:**

1. Identification and morphological study of drugs included in the syllabus.
2. Determination of Epidermal cell number, Epidermal cell size.
3. Determination of stomatal number, stomatal size, stomatal index, vein islet number, vein termination number and study of trichomes.
4. Determination of Vein islet Number and Vein termination number.
5. Microscopic study of Trichomes.

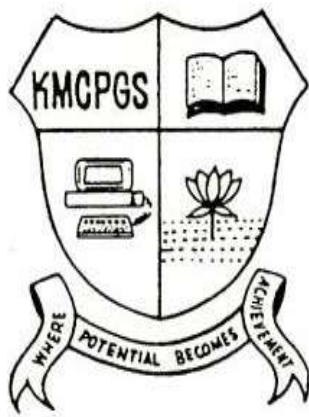
**TEXT BOOKS:**

1. Ansari S H. 2006. Essentials of Pharmacognosy, Birla Publications Pvt. Ltd. Delhi.
2. Chaudhuri B C. 2004. Megadiversity Conservation: Flora, Fauna & Medicinal Plants in India's Hot Spots. Daya Publishing House
3. Khandelwal K R. 2008. Practical Pharmacognosy-Tehcniques & Experiments (19<sup>th</sup> Ed), Nirali Prakashan, Pune.
4. Kolate C K, Purohit a P and Gokhale S B. 2008. Pharmacognosy (42<sup>nd</sup> Ed), Nirali Prakashan, Pune.
5. Mohammed ali. 2008. Text Book Of Pharmacognosy (2<sup>nd</sup>Ed ), CBS Publishers & Distributors, New Delhi.
6. Neeru Mathur. 2010. Medicinal Plants of India. RBSA Publishers
7. Prajapnati N D. 2013. A Handbook of Medicinal Plants: A Complete Source. Agro-Bios
8. Shah C S and Qadry J S, Shah Prakasha B S, Amdavad. 2005. A Text Book of Pharmacognosy,
9. Sunita Singh, Subhalaxmi. 2013. Medicinal Plants. Kalpaz Publications
10. Trivedi P C. 2016. Medicinal Plants: Traditional Knowledge. I K International Publishing House Pvt. Ltd

## REFERENCE BOOKS:

1. Chopra R.N. 1958. Indigenous Plants of India.
2. Chopra, R.N., Nayar S.L. and Chopara I.C. 1956. Glossary of Indian Medicinal plants. CSIR, New Delhi, India.
3. Iyengar, M.A. 1975. A hand book of Pharmacognosy, Manipal.
4. Iyengar, M.A. 1978. Powered drugs of India, Manipal.
5. Kokate, C.K. 1988. Practical Pharmacognosy.
6. Kokate, C.K., Purohit A.P. and Gokhale S.B. 1995. Pharmacognosy. Furia, Narali Prakashan, Jageshwari Mandir Lane, Pune.
7. Nadkarni, K.M. 1976. Indian Materia Medica, Vol I & II. Popular Prakashan Pvt. Ltd., Bombay.
8. Nitish Kumar. 2018. Biotechnological Approaches for Medicinal and Aromatic Plants: Conservation, Genetic Improvement and Utilization. Springer Verlag
9. Olayiwola Akerele Vernon Heywood Hugh Synge. 2009. Conservation of Medicinal Plants. Cambridge University Press.
10. Wallis, T.E. 1985. Test book of Pharmacognosy. CBS Publications and distributors, Bholonath Nagar, Shhadara, Delhi.
11. William Charles Evans. 1989. Trease and Evans Pharmnacognosy. 14<sup>th</sup> Edition.

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**CBCS-SYLLABUS**

**M.Sc. (PLANT BIOLOGY AND BIOTECHNOLOGY)**  
**(Semester III and IV)**  
**2019-2020**

## **SEMESTER - III**

### **HARD CORE COURSE- I**

#### **PBHT 313 - Angiosperm Systematics & Economic Botany**

##### **Unit I**

Comprehensive view of various approaches of plant classification: artificial (Linnaeus), natural (Bentham & Hooker), phylogenetic (Cronquist). Introduction to APG system of classification. Taxonomic hierarchy. Keys: single access or sequential keys, multi-access keys, indented keys; ICN: rules of nomenclature, typification; Effective and valid publication.

##### **Unit II**

Tools of Taxonomy- herbarium, flora, monograph. Techniques in Taxonomy- Numerical, Cytotaxonomy, Chemotaxonomy., Modern plant systematic- molecular approaches in plant systematic, -RFLP (Restricted Fragment Length Polymorphism), PCR based molecular markers, RAPD (Random amplifies polymorphic DNA).

##### **Unit III**

Detailed study of the following families: Annonaceae, Menispermaceae, Nymphaeaceae, Clusiaceae, Sterculiaceae, Sapindaceae, Meliaceae, Rhizophoraceae, Combretaceae, Myrtaceae, Lythraceae, Cactaceae, Rubiaceae, Asclepiadaceae, Convolvulaceae, Bignoniaceae, Verbenaceae,

##### **Unit IV**

Detailed study of the families: Amaranthaceae, Moraceae, Casuarinaceae, Zingiberaceae, Palmae, Araceae, Cyperaceae and Poaceae.

##### **Unit V**

World centres of origin of domesticated plants and uses of (Three species each)

i) Cereals, ii) Pulses, iii) Nuts, iv) Vegetables: underground and Leaf , v) Fruits: Tropical and Temperate fruits, vi) Spices and condiments obtained from : Stem, leaves, flowers, seeds, vii) Oils, viii) Commercial crops Textile fibre, ix) Timbers:, x) Essential oils xi) Drug yielding plants: obtained from roots, stem, bark leaves, fruits and seeds, xii) Forage/ fodder crops.

### **Practicals**

1. Binomial identification of local plants by using flora.
2. Study of Families mentioned in the syllabus – at least two local taxa from each family may be dissected and sketched in record sheets.
3. Construction of artificial key for any six plants.
4. Field visits (local / interstate) for 5 to 7 days and submission of 30 herbarium sheets of wild plants along with the field book.
5. Food plants: Morphology, Anatomy, histochemical tests for wheat, rice & Bengal gram.
6. Study of any locally available fodder / forage plant.
7. Microscopic examination and identification of fibers.
8. Macro and microscopic studies of any three medicinal plants included in the syllabus.
9. Identification of wood shavings based on the micro, and macroscopic features.
10. Visit to any Regional Research Laboratory of India (like TBGRI, Trivandrum).

### **TEXT BOOKS:**

1. Amal Kumar Mondal. 2016. Advanced Plant Taxonomy. New Central Book Agency
2. Bharat Bhattacharia. 2005. systematic Botany, Narosa publishers, New Delhi.
3. Chopra, G.L. 1982. Angiosperms (Systematics & Life Cycle) Pradeep publishers, Jullander, Punjab.
4. Gurucharan Singh. 2005. Plant Systematics (Theory & Practice), Oxford & IBH publishers, New Delhi.
5. Kocchar, S. L, 1998. Economic Botany of the Tropics II edition, Macmillan India Ltd, New Delhi.
6. Kochhar S. L. 2016. Economic Botany: A Comprehensive Study. Cambridge University Press India Pvt. Ltd.
7. Lawrence, H.M. 1971. Taxonomy of Vascular Plants, Oxford and IBH publishers, New Delhi.
8. Pandey, B.P. 2004. Angiosperms, S.Chand publishers, New Delhi.
9. Sharma O P. 2017. Plant Taxonomy. McGraw Hill Education

10. Sivarajan, V.V. 1991. Introduction to the principles of Plant Taxonomy, Oxford and IBH publishers, New Delhi.
11. Subramaniam, N.S. 1996. Laboratory manual of Plant Taxonomy, Vikas publishers, New Delhi
12. Subramaniam, N.S. 1996. Modern Plant Taxonomy, Vikas publishers, New Delhi

#### **REFERENCE BOOKS:**

1. Austin Balfour. 2016. Plant Taxonomy. Syrawood Publishing House
2. Austin Balfour. 2016. Principles of Plant and Animal Taxonomy. Syrawood Publishing House
3. CSIR – 1948-1976. 2000. The Wealth of India: A dictionary of Indian raw material & Industrial production, New Delhi, Raw materials XII Revision Vol. I-II (1985 – 1992). Supplement.
4. Davis, P.H and Heywood, V. H. 1973. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd. UK.
5. Franker, O. H., Brown, A. H and Burdon, J.J. 1995. The conservation of plant diversity. Cambridge University Press, Cambridge, UK.
6. Heywood, V. H. 1984. Modern methods in Plant Taxonomy, Academic Publishers, USA.
7. John Gonsalves . 2016. Economic Botany and Ethnobotany. Mittal Publications
8. Jones, S.B, Jr. and Luchsinger , A.E. 1986. Plant Systematics, 2<sup>nd</sup> Edn. Mc Graw Hill, New York.
9. Mabberley, David J.2013. Mabberley's Plant-book: A Portable Dictionary of Plants, their Classifications, and Uses . Cambridge University Press.
10. Michael G. Barbour and C. Stocking. 2005. Plant Biology, International Edition. Publisher: Brooks/Cole
11. Miolini. 2016. Textbook of Economic Botany ABS Book
12. Nels R. Lersten. 2013. Flowering Plant Embryology. Wiley
13. Simpson Beryl. 2013. Plants in our World: Economic Botany. McGraw-Hill Education
14. Stace, C. A. 1989. Plant Taxonomy and Biosystematics (2<sup>nd</sup> Edn.) Edward Arnold Ltd, London.
15. Takhtajan, A. 1995. Flowering Plants – Origin & Dispersal, Oliver and Boyd. UK.

**SEMESTER III**  
**HARD CORE COURSE II**  
**PBHT 314 - Genetics, Plant Breeding and Evolution**

**Unit I**

Mendelian Genetics, Incomplete dominance, interaction of Genes Multiple factor inheritance, Multiple allelism, Linkage and Crossing over; Chromosome mapping. Plastidal inheritance in *Mirabilis*, Mitochondrial inheritance in Yeast.

**Unit II**

Microbial genetics, Sex linked inheritance, DNA as a genetic material. Sex determination in plants; Mutation: Causes of mutation, mutagens, detection of mutation; Chromosomal aberration; Chromosomal variation; Population genetics.

**Unit III**

Gene linkage in bacteria; Circular chromosome map of *E. coli*, circular genetic map of phage T<sub>4</sub>; transposable elements; Insertion sequences, Complex transposons, transposons of *E. coli*, bacteriophage Mu, Yeast Ty elements.

**Unit-IV**

Plant Breeding: History, introduction, principles, modern techniques involved in crop improvement –Mutation breeding, Polyploid breeding and Transgenic technology. Hybridization: Intergeneric hybridization, Interspecific hybridization, Intervarietal hybridization, heterosis and hybrid vigour.

**Unit V**

Origin of basic biological molecules; a biotic synthesis of organic monomers and polymers, Concepts of Oparin and Haldane; experiment of Miller (1953); Evolutionary time scale, major events in the evolutionary time scale, origin of major group of plants; Concepts of neutral evolution; molecular divergence, molecular clocks, molecular tools in phylogeny. Theory of endosymbiosis- hologenome theory of evolution



**Practicals:**

1. Interaction of Genes, Evolutionary and Phylogenetic Tree (demo).
2. Sex linked inheritance.
3. Construction of chromosome maps.
4. Linkage maps of *Drosophila* and Maize.
5. Photographs / diagram / models of; Structural changes in chromosome (deletion, duplication, inversion and translocation); Numerical changes in the chromosome (euploidy and aneuploidy).
6. Incomplete dominance.
7. Polygenic inheritance or multiple alleles.
8. Trihybrid Test cross.

**TEXT BOOKS:**

1. Ajoy Paul, 2007. Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd. Kolkatta.
2. Brian K. Hall, Benedikt Hallgrimsson. 2013. Strickberger's Evolution. Jones & Bartlett Learning
3. Gupta P.K. 1996. Genetics, Rastogi Publications. Meerut.
4. Philip Sheeler and Donald E. Bianchi. 2004. Ed. Cell and Molecular Biology III Ed. Replica Press Pvt. Ltd., India.
5. Sarin C. 1990 Genetics. Tata Mc Graw Hill Publication Co. Ltd. New Delhi.
6. Strickburger. 1990. Genetics. III Ed. Maxwell MacMillon International Edn. New Delhi.
7. Veera Bala Rastogi 2008. Fundamentals of Molecular Biology, Rastogi Publications Meerut.
8. Venkata R. Prakash Reddy. 2015. Key Notes on Genetics and Plant Breeding. Astral Publication
9. Verma P.S., Agarwal V.K.. 2004. Cell Biology Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. New Delhi.

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11. Winchester, A.M. 1984. Genetic. Oxford & IBH publishing & Co. Ltd; New Delhi.

**REFERENCE BOOKS:**

1. Arnold Berk, Chris A. Kaiser, Harvey Lodish. 2016. Molecular Cell Biology. WH Freeman
2. Atherly, A.G. Girton, J.R and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
3. Benjamin Pierce. 2016. Genetics: A Conceptual Approach. WH Freeman
4. Damien Miller. 2017. Principles and Techniques of Plant Breeding. Larsen and Keller Education
5. Gardner J. Simmons J. Snustad P. 1991. Principles of Genetics. VIII edn. John Wiley & Sons INO New York.
6. Gardner, E.J. and Snutud D. Peter. 1978. Principles of Genetics. John Wiley & Sons, New York.
7. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick. 2017. Lewin's GENES XII.
8. John E. Bradshaw. 2016. Plant Breeding: Past, Present and Future. Springer Nature
9. Jones and Bartlett Publishers, Inc.
10. Levine, P.P. 1976. Genetics. Holt Rinehart & Wilson Inc., USA
11. Lewin B. 2000 Gene VII Oxford University Press. New York.
12. Michael R. Cumming, Michael A. Palladino, William S. Klug, Charlotte A. Spencer 2016. Concepts of Genetics. Pearson
13. Peter J. Russell. 2009. Genetics: A Molecular Approach - International Edition. Pearson
14. Ram M. 2014. Plant Breeding Methods. Prentice Hall India Learning Private Limited
15. Russel, P.J. 1998. Genetics. Benjamin Publishing Company Inc., USA
16. Shabir H. Wani C. P. Malik. 2014. New Plant Breeding Techniques. PointerPublishers

**SEMESTER - III**  
**HARD CORE COURSE III**  
**PBHT 315 - Cell and Molecular Biology**

**Unit I**

Cell: Ultra structure, of Plant Cell and function of Cell organelles-Cell wall, Plasma membrane, Cytoplasm. Structure and functions of cell organelles. Endosymbiont hypothesis on the evolution of mitochondria and chloroplast,

**Unit II**

Control mechanism of cell cycle, role of retinoblastoma and E<sub>2</sub>f proteins in cell cycle, mechanism of programmed cell death, initiation of cancer at cellular level, proto-oncogenes and tumor suppressor genes.

**Unit III**

Structure of chromatin- histones and nonhistone proteins, nucleosomal organization of chromatin. Heterochromatin and Euchromatin, Chromosomal packing and structure of metaphase chromosome. Molecular structure of the Centromere and Telomere.

**Unit IV**

Watson and Crick model of DNA structure, Different types of DNA. DNA replication in prokaryotes and eukaryotes: enzymes and proteins involved in replication. Replication in the telomere – telomerase. DNA damage and repair mechanisms: Types- Direct, excision. Mismatch and Recombination repair types

**Unit V**

Gene expression: Concept of gene; Important features of the genetic code. mRNA transcription and processing, mRNA transport and stability. Mechanism of translation; Protein sorting. Post-translational modification of proteins. Protein folding – self assembly, role of chaperones in protein assembly. Regulation of gene expression in prokaryotes and Eukaryotes. Organisation of rRNA and tRNA genes and Significance of introns, organellar genome organisation.

## **Practicals**

1. Aceto carmine root tip squash technique – Observation of chromosomes during mitotic stages.
2. Anther smear techniques for meiosis – Observation of chromosomes during meiotic stages.
3. Identification of chromosomes by Banding techniques – Giemsa, Quinacrine, Reverse, Centrometric.
4. Isolation of plant DNA and its quantification by a spectrophotometric method.
5. Isolation of plant RNA and its quantification by a spectrophotometric method.

## **TEXT BOOKS:**

1. Ajoy Paul, 2007. Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd., Kolkata.
2. Archana Sharma. Chromosomes, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Arumugam N. Cell biology, genetics and molecular Biology, Saras Publications, Nagercoil.
4. Gupta P K. Cell and Molecular Biology, Rastogi Publications, Meerut.
5. Rastogi V.B. 2008. Fundamentals of Molecular Biology, Rastogi Publications, Meerut.
6. Sumita Sen, Dipak Kumar Kar. Cytology and Genetics, Narosa, New Delhi
7. Venki Ramakrishnan. 2017. Gene Machine: The Race to Decipher the Secrets of the Ribosome. Harper Collins Publishers India

## **REFERENCE BOOKS:**

1. Bob B Buchanan, Wilhelm Gruissem, Russel L Jones. 2000. Biochemistry and Molecular biology of plants. I K International Pvt. Ltd.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. 2002. Molecular biology of the cell (IV Edn). Garland Science, Taylor and Francis group.
3. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. 2010. Essential Cell Biology. Garland Science.

4. Daniel L Hartl, Elizabeth W Jones. 2012. Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
5. David P Clark. 2010. Molecular biology. Elsevier.
6. Firdos Alam Khan . 2016. Biotechnology Fundamentals. CRC Press
7. Gerald Karp. 2008. Cell and Molecular biology: Concepts and experiments (V Edn). John Wiley & Sons.
8. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh, Paul Matsudaira. 2007. Molecular cell biology (VI Edn). W H Freeman & Company.
9. Harvey Lodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell. 2000. Molecular cell biology (IV Edn). W H Freeman & Company.
10. James D Watson, Tania A Baker, Stephen P Bell, Alexander Gann, Michael Levine, Richard Losick. 2009. Molecular biology of the gene (V Edn). Pearson.
11. James D. Watson, Tania A. Baker. 2013. Molecular Biology of the Gene. Pearson
12. Muhammad Sohail. 2017. Gene Silencing by RNA Interference: Technology and Application. CRC Press
13. Oscar Watson 2017. Molecular Biotechnology. Callisto Reference
14. Paul F. Kisak. 2017. Crispr Technology: The Revolutionary Breakthrough for Genetics & Evolution. Createspace Independent Publications
15. Phillip Sheeler, Donald E. Bianchi. 2009. Cell and Molecular Biology. Wiley
16. Robert F Weaver. 2002. Molecular biology (II Edn). McGraw Hill.
17. William H Elliott, Daphne C Elliott. 2001. Biochemistry and molecular biology (II Edn). Oxford.

**SEMESTER - III**  
**HARD CORE COURSE IV**  
**PBHT 316 - Gene Technology**

**UNIT-I**

Recombinant DNA technology: Types of vectors – plasmids, phagemids, cosmids, CaMV, M13, and Expression vectors. Characteristic features of vectors. rDNA technology, Gene cloning techniques, identification of clones by screening procedures, Construction of genomic / cDNA libraries, PCR and its applications, Blotting techniques, DNA fingerprinting.

**UNIT – II**

Genetic transformation: *Agrobacterium* as a natural genetic engineer, Ti and Ri plasmids, Opines and their significance, T-DNA. CRISPR Cas genome editing; whole genome transfer, Zinc finger; Gene transfer methods – Electroporation, Microprojectile bombardment. Transgene stability and gene silencing. Strategies to avoid gene silencing and improve gene expression in transgenic plants.

**UNIT – III**

Application of Genetic Engineering: Gene manipulation of microbes in the production of alcohol, beer, wine and vinegar. Genetically modified crops and their significance. Molecular farming. Pharmaceuticals and nutraceuticals.

**UNIT – IV**

Nano-technology: Basic concepts of Nano science and nanotechnology, its applications, characterization of bionanomaterials- Spectrophotometer, FTIR.

**UNIT- V**

Biotic stress tolerance; Herbicide resistance, bruise resistance, pest resistance, Disease resistance. Abiotic stress tolerance: Drought, temperature and salt. Application of gene technology for the production of quality oil and Industrial enzymes. Metabolic engineering for plant secondary metabolites.

**Practicals:**

1. Problems related to DNA fingerprinting and other genetic engineering techniques.
2. Demonstration of blotting techniques.
3. *Agrobacterium* mediated transformations.
4. Nucleic acid separation by electrophoresis.
5. Protein separation by Electrophoresis.
6. Isolation of genomic DNA from Bacteria.
7. Isolation of plasmid DNA from Bacteria.
8. Study of microbes in the production of alcoholic beverages.

**TEXT BOOKS:**

1. Chawla, H. S. 2002. Introduction to Plant Biotechnology, II Edition, Oxford & IBH Publishing Co., New Delhi.
2. Das, H.K. 2007. Textbook of Biotechnology, III Edn. Willey India (P) Ltd.
3. Kumar, H. D. 1998. Modern concepts of Biotechnology, Vikas publishing House, Noida (UP), India.
4. Rastogi, S. C. Biotechnology: Principles & Applications.
5. Satyanarayana, U. 2005. Biotechnology. Books & Allied (P) Ltd, India.
6. Tejovathi, G, Vimala, Y and Rekha Bhadauric. 1996. A Practical manual for Plant Biotechnology, CBS Publishers & Distributors, New Delhi.

**REFERENCE BOOKS:**

1. Rev. Fr. Dr. Ignacimuthu, S. 1996. Applied Plant Biotechnology, Tata McGraw-Hill Publishing Co., New Delhi
2. Snustad & Simmons. 2006. Principles of Genetics, IV Edn. Willey Asia Student Edition.

**SEMESTER III**  
**SOFT CORE COURSE I**  
**PBSC 318- Medicinal Botany**

**Unit 1**

Pharmacognosy - Definition and scope — History – Scheme for pharmacognostic studies of a natural drug – Indian Systems of medicine: Ayurveda, Siddha, Yoga, Unani, Homeopathy, Traditional botanical knowledge, Ethnobotany and Folklore medicines - AYUSH

**Unit II**

Medicinal plants – Methods of cultivation, factors affecting cultivation, use of Biofertilizer, pest control. Collection, Harvesting, Drying, Packaging and storage of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. Methods of cultivation of *Aloe vera* and *Ocimum* (Tulsi)

**Unit III**

Tissue culture of endangered medicinal plants- Role of tissue culture in the improvement of medicinal plants – Different types of drug adulteration and substitution – Microscopic analysis and phytochemical evaluation of crude drugs

**Unit IV**

Biological source, geographical distribution, morphology of useful part, active principles and therapeutic value of the following drugs: Fox glove (*Digitalis purpurea*), Myrobalan (*Terminalia chebula*), Neem (*Azadirachta indica*), Turmeric (*Curcuma* sp.), Asafoetida (*Ferulla asafoetida*), Ginger (*Zingiber officinale*), Lemon grass (*Cymbopogon citratus*), Clove (*Syzygium aromaticum*), Vinca (*Catharanthus roseus*)

**Unit V**

Extraction of Bioactive compounds, (Solvent extraction and microwave assisted extraction), Isolation and Characterization of bioactive compounds by Chromatographic techniques (TLC and HPLC), FTIR and NMR.



**Practicals:**

1. Identification and morphological study of drugs included in the syllabus.
2. Determination of Epidermal cell number, Epidermal cell size.
3. Determination of stomatal number, stomatal size, stomatal index, vein islet number, vein termination number and study of trichomes.
4. Determination of Vein islet Number and Vein termination number.
5. Microscopic study of Trichomes

**TEXT BOOKS:**

1. Ansari S H. 2006. Essentials of Pharmacognosy, Birla Publications Pvt. Ltd. Delhi.
2. Khandelwal K R. 2008. Practical Pharmacognosy-Tehcniques & Experiments (19<sup>th</sup> Ed), Nirali Prakashan, Pune.
3. Kolate C K, Purohit A P and Gokhale S B. 2008. Pharmacognosy (42<sup>nd</sup> Ed), Nirali Prakashan, Pune.
4. Mohammed ali. 2008. Text Book Of Pharmacognosy (2<sup>nd</sup>Ed ), CBS Publishers & Distributors, New Delhi.
5. Shah C S and Qadry J S, Shah Prakasha B S, Amdavad.. 2005. A Text Book of Pharmacognosy.

**REFERENCE BOOKS:**

1. Chopra R.N. 1958. Indigenous Plants of India.
2. Chopra, R.N., Nayar S.L. and Chopara I.C. 1956. Glossary of Indian Medicinal plants. CSIR, New Delhi, India.
3. Iyengar, M.A. 1975. A hand book of Pharmacognosy, Manipal.
4. Iyengar, M.A. 1978. Powered drugs of India, Manipal.
5. Kokate, C.K. 1988. Practical Pharmacognosy.
6. Kokate, C.K., A.P. Purohit and S.B. Gokhale. 1995. Pharmacognosy. Furia, Narali Prakashan, Jageshwari Mandir Lane, Pune.
7. Nadkarni, K.M. 1976. Indian Materia Medica, Vol I & II. Popular Prakashan Pvt. Ltd., Bombay.

8. Wallis, T.E. 1985. Test book of Pharmacognosy. CBS Publications and distributors, Bholonath Nagar, Shhadara, Delhi.
9. William Charles Evans. 1989. Trease and Evans Pharmnacognosy. 14<sup>th</sup> Edition.

**SEMESTER-III**  
**SOFT CORE COURSE II**  
**PBSC 318 A -Bioinformatics**

**UNIT-I**

Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www. Internet.

**UNIT-II**

Biological Research on the web: - Using search engines, finding scientific articles, public biological databases, searching biological databases. Use of nucleic acid and protein data banks - NCBI, EMBL, DDBJ, SWISSPORT multiple sequence alignment.

**UNIT-III**

Sequence analysis, pair wise alignment and Database search. Phylogenetic analysis, MEGA, Algorithms- Cladogram and Phylogram. Protein structures-visualizing, predicting and function from a sequence. Phylogenetic tree building- Neighbour joining, UPGMA maximum likelihood parsimony.

**UNIT IV**

Chemical composition - Bio-molecules. DNA, RNA. Structure of DNA, development of DNA sequence methods. Gene finder and feature detection in DNA.

**UNIT V**

Drug designing- Introduction, principles and use of bioinformatics in drug designing.

**Practicals:**

1. Accessing information from database using computer (Eg: Retrieving Nucleic acid sequence, Protein sequence etc.).

**TEXT BOOKS:**

1. Narayan Dubey. 2012. Basics of Bioinformatics. Oxford Book Company.
2. Misenes S and Cravete S.A., Methods in molecular biology Vol 132; Reilly Associates;

**REFERENCE BOOKS:**

1. Baxevanis A.D. and Ouellette B.F. 2001. Bioinformatics, A Practical Guide to the Analysis of Genes and Proteins (free online for NYU students: <http://www3.interscience.wiley.com/cgi-bin/booktoc/104086862>).
2. Jean-Michel Claverie. 2006. Bioinformatics for Dummies. Wiley.

## SEMESTER IV

### HARD CORE COURSE I

#### PBHT 419 - Biochemistry and Plant Physiology

##### Unit I

Monosaccharides and the glycosidic bond. Structure of starch and cellulose. Protein and non-protein amino acids – reductive amination and transamination – glutamate pathway; Molecular configuration and conformation of proteins – primary, secondary, tertiary and quaternary structures – properties and types of proteins – simple, complex and derived proteins.

##### Unit II

Enzymes: Classification, kinetics, mechanism of enzyme action – enzyme inhibition-enzyme regulation-allosteric enzymes-isoenzymes-coenzymes-ribozymes. Structure of Chlorophyll, Carotenoids, phycobilins, anthocyanins and betacyanins. Plant lipids: Fatty acids, phospholipids structure of Ergosterol and cholesterol.  $\beta$ -Oxidation of fatty acid. Structure and properties of cutins, suberins and waxes.

##### Unit III

Water absorption system in Plants – Mechanism of Ascent of Sap. Kinds of transpiration, Guttation and Exudation. Mechanism of stomatal movement. Mechanism of mineral absorption: Passive (Diffusion, Ion Exchange, Donnan Equilibrium and Mass Flow Hypothesis) and Active (Carrier Concept and Electro-Chemical) Theory. Mechanism of Phloem translocation: Pressure flow mechanism, phloem loading and unloading. Root – Microbe interaction in facilitating nutrient uptake.

##### Unit IV

Organization of Pigment system I and II, Absorption Spectrum, Action spectrum, Red drop and Emerson effect. Fluorescence and Phosphorescence. – Hill reaction - Non-cyclic and Cyclic Electron Transport, Photophosphorylation –  $C_3$  and  $C_4$  pathways; CAM pathway. Significance of Photorespiration. Mechanism of Aerobic respiration: Glycolysis and Krebs Cycle, Oxidative phosphorylation. Factors affecting Photosynthesis and Respiration. Symbiotic and asymbiotic nitrogen fixation. Nitrate assimilation.

##### Unit V

Physiological role and mechanism of action of Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene. Photoperiodism and Vernalization. Response of plants to salt, drought, freezing, heat, oxidative and UV stresses-mechanism of stress resistance. Circadian rhythm in plants. Signal transduction: receptors and G-Proteins, phospholipid signaling, calcium- calmodulin cascade.

### **Practicals**

1. Measurement of stomatal index and frequency.
2. Determination of water potential.
3. Determination of solute potential.
4. Estimation of total acidity in CAM plants.
5. Estimation of photosynthetic pigments – a, b, total chlorophyll and carotenoids by standard procedures.
6. Separation of photosynthetic pigments by paper chromatography.
7. Estimation of total nitrogen by Nesslerization method (or) Microkjeldhal method.
8. Extraction of amylase and determination of its activity.

### **TEXT BOOKS:**

1. Bhattacharya A, Vijaya Luxmi. 2015. Methods and Techniques in Plant Physiology. New India Publishing Agency
2. Devlin and Witham, 1986. Plant Physiology, CBS Publishers and Distributors, New Delhi.
3. Ghosh and Mukerjee. Photosynthesis.
4. Jain V K. 2017. Fundamentals of Plant Physiology (Latest edition). S Chand Publishing Comp.
5. Noggle, G.R. and Fritz, G.J. 1976. Introductory Plant Physiology. Prentice Hall, India, New Delhi.
6. Salisbury F.B and Ross C.W. 1992. Plant physiology (Fourth Edition) Wordsworth Publishing Company, California, USA.
7. Sinha, R. K. 2004. Modern Plant Physiology, Narosa Publishing House, New Delhi.
8. Verma V. 2016. Plant Physiology. Athena Academic
9. Voet and Voet, 1992. Biochemistry, John Wiley and Sons., New York, USA.

### **REFERENCE BOOKS:**

1. Bray, C.M. 1983. Nitrogen metabolism in plants. Longman, England.
2. Casey, E. J. 1962. Biophysics: Concepts and mechanisms. East West Press, New Delhi.
3. Dennis, D.T., Turpin, D.H., Lefebvre, D.B. and Layzell, D.B. 1997. Plant Metabolism (2<sup>nd</sup> Edn.) Longman, Essex, England.
4. Girma Mekonnen. 2015. Basic Concepts in Plant Physiology. LAP Lambert Academic Publishing
5. Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley and Sons., New York, USA.
6. Kramer, P. J. 1969. Plant and soil water relationships. McGraw Hill Book Company, New York.
7. Lincoln Taiz, Eduardo Zeiger, Ian M. Møller. 2018. Plant Physiology and Development. OUP USA
8. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones, Springer Verlag, New York, USA.
9. Steward, F.C. 1956. Plant Physiology (Vol. I-VID). Addition Clowes & Sons, Limited, London.
10. Taiz, L. and Zeiger, E. 2003. Plant Physiology (Indian Edn.), Panima Publishing Corporation, New Delhi.
11. Vladimir Ivanovich Palladin. 2016. Plant Physiology. Palala Press

**SEMESTER-IV**  
**HARD CORE COURSE II**  
**PBHT 420 - Plant Biotechnology**

**UNIT-I**

Introduction to Plant Biotechnology. Concept of cellular differentiation and totipotency. Tissue culture media (composition, preparation). Types of cultures. Sterilization of explants. Initiation and maintenance of callus and cell suspension culture, organogenesis.

**UNIT-II**

Micropropagation, callus regeneration, axillary shoot induction. Somatic embryogenesis and artificial seeds. Production of haploids, Somaclonal variations, Protoplast isolation culture and fusion. Cybrids. Germplasm storage, Cryopreservation.

**UNIT-III**

Technology of plant cell culture for production of bioactive compounds. Bioreactors systems and models for mass cultivation of plant cells. The production of secondary metabolites from plant cell culture.

**UNIT-IV**

Cell culture as biofactories. *Agrobacterium* mediated gene transfer; *Agrobacterium* based vectors, viral vectors and their application.

**UNIT-V**

Direct gene transfer methods; chemical methods, electroporation, microinjection, particle bombardment. Biotransformation using plant cell cultures.

**Practicals**

1. Plant tissue culture techniques (media preparation, culture of explants).
2. Callus culture.
3. Cell suspension culture.
4. Plant transformation system (demonstration).



5. Study of the design and components of bioreactor and its working principle.
6. Co-culture of *Agrobacterium* with leaf disc method.

**TEXT BOOKS:**

1. Ashwani Kumar, Sopory S K. 2016. Advances in Plant Biotechnology and its applications. I K International Publishing House Pvt. Ltd
2. Bhojwani, S.S. and Rajdan. 2004. Plant Tissue Culture: Theory and Practice.
3. Ignacimuthu, S. 1997. Applied Plant Biotechnology. Tata McGraw Hill.
4. Krishna G.K. A. Elangovan, S. Devika. 2016. Plant Biotechnology. New Vishal
5. Peter M. Gresshoff. 1994. Plant Genome Analysis: Current Topics in Plant Molecular Biology. CRC Press.
6. Roberta Smith. 2000. Plant Tissue Culture: Techniques and Experiments. 2nd ed., Academic Press.
7. Shekhawat MS and Vikrant. 2011. Plant Biotechnology. M.J.P. Publishers, India.
8. Vasil IK. 1988. Cell culture and somatic cell genetics of plants, Vol. 1-6.

**REFERENCE BOOKS:**

1. Ava Freeman. 2019. Plant Biotechnology: Principles and Future Prospects. Callisto
2. Bernard R. Glick and John E. Thompson. 1993. Methods in Plant Molecular Biology and Biotechnology, CRC Press.
3. Bhowjwani, S.S. 1990. Plant Tissue Culture: Application and Limitations. Amsterdam, Elsevier.
4. Charles Cunningham and Andrew J.R. Porter. 1997. Recombinant Proteins from Plants: Production and Isolation of Clinically Useful Compounds (Methods in Biotechnology), Humana Press.
5. Crispeels, M.J. and Sadava, D.E. 2003. Plants, Genes and Crop Biotechnology, Jones and Bartlett Publishers (2nd Edition).
6. Isabel Nelson. 2019. Plants, Genes and Crop Biotechnology. Callisto Reference
7. John Hammond, Peter McGarvey, Vidadi Yusibov. 1999. Plant Biotechnology: New Products. And Applications, Springer Verlag.

8. Potrykus I. and Spangenberg. 1997. Gene Transfer to Plants (Springer Lab Manual), Springer Verlag.
9. Purohit SS. 2014. Principles of Plant Biotechnology. Agrobios Reference
10. Roberta Smith. 2000. Plant Tissue Culture: Techniques and Experiments, Academic Press; 2nd ed.
11. Slater. 2012. Plant Biotechnology. Oxford University Press

**SEMESTER IV**  
**HARD CORE COURSE III (OPTIONAL)**  
**PBHT 420A - Biodiversity and Conservation**

**UNIT - I**

Biological Diversity: Definition- evolution of the concept- types and measures of biodiversity- Species Concept - Species, Community and ecosystem diversity, Genetic diversity, values and importance - Species Inventory and Systematics in Diversity Environment and Genetic Variations – Biological Classification – Biological and Phylogenetic Concepts.

**UNIT II**

Species Diversity – Global Distribution of Species – Latitudinal and Altitudinal Distribution -Tropical species diversity – Diversity in terrestrial, marine and freshwater – Micro-organisms-lower and higher plants - Species extinctions - Endangered species; Monitoring indicator species and habitats; Threats to biodiversity: Extinction – Past and present rates of Extinction, Human Caused Extinctions, Endemic species, Extinction rates, Man and animal conflicts.

**UNIT III**

Habitats and Ecosystem – Classification, Ecosystem mapping, tropical forests, grasslands, wetlands, lakes, coral reefs, mangroves; Habitat loss: Habitat destruction – Fragmentation and degradation, desertification,

**UNIT IV**

Economics of Ecosystem, Green Revolution in India and world, Food Plants, forage plants, medicinal and ornamental plants, animal uses – livestock and fisheries.

**UNIT –V**

Conservation and Management – National Legislations, Protection of Wild flora and Fauna - IUCN categories– Red data book and Red list. Protection of National Habitats - National and International Protected Areas Biodiversity. Current Practices in Conservation - *in situ* Conservation and *ex situ* Conservation, hot spots, National and International organizations and Legal Instruments for Biodiversity conservation including Biodiversity Act of 2002 – Patent Act, Agenda 21, Multilateral Treaties,

Convention on Biodiversity. Recent Scientific advances and biotechnology in Biodiversity conservation.

**Practicals:**

1. Taxonomic identification of plants.
2. Vegetation studies by line, quadrates and belt transect methods and their analysis.
3. Species inventory, Diversity and distribution patterns and calculation of indices; establishment of plots and species area curves.

**TEXT BOOKS:**

1. Chaudhuri, A. B. and Sarkar. D. D. 2003. Mega diversity Conservation, flora, Fauna and
2. Dadhich L. K. and A.P. Sharma. 2002. Biodiversity –Strategies for Conservation, APH Publishing Corporation, New Delhi.
3. Khan, T. I and Dhari N Al Ajmi. 1999. Global Biodiversity – Conservation Measure, Pointer Publishers, Jaipur.
4. Kotwal, P.C. and S. Banerjee. 2002. Biodiversity Conservation – In Managed forest and Protected areas, Agrobios, India.
5. Krishnamurthy, K.V. 2003. An Advanced Textbook on Biodiversity – Principles and Practice,. Oxford and IBH Publishing, New Delhi.
6. Melchios G. 2001. Biodiversity and conservation, Oxford and IBH Publishing, New Delhi.
7. Nayar M. P. 1992. Hotspots of Endemic Plants of India, Nepal and Bhutan. Tropical Botanical garden and Research Institute, Thiruvananthapuram.
8. Puspangadan P, Ravi K and Santhosh V. 1997. Conservation and Echnomic Evaluation of Biodiversity. Oxford and IBH Publishing, New Delhi.
9. Singh, M.P., B.S. Singh and Soma S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, Delhi.
10. Sinha, R. K 1997. Global Biodiversity, INA Shree Publishers, Jaipur

### **REFERENCE BOOKS:**

1. Francesco, C. 1996. Biodiversity, Science and Development, Backhuys Publishers, The Netherlands.
2. Groombridge, B. 1992. Global Biodiversity – Status of the Earths Living Resources, Chapman & Hall, London.
3. IUCN 1992. Global Biodiversity and Strategy.
4. Kato, M. 1999. The Biology of Biodiversity, Springer Verlag, Tokyo. M.Sc. Environmental Sciences (UD) 2011-12
5. Ramade, F. 1991. Ecology of Natural Resources, John Wiley.

## **SEMESTER IV**

### **HARD CORE COURSE IV (OPTIONAL)**

#### **PBHT 420B – Research Methodology**

##### **Unit I**

Choosing the problem for research – Review of Literature – Primary, Secondary and Tertiary sources, Bibliographs – Indexing and abstracting, Reporting the results of research in conference, Oral and Poster presentation.

##### **Unit II**

Planning, preparation and organization of thesis, Research journals, National and International monographs – Reprints – Proof correction, Thesis writing, Full paper – Short Communication – Review Paper.

##### **Unit III**

Organization to computer – CPU – Input and output devices – Memory – Internal and external storage memory – Knowledge about windows and its scientific applications (MS Office, Power Point, Excel) – Retrieval of information from internet. Plagiarism – ethics – copyrights – biosafety.

##### **Unit IV**

Scientific data collection, source and methods – Web browsing and searching. Tabulation – Graphical and diagrammatic representation, Literature and refer ence collection, Thesis format – Journal format, Citation, proof correction and editing.

##### **Unit V**

Databases and networks- citation index- H index- Pub Med, Scopus, Researchgate, Linkedin, open access policy-IPR.

##### **Practicals:**

1. Preparation of abstract.
2. Graphical representation of data.
3. Training to the student to prepare bibliography.

**TEXT BOOKS:**

1. Balagurusamy, E. 1985. Programming in BASIC. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Connor and Peter Woodford. 1979. Writing Scientific Paper in English Pitman. Medical Publishing Co. Ltd., England.
3. Edekar, V. H., 1982. How to write assignments, Research papers, dissertations, Kanak publ., New Delhi.

**References:**

1. Debbie Holmes, Peter Moody, Diana Dine, and Laurence Trueman. 2016. Research Methods for the Biosciences, Third Edition. Oxford University Press..
2. Jayaraman, J. 1972. Techniques in Biology. Higginbothams Pvt. Ltd., Madras.
3. Kothari, C. R. 1991. Research Methodology: Methods and Techniques. Wiley Eastern Ltd., New Delhi.
4. Sree Ramulu, V. S. 1988. Thesis Writing. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

**SEMESTER IV**  
**SOFT CORE COURSE I**  
**PBSC 424 – Mushroom Cultivation**

**Unit I**

Introduction, History and importance of mushrooms, Vegetative characters - Formation and development of Basidiocarp, structure of basidiocarp - *Agaricus*. Mushroom research centres in India and in local environments.

**Unit II**

Isolation and culture of spores, media preparation for culture. Production of mother spawn, bed spawn, multiplication of spawn - Inoculation Technique - Cultivation technology - Substrates, composting technology, bed, polythene bag preparation, spawning - casing – Cropping.

**Unit III**

Mushroom production - Harvest - Storage methods and marketing. Nutritional value of mushrooms. Value addition in mushrooms. Use of spent Mushroom in vermicomposting and in organic farming/.

**Unit IV**

Edible, and medicinal Mushrooms. Management of fungal, bacterial, and viral diseases of mushroom, Health hazards associated with mushroom cultivation

**Unit-V**

Cultivation of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus florida*) and paddy straw mushroom (*Volvariella volvcea*).

**TEXT BOOKS:**

1. Alice, D., Muthusamy and Yesuraja, M. 1999. Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
2. Marimuthu, T. et al. 1991. Oyster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
3. Nita Bhal. 2000. Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.



4. Pathak, V. N. and Yadav, N. 1998. Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tewari Pankaj Kapoor, S. C. 1988. Mushroom Cultivation. Mittal Publication, New Delhi.
6. Tripathi, D. P. 2005. Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Alexander Schwab. 2007. Mushrooming without Fear : The Beginner's Guide to Collecting Safe and Delicious Mushrooms. Skyhorse Publishing
2. Bob Harris. 2003. Growing Wild Mushrooms : A Complete Guide to Cultivating Edible and Hallucinogenic Mushrooms. Ronin Publishing
3. Nikulsinh M. Chauhan. 2013. Scientific Cultivation of Mushroom. Biotech Books
4. Robin Gogoi Yella Rathaiah T R Borah. 2006. Mushroom Cultivation Technology. Scientific Publishers
5. Singh R. 2017. Modern Mushroom Cultivation and Recipes. Agrobios (India)
6. Tradd Cotter. 2014. Organic Mushroom Farming and Mycoremediation: Simple to Advanced and Experimental Techniques for Indoor and Outdoor Cultivation. Chelsea Green Publishing Co.

**M.Sc. PLANT BIOLOGY AND BIOTECHNOLOGY**

**MARKS FOR THEORY PAPER**

- Each Paper Maximum Marks = 100 Marks
- CIA = 40 Marks
- End Semester Examination = 60 Marks

**QUESTION PAPER PATTERN**

Kanchi Mamunivar Centre for Postgraduate Studies (Autonomous), Lawspet,  
Puducherry

**M.Sc. PLANT BIOLOGY AND BIOTECHNOLOGY**

**Time: 3 Hours**

**Maximum: 60 Marks**

**SEMESTER-I-IV**

**Hard Core Course I-PBHT 101-Title of the paper**

**Section-A (10 X 1 = 10 Marks)**

Questions 1-10 (Two Question from each Unit)

Answer all question; Each answer should not exceed 50 words

**Section-B (5 X 4 = 20 Marks)**

Questions 11-15 with internal choice

Answer all the questions; Each answer should not exceed 200 words

11. (a) or (b)

12. (a) or (b)

13. (a) or (b)

14. (a) or (b)

15. (a) or (b)

(One Question from each Unit)

**Section-C (3 X 10 = 30 Marks)**

Questions 16-20

Answer any three questions; Each answer should not exceed 600 words

One Question from each Unit.

Maximum two subdivisions in a Question.

**M.Sc. PLANT BIOLOGY AND BIOTECHNOLOGY**  
**INSTRUCTIONS TO QUESTION PAPER SETTERS**

**Time: 3 Hours**

**Maximum: 60 Marks**

Section-A = 10 Questions

Choose two questions from each Unit

Section-B = 5 Questions with internal choice

Choose one question from each unit

Section- C = 5 Questions

One from each unit

**Model theory question paper for Hard core and Soft core**  
**Kanchi Mamunivar Centre for Postgraduate Studies (Autonomous), Puducherry - 8**  
**M. Sc. Plant Biology and Biotechnology**  
**Semester –I, Hard Core Course - I**  
**Paper I: PBHT 101 – Microbiology and Plant Pathology**

**Time: 3 hours**

**Max. Marks: 60**

**Section – A (10x1=10 marks)**

**Answer all the questions**

**Each answer should not exceed 50 words**

- |                        |                   |
|------------------------|-------------------|
| 1. Pasteurization      | 1. Lyophilization |
| 2. <i>Azospirillum</i> | 2. Bioreactor     |
| 3. Bacteriophage       | 3. cDNA           |
| 4. Pathogen            | 4. Apoptosis      |
| 5. Gyrases             | 5. Nitrification  |

**Section – B (5x4=20 marks)**

**Answer all five questions**

**Each answer should not exceed 200 words**

11.(a) Write notes on gram staining technique.

**OR**

(b) Describe the various methods of preservation of microbes

12.(a) Briefly describe the positive interactions of microbes in soil.

**OR**

(b) Describe the design and application of a biofermentor.

13.(a) Write notes on bacterial transformation.

**OR**

(b) Describe about genomic library.

14.(a) Write briefly on cell to cell fusion in plant cells.

**OR**

(b) Describe the pathogen induced diseases in plants.

15.(a) Write a note on lytic cycle in bacteriophage.

**OR**

(b) Describe the methods of sterilization.

**Section – C (3x10=30 marks)**

**Answer all three questions**

**Each answer should not exceed 600 words**

16. Write in detail about the culture techniques in microbiology.

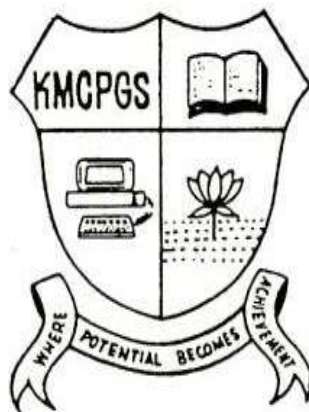
17. Write explanatory notes on air borne diseases.

18. Discuss about the sexual reproduction in bacteria.

19. Write an essay on Host- Parasite interactions at whole plant, cellular and molecular level.

20. Describe in detail about the programmed cell death.

**Government of Puducherry**  
**DEPARTMENT OF BOTANY**  
**KANCHI MAMUNIVAR CENTRE FOR POSTGRADUATE STUDIES**  
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**LAWSPET, PUDUCHERRY – 605 008**  
**TEL: 0413-2251687**



**CBCS-SYLLABUS**  
**M. Phil. BOTANY**  
**(For semesters I and II)**  
**2019-2020**

**KANCHI MAMUNIVAR CENTRE FOR POST-GRADUATE STUDIES****(AUTONOMOUS), PUDUCHERRY – 605 008****M. Phil. Scheme of Examination - Credits****Total No. of credits: 36****Total Marks: 500**

<b>Semester</b>	<b>Paper</b>	<b>Paper code</b>	<b>Title of the paper</b>	<b>No. of hrs/week (15)</b>	<b>No. of credits</b>	<b>Total no. of credits</b>	<b>Marks for the paper</b>
<b>I</b>	<b>Paper-I</b>	<b>MHT-11</b>	<b>Research Methodology</b>	<b>5</b>	<b>6</b>	<b>18</b>	<b>100</b>
	<b>Paper-II</b>	<b>MHT-12</b>	<b>Adv. Topics in Botany</b>	<b>5</b>	<b>6</b>		<b>100</b>
	<b>Paper-III</b>	<b>MHT-13</b>	<b>Area Paper</b>	<b>5</b>	<b>6</b>		<b>100</b>
<b>II</b>	<b>Paper-V</b>	<b>MHD-22</b>	<b>Dissertation</b>	<b>15</b>	<b>15</b>	<b>18</b>	<b>150</b>
	<b>Paper-VI</b>	<b>MHV-23</b>	<b>Viva Voce</b>	<b>--</b>	<b>3</b>		<b>50</b>

**Total Credits = 36**

## **M. Phil. in Botany**

### **SEMESTER-I**

#### **Paper –I- MHT 11 – Research Methodology**

##### **Unit I: Microscopy and Centrifugation**

Microscopy - Differential interference contrast (DIC), polarization, fluorescent Microscopy, dark field and phase contrast microscopy. Electron microscope - SEM and TEM. Atomic Force Microscopy. Centrifugation: Principle and Types of centrifuges. Ultracentrifugation, density gradient centrifugation and continuous centrifugation.

##### **Unit II: Spectrometry and Electrophoresis**

Spectrophotometer - Principle – Beer Lambert's Law. UV, IR, FTIR, Atomic Absorption Spectroscopy and NMR. Electrophoresis: Principle of Gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE & SDS PAGE) and Agarose gel electrophoresis, comet assay and capillary electrophoresis. Two dimensional electrophoresis and isoelectrofocussing.

##### **Unit III: Separation Techniques (Chromatography)**

Chromatography: Principle, Procedures and Application of TLC, PC, Gel Filtration and Ion exchange, Affinity Chromatography, GC, GLC, HPLC(High-performance liquid chromatography), FPLC (Fast protein liquid chromatography) and HPTLC (High performance thin layer chromatography).

##### **Unit IV: Molecular Biological Techniques**

Molecular biological techniques: Isolation and amplification of nucleic acid- Genome DNA (*E.coli*), Plasmid DNA, total RNA, Polymerase chain reaction – Types and its application. Gene cloning techniques, Use of adapters and linkers in cloning-screening of recombinants-labeling of nucleic acids by radioactive methods plaque and colony hybridization.

##### **Unit V: Biostatistics**

Biostatistics: Collection and Presentation of Experimental data. Biological significance of correlation and regression – Tests of significance: Basis of statistical inference – Student's 't' test for mean, difference of means and test for correlation and regression coefficients – Chi-square test – Analysis of variance and DMRT (Duncan's multiple range test).

## References

1. Becker, J.M., Caldwell, G.A. and Zachgo, E.A. 1996. Biotechnology: A Laboratory Course, 2nd Edn. Academic Press, Inc., San Diego, California.
2. Chirikjian, J.G.1995. Biotechnology: Theory and Techniques Vol. I. Plant Biotechnology, Animal Cell Culture, Immuno-biotechnology. Jones and Bartlett Publishers, London, England.
3. Cynthia Gibas and Per Jambek. 2001. Developing Bioinformatics computer skills, Shroff Pub., Mumbai.
4. Gupta, S.C. and Kapoor, V.K. 2002. Fundamentals of Mathematical Statistics, (11th Edn) Sultan Chand and Sons, New Delhi.
5. Harborne, J.B. 1998. Phytochemical Methods. Chapman & Hall, London.
6. Jordan, D.W. and Smith, P. 2002. Mathematical Techniques. Oxford University Press, New Delhi.
7. Primrose, *et al.* 2005. Principles of gene manipulation. Black Well Science, London.
8. Sambrok and Russel. 2001. Molecular cloning-A laboratory manual. Cold Spring Laboratory Press, New York.
9. Wilson K, Walker, J. 1994 . Principle and techniques of practical biochemistry, 4th Ed) Cambridge university press, Cambridge.



## **M. Phil. in BOTANY**

### **SEMESTER-I**

#### **Paper –II- MHT 12 – Advanced Topics in Botany**

##### **Unit I: Diversity of Life forms**

Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants – Important criteria used for the classification of each taxon - Major habitat types, seasonality and phenology of the sub-continent, geographic origins and migrations of species.

##### **Unit II: Strategies for Conservation**

Protected areas in India – Sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity – gene banks, seed banks, cryobanks, General account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific and industrial Research (CSIR), and the Department of Biotechnology (DBT)

##### **Unit III: Bio-safety and Intellectual Property Rights (IPR)**

Bio-safety-methods and implication of Genetically modified organisms - Intellectual Property Protection (IPP), Intellectual Property Rights (Patents, Trademarks, trade secrets and copy rights), GATT, TRIPS, and WHO - Patenting of biological materials, obligation with patent application, Patenting of transgenics, Plant breeders right and farmers right- Biohazards of GMO.

##### **Unit IV: Bio-informatics and Molecular Biology**

Bioinformatics - introduction, Databases, Protein sequencing, macromolecule structures and nucleic acid sequencing; Nano DNA technology: Concept and application - PCR variations and application; DNA modifying enzymes - nucleases, polymerases, restriction endonucleases, Nucleic acid and blotting techniques.

##### **Unit V: Data Collection and Analysis**

Web browsing and searching - Electronic biological data bases – NCBI, Pub Med, Sequence and Structure data bases. Research publications, preparation of manuscripts-full paper, short communications. Review of articles, Thesis writing, Bibliography and Proof reading, Journal citation index, H index, Plagiarism and Ethics.

**TEXT BOOKS:**

1. Adams V.D. Fields C, Venter J.C. – Automated DNA sequencing and analysis.
2. Anonymous, 1997. Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy.
3. Bishop V.J. Rawling C.J. – Nucleic acid and protein sequences analysis. A practical approach.
5. Bryan Bergeron. Bioinformatics computing, Pearson Education.
6. Conway, G and Barbier, E.1994. Plant Genes and Agriculture. Jones and Barlett. Publishers Bostori.
7. Cristi, B.R.(ed) 1999. CRC Handbook of Plant Sciences and Agriculture. Vol I in-situ Conservation. CRC Press Boca Roton, Florida. USA.

**REFERENCE BOOKS:**

1. De.K.K. 1987 Plant Tissue Culture. New Central Book Agency, Calcutta.
2. Dubey, R.C 2001 Text Book of Biotechnology, S. Chand & Co., New Delhi.
3. Falk, D.A., Olwell, M and Millan C. 1996. Restoring Diversity. Island Press. Columbia, USA
4. Frankel, OH., Brown, AHD & Burdon. J.J.1995. The Conservation of plant Diversity. Cambridge University Press Cambridge, UK
5. Gupta, P.K. Elements of Biotechnology – Rastogi publications.
6. Kumar, H.D 1993. Molecular Biology and Biotechnology, Vikas publishers, New Delhi.
7. Martell and Smith. 1983. Plant Biotechnology, Cambridge U.K. University Press.
8. Old, R.W. and Primerose, S.B.1996. Principles of Gene manipulation, Black well – Scientific publications, London.
9. Paroda, R.S. and Arora, R.K. 1998. Plant Genetic Resources: Conservation and management. IPGRI (Publication) Wouth Asia Office c/o NBPGR, Pusa Campus, New Delhi.
10. Westhead D.R. Parish, JH and Twyman RM 2003. Bioinformatics, Viva publishers.

## M.PHIL. BOTANY

### SEMESTER-I

#### PAPER III - APPLIED MICROBIOLOGY (Area/Special paper)

##### Unit I

**Methods in Microbiology:** Types of media and preparation of media. Isolation of bacteria and fungi from soil/water/plant tissues (endophytes). Pure culture techniques, Maintenance and preservation of pure cultures. Staining of microbes-simple /differential/ acid fast/negative staining.

##### Unit II

**Microbial Secondary Metabolites:** Primary and secondary metabolism and metabolites. General structure and function of fermenters, characteristics of large scale fermenters, scale up process. Isolation and screening methods of microbes for antibiotic production, Strain improvement.

##### Unit III

**Agricultural microbiology:** Microbes and soil fertility- Biofertilizers-N<sub>2</sub> fixers (symbiotic/ non-symbiotic / associative), phosphate solublizers. Mycorrhizae-types, structure / function and role in ecosystem (agriculture/horticulture/ afforestation). Microbes in plant protection-biological control & mechanism involved. Biopesticides/ biofungicides, *Bacillus thuringiensis*.

##### Unit IV

**Industrial Microbiology:** Microbes in industry, Industrial fermentation. Bioreactors, batch /continuous / fed batch fermentation. Production of antibiotics-penicillin and streptomycin. Scale up process and Down stream processing, Microorganisms as source of food: yeast as food (SCP) and food supplement, Mushroom as a food source.

##### Unit V

**Environmental applications:** Microbes in sewage and waste water treatment, degradation of xenobiotics, mineral recovery, Composting, Bioconversion of waste. Microbial biosensors, Bioremediation (oil and heavy metals).

**M. Phil. BOTANY**  
**SEMESTER-I**  
**PAPER –III: APPLIED PLANT BIOTECHNOLOGY (Area/Special paper)**

**Unit I- Plant Tissue Culture**

History of Plant Tissue culture, Regeneration and Totipotency, Concept of Tissue Culture Lab and Green Houses, Nutrient Medium Preparation – MS and N<sub>6</sub> Medium, Sterilization Methods- Steam, Dry and Filter Sterilization, Types and Preparation of Explants, Inoculation techniques and Maintenance of Cultures.

**Unit II- Regeneration and Metabolites Production**

Role of Plant Growth Regulators in Regeneration, Micro-propagation, Callus Culture, Organogenesis, Somatic embryogenesis and Production of Synthetic Seeds, Protoplast Culture and Hybridization, Anther Culture and Haploids Production, Production of Secondary Metabolites and its Significance, Acclimatization and Hardening Techniques.

**Unit III -Transgenesis and Molecular Analysis**

Marker genes, Reporter genes, isolation and Manipulation of Ti plasmid, *Agrobacterium* and Biolistic-mediated Gene Transformation, Isolation of genomic DNA, PCR and its application for Transgenic analysis, Selection of Putative Transgenics by radioactive mediated hybridization Techniques, Southern blotting, Northern blotting and Western blotting.

**Unit IV-Production of Transgenic Plants**

Transgenics in crop improvement: Herbicide, and Pesticide resistance, Insect resistance-*Bacillus thuringiensis* approach and Disease resistance, Abiotic-Stress Tolerant Plants: Resistance to Drought, Salinity and Heavy Metals. Crops with improved yield and Quality- Delayed Ripening, Rice with increased vitamin A content-Golden Rice. Gene silencing in transgenics.

**Unit V-Molecular Pharming**

Pharmaceutical Crops and the danger to our food supply. Advantages and disadvantages of using plants as bioreactors. Medical Pharming: Pharmaceuticals, Plantibodies, Edible Vaccines, Edible interferons. Non-medical Pharming: Industrial enzymes and Bioplastics.

**KANCHI MAMUNIVAR CENTRE FOR POST-GRADUATE STUDIES  
(AUTONOMOUS), PUDUCHERRY – 605 008**

**M. Phil. in Botany  
SEMESTER-I**

<b>Paper I: MHT 11 – Research Methodology</b>	<b>Marks 100</b> <b>(60 Theory+40 Internal)</b>
<b>Paper II: MHT 12 – Advanced Topics in Botany</b>	<b>Marks 100</b> <b>(60 Theory+40 Internal)</b>
<b>Paper –III- MHT 13 – Area Paper (Guide paper)</b>	<b>Marks 100</b>

**KANCHI MAMUNIVAR CENTRE FOR POST-GRADUATE STUDIES  
(AUTONOMOUS), PUDUCHERRY – 605 008**

**M. Phil. in Botany**

**Semester-II**

**Paper –IV- MHD 22 – Dissertation (Marks 150)**

**External Mark: 100, Internal Mark: 50**

**Paper –V- MHV 23 – Viva Voce (Marks - 50)**

**Model Question Paper**

**M. Phil. BOTANY Degree Examination, 2019**

**Semester-I-Paper-I-MHT 11- Research Methodology**

**Time: 3 Hours**

**Max. Marks: 60**

**Section-A**

**(10×1=10 marks)**

Answer all the questions

- |                             |                     |
|-----------------------------|---------------------|
| 1. Resolution               | 6. SEM              |
| 2. Electrophoretic mobility | 7. FTIR             |
| 3. Genomic DNA              | 8. TLC              |
| 4. ANOVA                    | 9. PCR              |
| 5. PubMed                   | 10. Chi-square Test |

**Section-B**

**(5×4=20 marks)**

Answer all the questions

6. (a) Describe the optical pathway of phase contrast microscope.  
(OR)  
(b) Explain the basic principles and image formation in TEM.
7. (a) Describe the qualitative analysis of DNA using Electrophoresis technique.  
(OR)  
(b) Give an account on Isoelectric focusing and its significances.
8. (a) Write down the role of adapters and linkers in cloning technique.  
(OR)  
(b) Describe the method of isolation of pure DNA from plant tissue.
9. (a) Explain the various modes of presentation of experimental data.  
(OR)  
(b) Give a brief note on various electronic biological data bases.
10. (a) Describe the Regression coefficient and its advantages.  
(OR)  
(b) Write a note on (i) H-index (ii) Plagiarism.

**Section-C**

**(3×10=30 marks)**

Answer any three questions

11. Describe the basic principles and working mechanism of Density gradient centrifugation.
12. Give a detailed note on working principles of Atomic Absorption Spectroscopy.
13. Discuss the principles, separation methods and applications of HPLC.
14. Describe the process of DNA finger printing technique.
15. Discuss the various components of thesis writing.

**Model Question Paper**  
**M. Phil. BOTANY Degree Examination, 2019**

**Semester-I-Paper-II-MHT 12- Advanced Topics in Botany**

**Time: 3 Hours**

**Max. Marks: 60**

**Section-A**

**(10×1=10 marks)**

Answer all the questions

- |                        |               |
|------------------------|---------------|
| 1. Taxonomic Hierarchy | 6. Microarray |
| 2. Gene bank           | 7. NBPGR      |
| 3. TRIPS               | 8. Transgene  |
| 4. Biological hazards  | 9. GMO        |
| 5. Southern blot       | 10. H Index   |

**Section-B**

**(5×4=20 marks)**

Answer all the questions

6. (a) Illustrate the important criteria used for the classification of each taxon.  
(OR)  
(b) Write an account on migration of plant species.
7. (a) Write down the role of seed banks and cryobanks in conservation.  
(OR)  
(b) Describe the role of wetland and mangrove ecosystem in biodiversity conservation.
8. (a) Give a note on trademarks and copyrights.  
(OR)  
(b) Explain the bio-safety methods followed in GM organisms.
9. (a) Describe the concept of Intellectual property protection and its importance.  
(OR)  
(b) Write a note on Plant breeder's right and farmer's right.
10. (a) Describe the steps in Protein sequencing.  
(OR)  
(b) Give an account on Nano DNA technology and its applications.

**Section-C**

**(3×10=30 marks)**

Answer any three questions

11. Describe the classical and quantitative methods of taxonomy of plants.
12. Give a detailed note on activities of BSI, ICAR and DBT.
13. Discuss the role of National parks, biosphere reserves and coral reefs in the conservation of wild biodiversity.
14. Write an essay on patenting of biological materials and transgenics.
15. Discuss the various polymerases and restriction endonucleases as DNA modifying enzymes.



**Model Question Paper**  
**M. Phil. Botany Examination, 2019**

**Semester-I-Paper-III-MHT 13: Area paper- Applied Microbiology**

Question Paper

**Time: 3 Hours**

**Max. Marks: 100**

**Section-A (10×2=20 marks)**

Answer all the questions

- |                          |                            |
|--------------------------|----------------------------|
| 1. Differential staining | 6. N <sub>2</sub> fixation |
| 2. Endophytes            | 7. SCP                     |
| 3. Secondary metabolites | 8. Fed batch culture       |
| 4. Streptomycin          | 9. Xenobiotics             |
| 5. Mycorrhizha           | 10. Bioremediation         |

**(Section-B (4×5=20 marks)**

Answer all the questions

11. (a) Describe on different media used microbial culture.  
(OR)  
(b) Write on acid fast staining.
12. (a) Describe the application of a biofermentor.  
(OR)  
(b) Explain between primary and secondary metabolites.
13. (a) Write short notes on phosphate solubilizing bacteria.  
(OR)  
(b) Discuss the symbiotic nitrogen fixation in plants.
14. (a) Write briefly on downstream process in pharmaceutical industry.  
(OR)  
(b) Describe different process of composting.

**(Section-C (4×15=60 marks)**

Answer any four questions

15. Write a note on preservation of microbes with different techniques.
16. Describe the isolation and screening methods of microbes for antibiotic production.
17. Write a note on strain improvement or strain development.
18. Describe about the microbes involved in soil fertility.
19. Explain the microorganisms as source of food and also food supplement.
20. Describe in detail about the waste water treatment.