

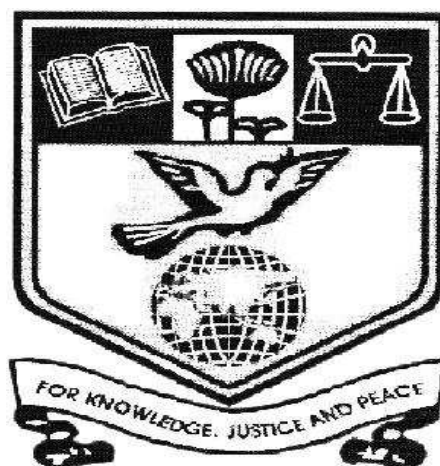
# NEHRU MEMORIAL COLLEGE (AUTONOMOUS)

Nationally Accredited with “A” Grade by NAAC  
PUTHANAMPATTI – 621 007  
TIRUCHIRAPPALLI – Dt

## ***SYLLABUS***

***M.Sc., BOTANY***

**Under -Graduate Programmes – Course Structure under CBCS  
(Candidates admitted from the year 2018 onwards)**



**PG & RESEARCH DEPARTMENT OF BOTANY  
2018**

## **VISION**

- To explore and not to exploit the plant world.
- Continued well-being of the people through excellence in studies, exploration, conservation and sustainable utilization of the plant world.

## **MISSION**

- To provide a student-centered and professions-oriented higher education that bestows academic environment
- To demonstrate and promote creative, intellectual inquiry with positive relationships among students, faculty and staff that enhance the learning experience a fruitful and outstanding one for future application in a dynamic world.

### **PROGRAMME SPECIFIC OBJECTIVES:**

- I. To provide knowledge through various plant groups from primitive to highly evolved
- II. To make the students aware of applications of different plants in various industries.
- III. Equip the students to skill related to the laboratory as well as field based studies
- IV. Make the students aware about conservation and sustainable use of plants.
- V. To address the social economical challenges related to plant sciences.
- VI. To facilitate students for taking up and shaping a successful career in Botany

### **PROGRAMME OUTCOMES:**

- A. To ensure students to achieve an up -date level of understanding and knowledge on the scope and significance of Botany
- B. Knowledge and understanding the range of plant diversity in terms of structure, function and environmental relationships
- C. Communication of scientific ideas in writing and orally, Ability to work as part of a team and Ability to use library resources
- D. Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification
- E. Intellectual skills – able to Plan, conduct and write a report on an independent term project.

## MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A relation between the Program Specific Objectives and the outcomes is given in the table

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES				
	A	B	C	D	E
I	3	2	1	3	2
II	3	2	2	3	2
III	2	3	2	1	3
IV	3	2	1	2	1
V	3	2	3	1	3
VI	3	2	3	3	2

**Contribution**

1: Reasonable

2: Significant

3: Strong

**NEHRU MEMORIAL COLLEGE (AUTONOMOUS)**  
**M.Sc., BOTANY Programme - Course Structure**  
**Under CBCS (Choice Based Credit System)**  
(For the candidates admitted during the year 2018 onwards)

Sem	Courses	Sub code	Title of the Course	Hrs/ week	Credits	Exam Hrs.	Marks		Total
							Int	Ex t	
<b>Semester – I</b>									
I	CC-I		Plant Diversity – I (Algae, Fungi, Lichens & Bryophytes)	4	4	3	25	75	100
	CC-II		Plant Diversity–II (Pteridophytes, Gymnosperm & Paleobotany)	5	4	3	25	75	100
	CC-III		Microbiology, Plant Pathology & Immunology	5	4	3	25	75	100
	CC-IV		Genetics , Plant breeding and Biostatistics.	5	4	3	25	75	100
	CP-I		Core Practical- I (Covering CC-I to CC-IV)	6	4	4	40	60	100
	CEC-I		Candidate has to choose any one of the course from Group –I	5	5	3	25	75	100
				<b>30</b>	<b>25</b>		<b>165</b>	<b>435</b>	<b>600</b>
II	CC-V		Developmental Botany	6	4	3	25	75	100
	CC-VI		Cell and Molecular Biology	6	4	3	25	75	100
	CC-VII		Plant Biochemistry	6	4	3	25	75	100
	CP-II		Core Practical- II (Covering CC-V to CC-VII)	6	4	4	40	60	100
	CEC-II		Candidate has to choose any one of the course from Group –II	6	4	3	25	75	100
			<b>30</b>	<b>20</b>		<b>140</b>	<b>360</b>	<b>500</b>	
III	CC-VIII		Plant Physiology	6	4	3	25	75	100
	CC-IX		Plant Systematics	6	4	3	25	75	100
	CP-III		Core Practical- III (Covering CC-VIII to CC-IX)	6	4	4	40	60	100
	CEC-III		Candidate has to choose any one of the course from Group –III	6	4	3	25	75	100
	CEC-IV		Candidate has to choose any one of the course from Group –IV	6	4	3	25	75	100
			<b>30</b>	<b>20</b>		<b>140</b>	<b>360</b>	<b>500</b>	
IV	CC-X		Research Methodology	5	5	3	25	75	100
	CP-IV		Core Practical –Research methodology	5	5	3	40	60	100
	CEC-V		Candidate has to choose any one of the course from Group –V	5	5	3	25	75	100
			Project work*	15	10	-	-	100	100
			<b>30</b>	<b>25</b>		<b>90</b>	<b>310</b>	<b>400</b>	
			<b>Total</b>				<b>535</b>	<b>1465</b>	<b>2000</b>

**GROUP-I Core Elective Course-I (SEMESTER-I)**

Sub Code	Title of the course	Inst. Hrs /Week	Credits	Marks		
				Int	ext	Total
	Forestry	5	5	25	75	100
	Mushroom cultivation techniques	5	5	25	75	100

**GROUP-II Core Elective Course-II (SEMESTER-II)**

Sub Code	Title of the course	Inst. Hrs /Week	Credits	Marks		
				Int	ext	Total
	Farm Science	6	4	25	75	100
	Plant Tissue Culture	6	4	25	75	100

**GROUP-III Core Elective Course-III (SEMESTER-III)**

Sub Code	Title of the course	Inst. Hrs /Week	Credits	Marks		
				Int	ext	Total
	Ecology and Phytogeography	6	4	25	75	100
	Bioinformatics	6	4	25	75	100

**GROUP-IV Core Elective Course-IV (SEMESTER-III)**

Sub Code	Title of the course	Inst. Hrs /Week	Credits	Marks		
				Int	ext	Total
	Biofertilizers Technology	6	4	25	75	100
	Pharmacognosy	6	4	25	75	100

**GROUP-V Core Elective Course-V (SEMESTER-IV)**

<b>Sub Code</b>	<b>Title of the course</b>	<b>Inst. Hrs /Week</b>	<b>Credits</b>	<b>Marks</b>		
				<b>Int</b>	<b>ext</b>	<b>Total</b>
	Plant Biotechnology and Genetic Engineering	<b>5</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
	Bioinstrumentation and Biotechniques	<b>5</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>

**COURSE DETAILS**

<b>Types of course</b>	<b>Number of course</b>	<b>Inst. Hrs/Week</b>	<b>Credits</b>
<b>Core course</b>	<b>10</b>	<b>54</b>	<b>41</b>
<b>Core practical</b>	<b>4</b>	<b>23</b>	<b>17</b>
<b>Elective</b>	<b>5</b>	<b>28</b>	<b>22</b>
<b>Project</b>	<b>1</b>	<b>15</b>	<b>10</b>
<b>Total</b>	<b>20</b>	<b>120</b>	<b>90</b>

SEM	BOTANY	CT	HOURS	CREDITS
I	<b>Plant Diversity –I (Algae, Fungi, Lichens, &amp; Bryophytes)</b>	CC-I	4	4

### LEARNING OBJECTIVES:

- To understand the salient features of Algae
- To understand the composition of and levels (ecological, organizational, genetic and cultural) of diversity
- To acquire knowledge on general characteristics of fungi
- To familiarize the salient features and economic importance of Bryophytes

#### Unit-I

Introduction to Algae: Algae in diverse habitats (Terrestrial, Fresh water, Marine); Thallus organization (range of thallus) and reproduction (vegetative, asexual, sexual) ; ultrastructure of cell, Flagella, Chloroplast, pyrenoids, and eye spot in major groups of algae; classification of Fritsch ; Life cycle patterns in Algae ; Economic importance of Algae.

#### Unit-II

Major Classes And Genera Of Algae : Comparative study of classes of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, and Rhodophyceae with reference to range of thallus structure of plant body including structure, methods of reproduction and variation in life cycles; life histories of *Chlorella*, *Padina*, *Gelidium*, *Anabaena*, *Diatoms* and *Voucheria*

#### Unit –III

Fungi : General characteristics of Fungi; Range of thallus organization ; Nutrition and growth in fungi ; types of reproduction in fungi ; Fungal classification (Ainsworth, 1971) ; Diagnostic features of different classes of fungi ; structure and life histories of *Plasmodiophora*, *Penicillium*, *Pleorotus*, *Fusarium*, and *Cercospora*. Economic importance of Fungi

#### Unit –IV

Lichens: General features, classification (Miller, 1984), Distribution, thallus organization, reproduction (vegetative, asexual and sexual), Economic importance of lichens.

#### Unit –V

Bryophytes: General characteristics of Bryophytes, classification (Watson, 1955), structural organization of gametophyte and sporophyte in different classes of Bryophytes, life histories of *Marchantia*, *Porella*, *Anthoceros*, *Polytrichum*. Bryophytes as pollution indicators

#### Books for studies:

1. Kumar H.D. 1988. Introductory Phycology. East West Press, New Delhi.
2. Vashista B.R and Sinha, A.K. 2005. Botany for degree students – Algae, S. Chand & Co., New Delhi.
3. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996 - Introductory mycology, John Wiley & Sons Inc., Toronto.
4. Gupta, J.S. 1986. Textbook of fungi. Oxford and IBH publishing company Pvt. Ltd., New Delhi.
5. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophyta, S. Chand & Co., New Delhi.

#### Books for references:

1. James Graham – Lee W. Wilcox - Linda E. Graham (2008). Algae (2<sup>nd</sup> edition)
2. Round, F. E. (1981). The Ecology of Algae. Cambridge University Press, London.
3. A V S S Sambamurty (2005). A Textbook of Algae. I K International
4. S K Singh and Seema Srivastava (2008) A Textbook of Algae. Campus
5. R.M. Johri, Sneh Lata and Kavita Tyagi, (2011). A Textbook of Fungi
6. Rajni Gupta, APH, (2004). A Text Book of Fungi ISBN: 8176487368
7. C.S. Chandoliya (2009). Fungi: Biological Diversity Cyber Tech Pub
8. H.C.I. Gwynne – Vaughan and B. Barnes (2004). Fungi: Their Structure and Development Biotech Books
9. Chopra, R (2005). Biology of Bryophytes. New Age International (P) Ltd . New Delhi



## **COURSE OUTCOMES:**

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

- To learn about the morphology, structure, pigmentation , food reserves and methods of algae
- To differentiate between various groups of Algae, Fungi, and Bryophytes
- To familiarize with the morphological and systematic knowledge about Bryophytes

SEM	BOTANY	CT	HOURS	CREDITS
I	<b>Plant Diversity - II</b> <b>(Pteridophytes, Gymnosperms and</b> <b>Paleobotany)</b>	<b>CC-</b> <b>II</b>	<b>5</b>	<b>4</b>

### COURSE OBJECTIVE

- This paper impart the knowledge about the occurrence, distribution, structure
- To know Life history of Pteridophytes and Gymnosperms besides
- impart adequate information about Paleobotany

#### **Unit- I**

General characters of Pteridophytes. Classification of Pteridophytes (Smith, 1971).  
Variation in morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: Psilotales, Rhyniales, Lycopodiales, Selaginellales, Isoetales, and Equisetales.

#### **Unit - II**

Variation in Morphology, reproduction and evolution of male and female gametophytes and sporophytes of the following orders: Ophioglossales, Marattiales, Osmundales and Stellar evolution in pteridophytes, Heterospory and origin of seed habit. Structure, development and evolution of sorus. Economic importance of Pteridophytes.

#### **Unit - III**

A general account of the characteristic features of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). General structure and interrelationships of Pteridospermales, Bennettitales, Pentoxylales and Cordaitales..

#### **Unit - IV**

A general account on the distribution, morphology, anatomy, reproduction and phylogeny of Cycadales, Coniferales, Ginkgoales, Ephedrales, Welwitschiales and Gnetales - Economic importance of Gymnosperms.

#### **Unit- V**

Concepts of Paleobotany, A general account on Geological Time Scale. Fossil types: Compressions, incrustation, casts, molds, petrifications, coalballs and compactions.

### **Books for studies:**

1. Johri, R.M. Snehlata and Sandhya Sharma, (2004). A Textbook of Pteridophyta. Vedams Books (P) Ltd., New Delhi
2. Rasheed, A. (1999). An Introduction to Pteridophyta, Vikas Publishing Co., New Delhi.
3. Sharma, O.P. (1990). Textbook of Pteridophyta, MacMillan India Ltd., New Delhi.
4. Smith, G.M (1955). Cryptogamic Botany Vol. II, Tata Mcgraw Hill Publishing Co., Ltd., New Delhi.
5. Vashishta, P.C , Sinha and Anilkumar (2010). Pteridophytes, S.Chand & Company Ltd, New Delhi.
6. Vashishta.P.C.(1990). Pteridophyta, S.Chand& Co. Ltd, New Delhi.

### **Books for references:**

1. Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
2. Sporne, K. R. (1972). The Morphology of Pteridophytes. B. I. Publications, Madras.
3. Sundararajan, S. (2007). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
4. Chamberlain, C. J. (1957). Gymnosperms Structure and Evolution. University Chicago Press, New York.
5. Foster, A. S. and Gifford, E. M. (1965). Morphology and Evolution of Vascular Plants. W. H. Freeman & Co.
6. Nikias, K. J. (1981). Paleobotany, Paleocology and Evolution. Praeger Publishers, USA.
7. Seward, A. C. (1919). Fossil Plants. Vol. I, II, III and IV. Cambridge University Press, London.

### **COURSE OUTCOMES:**

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

- Learn about the general characters and classification by K.R. Sporne, stelar evolution in
- Pteridophytes, heterospory and origin of seed habit.
- Know about the structure, life history and Economic importance of Gymnosperms.
- Studied the methods of fossilization and fossil plants

SEM	BOTANY	CT	HOURS	CREDITS
I	Microbiology, Plant Pathology and Immunology	CC-III	5	4

### **COURSE OBJECTIVES:**

- This paper helps to understand about the structure, biology and mode of nutrition of virus and bacteria.
- This paper also gives knowledge on pathogens causing diseases in plants and their mode of action.
- It also provides information on immunology.

#### **Unit -I**

Five kingdom system by Whittaker (1969) – Prokaryotic and Eukaryotic microbes – General features of Viruses – Classification, characteristics, ultra structure, isolation, purification, chemical nature – replication and transmission, Virions and prions, phytoplasma (including mycoplasma), Economic importance.

#### **Unit -II**

Bergey's system of Bacterial classification (1984-1991) – Salient features of Eubacteria, Archibacteria, Cyanobacteria and Actinomycetes. General account on Bacteria, ultra structure, nutrition, growth, reproduction, bacterial culture technique and economic importance.

#### **Unit -III**

Plant pathology – general account on organisms and causal factor responsible for plant diseases – methods of studying plant diseases – Koch's postulates – common terminologies used in plant pathology (symptomology, Etiology, Epidemic disease, Control measures) – Host parasite interactions – Mycotoxins – Aflatoxins, Defense mechanisms in plant – integrated disease management.

#### **Unit -IV**

Common plant diseases of India -Tobacco Mosaic, Cucumber mosaic, Little leaf disease of Brinjal, Citrus canker, Rice blight, Tikka disease of groundnut, Anthracnose of mango, Wilt of Cotton, Downy mildew of grapes, White rust of Mustard, Damping off disease of seedlings.

## Unit- V

Antigen; Structure and functions of different classes of immunoglobulins; Primary and secondary immune response; Lymphocytes and accessory cells; Humoral and cell mediated immunity; MHC; Mechanism of immune response and generation of immunological diversity; Genetic control of immune response, Effector mechanisms; Applications of immunological technique

### Books for studies:

1. Prescott, L.M. and D.A. Harley. 1996. Microbiology. W.W. C. Brown Publishers, London.
2. Pommerville, J.C. 2006. Alcomas Fundamentals of Microbiology. Jones and Bertlett Publishers, London.
3. Atlas, R.M. 1995. Principles of Microbiology. Morby Publishers, St. Louis.
5. Stanier, R.Y., J.L. Ingraham, M.L. Wheelis and P.R. Painter. 1990. The Microbial World, Prentice Hall of India Pvt. Ltd. New Delhi.
6. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. Pandey, B.R. 1997. Plant Pathology. S. Chand and company, New Delhi.
8. Agrios, G.N. 2006. Plant Pathology, Fifth Edition, Academic Press, New York.
9. Detection and diagnosis of plant diseases. M.L. Gullin, Springer, 2014 Chand and Co. Ltd., New Delhi.
10. Kuby, J. (2000). Immunology. 4th ed. W. H. Freeman and Co., New York.

### Books for references:

1. Carpenter, P. L. (1967). Microbiology. Saunders Co., Philadelphia, USA.
2. Davis, B. D., Dulbecco, R., Eiser, H. N. and Grinsberg, H. S. (1980). Microbiology. Harper & Row, New York.
3. Dubey, R. C. and Maheshwari, D. K. (2007). A Textbook of Microbiology. S. Chand and Co. Ltd., New Delhi.
4. Edmond, P. (1978). Microbiology: An Environment Perspective. Macmillan & Co., New Delhi.
5. Ketchum, P. A. (1988). Microbiology: Concepts and Applications. John Wiley & Sons, New York.
6. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. (1993). Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
7. Postage, J. (1975). Microbes and Man. Penguin Book, Baltimore.
8. Salle, A. J. (1974). Fundamental Principles of Bacteriology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
9. Schegal, H. E. (1986). General Microbiology. Cambridge University, London.

10. Sharma, P. D. (1992). Microbiology. Rastogi & Co., Meerut.
11. Staley, J. T. *et al.*. (1991). Bergey's Manual of Systematic Bacteriology. Vol. I to IV. Williams & Wilkins, London.
12. Stanier, R. Y., Adelberg, E. A. and Ingram, J. L. (1978). General Microbiology. Mac Millan & Co., New Delhi.
13. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
14. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
15. Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
16. Rangaswamy, G. (1972). Diseases of Crop Plants in India. Prentice Hall of India P Ltd.
17. Rangaswamy, G. and Soumini Rajagopalan. (1973). Bacterial Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
18. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
19. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn & Co., Boston.
20. Southey, J. F. (1965). Plant Nematology. Tech. Bull. No.7, Ministry of Agricultural, Fisheries and Food, Her Majesty's Stationery Office, London.
21. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc.,

### **Immunology**

10. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand and Co. Ltd., New Delhi.
11. Kuby, J. (2000). Immunology. 4th ed. W. H. Freeman and Co., New York.
12. Wein and Stewart, J. (1997). Immunology, Churchill Livingstone, New York.

### **COURSE OUTCOMES:**

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

- Learn about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic
- Know about organisms and causal factor responsible for plant diseases
- & methods of studying plant diseases
- Demonstrate about the immune system and importance

SEM	BOTANY	CT	HOURS	CREDITS
I	<b>Genetics, Plant Breeding and Biostatistics</b>	CC-IV	5	4

## **COURSE OBJECTIVE**

- To acquire broad knowledge on basic and recent trends of genetics
- To understand the various aspects of plant breeding and its methodologies
- Students will be able to make informed decisions based on data and apply statistical tools and techniques in their research works

### **Unit- I**

Mendelian Laws of inheritance – interaction of genes, Multiple alleles and pseudoalleles, color blindness in human beings, Chromosome theory of inheritance, sex determination in plants, theories of sex determination. Sex linked characters – primary, secondary and permanent, non-disjunction of sex chromosomes in Drosophila. Sex influenced and sex limited characters

### **Unit - II**

Modern concept of genes. Fine structure of the gene, IS Element – transposons. Regulation of gene expression in Eukaryotes and Prokaryotes. Gene mutation – Detection of mutation CIB Method, Muller method, Biochemical mutants in Bacteria and Neurospora. Detection of mutation in Bacterio-phages and higher plants. Molecular basis of mutation, physical and chemical mutagens and their mode of action.

### **Unit - III**

Extrachromosomal inheritance, genome of mitochondria and plastids and their role in inheritance. Uniparental inheritance in Chlamydomonas and Paramecium –Male sterility. The law DNA constancy and C-value paradox; Numerical and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; Environmental mutagenesis and toxicity testing; Population genetics

### **Unit - IV**

Principles of plant breeding; Important conventional methods of breeding self and cross pollinated and vegetatively propagated crops; Non conventional methods; Polyploidy ; Genetic variability; Plant diseases and defensive mechanisms. Methods of plant breeding self-fertilized, cross fertilized and vegetatively propagated plants. Breeding plants for improving yield, quality, resistant to diseases and pests.

## Unit -V

Population and sampling. Data collection & Representation – graph and tabulation. Measures of central tendency – mean (only arithmetic), median and mode. Measures of dispersion –mean, deviation, standard deviation and standard error. Probability of distribution (binomial, Poisson & normal). Tests of statistical significance – chi-Square test, t-test, Regression and Correlation, Analysis of variance.

### Books for studies:

1. Freifielder, D. (1995). Microbial Genetics. Narosa Publication, New Delhi.
2. Verma P.S. and Agarwal V.K. (2007) cell biology, Genetics, molecular biology and evolution, S.Chand and company Ltd, New Delhi.
3. Verma P.S. and Agarwal V.K. (2010) Genetics, S.Chand and Company Ltd, New Delhi.
4. Gupta, P.K (2009). Genetics, Rastogi publications, Meerut, New Delhi
5. Sadhu, M.K.1996. Plant propagation. New age international publisher, New Delhi.
6. Sinha, V and Suinta sinha, 1990. Cytogenetics, Plant breeding and Evolution, Vikas publishing Home Pvt Ltd.

### Books for references:

1. Gardener, E.J. (1975). 5th Ed. Principles of Genetics, Johanwiley, New York.
2. Gilber, N.W. (1978). Organellar Heredity, Revan Press, New York.
3. Gupta, P.K. (1994). Genetics. Rastogi Publication, Meerut, India.
4. King, R.C. (1975). A Hand book of Genetics, Plenum Press, New York.
5. Strickboarger, M.V. (1977). Genetics, Mac Milian, New York.
6. Arnold, R.W. (1960). Principles of Plant Breeding. Jolin Wily & Sons, Inc, New York.
7. Sing, D.D.Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
8. Swaminathan, M.S. And Jana.S (1992). Biodiversity. Mac Millan, India Press, Madras.
9. Khan, J.D and Khanum, A. (1994), Fundamentals of Biostatistics.
10. Zar, J.K. (1984) Biostatistical analysis, Prentice-Hall International, INC, Engleword chiffs, New Jersey.

### COURSE OUTCOMES:

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

- Learn about Mendelian principles
- Know about gene mapping methods & Extra chromosomal inheritance
- Familiarize about Evolution & Emergence of evolutionary thoughts
- Gain knowledge on Plant breeding techniques



SEM	BOTANY	CT	HOURS	CREDITS
II	<b>Plant Diversity- I &amp; II, Microbiology, Plant Pathology and Immunology and Genetics, Plant Breeding and Biostatistics (Practical-I covering - CC-I to CC-IV))</b>	CP-I	6	4

### **LEARNING OBJECTIVES:**

To enable the students:

- To develop the skill on the identification of lower and higher plants with their salient features
- To enhance the student's knowledge and impress upon the important aspects of micro-organisms
- To provide practical knowledge and skill in the isolation and handling of microorganisms
- Students will be able to make informed decisions based on data and apply statistical tools and techniques in their research works.
- Solve problems quantitatively using appropriate arithmetical, algebraic, or statistical methods

#### **Algae**

1. Study the morphology and anatomical characters of Algae studied in theory

#### **Fungi**

2. Study of the morphological and reproductive structures of the genera mentioned in theory.

#### **Lichens**

3. Study of morphology and anatomy of the vegetative and reproductive organs of Fruticose (Usnea) and foliose lichens (paramilia)

#### **Bryophytes**

4. External morphology and internal anatomy of the vegetative and reproductive organs of the genera belong to Bryophytes (any two from each class) given in the theory.

## **Pteridophytes**

5. External morphology and internal anatomy of the vegetative and reproductive organs of the genera belong to Pteridophytes (any two from each class) given in the theory.

## **Gymnosperms**

6. External morphology and internal anatomy of the vegetative and reproductive organs of the species of Gymnosperms (Gnetum, Cycus).

## **Paleobotany**

7. Materials observed i.e. Fossil slides/models/photographs included in the theory

## **Microbiology**

8. Cleaning and sterilization methods. (Laminar air flow chamber, Autoclave and Oven).
9. Preparation of culture media agar slant – agar plate.
10. Isolation of microbes by streak and pour plate method (Demo).
11. Isolation of microbes by soil dilution techniques (Demo).
12. Isolation and identification of Bacteria and Fungi from spoiled food (Demo).
13. Gram staining of Bacteria. Simple staining of bacteria (Ethylene blue/Crystal violet).
14. MBRT of milk (Phosphatase test).

## **Plant Pathology**

15. Study of the following diseases: Rust of wheat, Wilt of cotton, White rust of mustard, Anthracnose of mango – Citrus canker, rice blight – Tobacco mosaic, Cucumber mosaic– Little leaf of brinjal.

## **Immunology**

16. Blood group determination (Demonstration).

## **Genetics**

17. Simple problems about segregation and independent assortment and gene interaction based on theory.
18. Chromosome mapping from three point test cross – data, calculation and interference [Linkage and crossing over percentage].
19. Problems from population genetics – Hardy Weinberg law
20. Estimation of nucleic acids, Isolation of plant DNA, plasmid DNA (Protocol)
21. Demonstration of Southern and Northern blots.

## **Plant Breeding**

22. Training in hybridization techniques – Emasculation, Crossing and Bagging.

## **Biostatistics**

23. Calculation of standard deviation – standard error based on the data given (fruits/leaves/seeds)

24. Chi square test.

## **COURSE OUTCOMES:**

- Evaluate and discuss groups of plants in terms of their diversity and describe their evolution,
- Identify standard methods for the isolation, identification and culturing of microorganisms.
- Comprehend the ubiquitous nature of microorganisms and identify the different groups of microorganisms from different habitats and their applications
- Students will be able to make informed decisions based on data and apply statistical tools and techniques in their research works

SEM	BOTANY	CT	HOURS	CREDITS
I	<b>Forestry</b>	CEC-I. (A)	5	5

### **LEARNING OBJECTIVES:**

- To enable the students to understand the importance of forests
- It also makes students aware of the current global problems in forestry related to human intervention and the need of developing a sustainable way of life
- To provides a platform to appreciate biodiversity and the importance of conservation strategies

#### **Unit - I**

Forests - Definition - Extent of forests in india and other countries - Role of forests - Factors of locality - climatic - edaphic - topographic - biotic - Interaction of Forests with the environment silviculture - Objectives - Scope - General Principles - Regeneration – Natural and artificial - Nursery techniques and methods - maintenance.

#### **Unit- II**

Forest utilization - Logging - Extraction of timber - Felling rules and methods - Conversion methods - Transportation of timbers - Major and minor transportation methods - storage and sales of logs. Forest products - timber industries - plywood - particles boards - fibre products.

#### **Unit - III**

Forest Policies and Legislations - General concept of tree improvement, methods and techniques, genetic testing programming, Forest Policy - Necessity - Formulation of National Forest Policy - History of Forest development in India - Indian Forest Policy of 1894, 1952 and 1988.

## **Unit - IV**

Forest Protection - Role of Forest Protection in Indian Forestry - Injuries caused by various agencies - Injuries caused by human being - Animals - plants - Forest fire - Fire protection methods - Control measures for pest and diseases for major tree species - biological, chemical and integrated pest management methods. Role of human society in forest protection.

## **Unit -V**

Definition - Objectives of agroforestry - Classification of agroforestry systems - Ecological aspects of agroforestry. Social forestry - its components and implementation at local and national levels.

### **Books for studies:**

1. Dwivedi, A.P. (1992) Agroforestry – Principle and practices. Oxford and IBH Publishing Co., New Delhi.
2. Dwivedi, A.P. 1993. A Text Book of Silviculture, International Book Distributors, Dehradun
3. Edmond Senn, Arews, Halfacre. (1987). Fundamentals of Horticulture, Tata McGraw Hill book Co., Ltd. New Delhi.
4. Khanna, I.S. (1984) Principles and practices of Silviculture. KhannaBhandu, Dehra Dun

### **Books for references:**

1. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India
2. Khanna, L. S. 1984. Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.
3. Ram Prakash and L.S. Khanna. 1991. Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun. 298p.
4. FAO (1987), Forestry Extension Methods, SLNo. 80, FAO Publication, Caracall, Rome, Italy.
5. Jha , L.K. & Sen Sarma, P.K. (Eds) (1996), A manual of Forestry Extension Education,

### **COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

- Identify name and classify various forest tree species
- Appreciate tree use and distribution for plantation and natural forest habitat
- Understand the importance of forestry for social, ecological, economic, cultural and environmental purposes

SEM	BOTANY	CT	HOURS	CREDITS
I	Mushroom cultivation and vermiculture	CEC I (B)	5	5

### **LEARNING OBJECTIVES:**

- To explore mushroom cultivation and its economic importance and spawn production technology.
- To understand about compost preparation for Mushroom cultivation.
- To explore mushroom cultivation and its economic importance and spawn production technology.

#### **Unit -I**

Introduction and Importance of mushrooms; Present status of mushroom industry in India; edible mushroom; Biology of mushroom; food value of mushrooms; recipes of mushrooms, Poisonous mushrooms, and Medicinal mushrooms.

#### **Unit -II**

Mushrooms farm structure; design and layout; Spawn principles and techniques of spawn production; Principle and techniques of compost and composting; Cultivation techniques of White button mushroom and Oyster mushroom; Management of fungal, bacterial and viral diseases in mushroom; Competitors, pests and nematodes in mushrooms; Post harvesting techniques and Economics of mushroom cultivation.

#### **Unit- III**

Vermiculture Technology: Introduction; organic farming, soil fertility – Distribution and Ecology of Earthworms – Earthworm taxonomy – Morphological characteristics of Earthworm – Food habits, excretion and life cycle. Earthworm as farmer's friend. Types of Earthworms – Exotic and native species, South Indian and North Indian species used for vermin composting.

#### **Unit -IV**

Collection and maintenance of earthworms for vermicompositing and culturing techniques of earthworms. Preparation of vermicompost requirement, different methods of Vermicompositing (Heap method, Pot method, and Tray method). Changes during vermicompositing, Nutrient value of vermicompositing and worm cast and its importance, Problems in vermicompost preparation.

#### **Unit -V**

Role of earthworm in soil fertility; Use of vermi compost for crop production; Use of earthworms in land improvement and reclamation; Economics of Vermicompost and Vermicompost production and uses. Role of earthworm in solid waste, sewage and faecal waste management and Vermicompost filters. Earthworm as bioreactors. Interaction of earthworm with other organisms. Influence of chemical inputs on earthworms activities. Large scale manufacture, packaging Vermicompost and marketing, financial supporting (government and NGOs for vermi culture work).

#### **Books for studies:**

1. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
2. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
3. Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Cultivation. Vishwa Prakashan (New Age International (p) Ltd.) New Delhi.
4. Puvanakrishnan, R., Sivasubramanian, S. And T. Hemalatha.2015.Microbes and EnzymesBasics and Applied.MJP Publishers.



**Books for reference:**

1. Subba Rao, N. S. and Dommergues, Y. R. (1998). Microbial Interactions in Agriculture and Forestry. Vol. I, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Verma, A. (1999). Mycorrhiza. Springer Verlag, Berlin.
3. Wallanda, T. *et al.* (1997). Mycorrhizae. Backley's Publishers, The Netherlands.
4. Alice, D., Muthusamy and Yesuraja, M. (1999). Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
5. Marimuthu, T. *et al.* (1991). Oster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
6. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Tripathi, D. P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Understand the mushroom characteristics and their importance Comprehend the lifecycles of various classes of fungi
- Discuss on the principles and methods involved in different stages of mushrooms
- Apply their knowledge in cultivating various tropical and subtropical mushrooms and their role in human welfare.

SEM	BOTANY	CT	HOURS	CREDITS
II	<b>Developmental Botany</b>	CC-V	6	4

**LEARNING OBJECTIVES:**

- To understand the structure and development of male and female reproductive organs of angiosperms
- To analyze the morphogenetic potentials pertaining to its development of various organs
- To understand the various aspects of plant development and sexual reproduction

**Unit I:**

Basic concepts of cell development: Potency, commitment, specification, induction, competence, determination and differentiation. Morphogenetic gradients: polarity and symmetry, integration and organization of cells into tissues, tissues into organs, organs into whole plant, cytoplasmic determinants, programmed cell death, aging and senescence.

**Unit II:**

Morphogenesis and Organogenesis in plants: Organization of root and shoot apical meristem, shoot and root development, leaf development and phyllotaxy. Transition from vegetative to reproductive phase: Morphological, histochemical and cytochemical changes in vegetative plant body, floral meristems, floral development in Arabidopsis and Antirrhinum. Plant tumours - types and its development.

**Unit III:**

Flowers – Essential and non-Essential parts. Male and Female reproductive structure in flowers Structure of androecium and gynoecium, Anther: Structure and development of anther, origin, structure and function of anther wall and tapetum, ultra structure and germination of pollen grains. Ovule: structure and development of ovule, types of ovule, female gametophyte, ontogeny, nutrition and morphology of embryo sac, pollen-pistil interaction.

#### **Unit IV:**

Fertilization and Embryo Development: Fertilization – pollen entry and types, physical, and biochemical changes during pollen entry, Double fertilization and triple fusion. Sexual incompatibility (SI): Homomorphy and Heteromorphy, GSI and SSI, Genetic inheritance of SI – Methods to overcome SI; Endosperm: types, haustoria - Cellular, free nuclear and Helobial types; Ruminant endosperm, perisperm. Embryo: proembryo, Embryogeny - developmental types, dicot plant (*Capsella burapastoris*), monocot plant (*Luzula*)

#### **Unit V:**

Fruit and Seed Development: Fruit: Pericarp, structure and development, physical and biochemical factors; Parthenocarpy - stimulative and vegetative parthenocarpy; Apomixis types (nonrecurrent, recurrent and vegetative); Agamospermy and Polyembryony – types and adventive embryony, seed structure and its development, viviparous germination

#### **Books for studies:**

1. Bhojwani, S.S. and Bhatnagar, S.P. *The Embryology of Angiosperms*. Vikas Publishing House, New Delhi
2. Johri, B.M., Ambegaokar, K.B. and Srivastava, P.S. *Comparative Embryology of Angiosperms*, Vol. I & II, Springer Verlag.
3. Kalyan Kumar De 1997 *An Introduction to Plant Tissue Culture*, New Central Book Agency, Calcutta.
4. E.W.Sinnott 1960 *Plant Morphogenesis* McGraw-Hill, New York.

#### **Books for references:**

1. Maheswari, P. 1985. *An Introduction to the Embryology of the Angiosperm*, Tata McGrawHill Publishing Company, New Delhi.
2. Burgess, J. 1985. *An Introduction to Experimental and Applied Embryology of Angiosperms*, Oxford and IBH Publishing Company, New Delhi.
4. Wolpert, L. 2002. *Principles of Development*, Second Edition, Oxford University Press, New Delhi.

**COURSE OUTCOME:**

On the successful completion of the course, students will be able to

- Have a clear idea of developmental process in plants
- Learn morphogenesis and organogenesis in plants
- Have a better understanding on fertilization and post-fertilization processes
- Have enriched knowledge on the fruit, seed, embryo and endosperm development

SEM	BOTANY	CT	HOURS	CREDITS
II	<b>Cell and Molecular Biology</b>	CC-VI.	6	4

### **COURSE OBJECTIVES:**

- To understand the structure of cells , their functional aspects types and properties at the molecular level
- To understand the properties of Nucleic acids
- To study about the details of protein synthesis and cell signaling

### **UNIT-I:**

Ultra structure of plant cell: cell wall - primary and secondary structure, Plasma membrane – various model and properties, Cytosol - cytoskeleton organization, Cell organelles: mitochondria, plastids, endoplasmic reticulum, golgi complex, nucleus, ribosomes, plasmodesmata, plant vacuoles, lysosomes, peroxisomes and glyoxysomes.

### **UNIT-II:**

Chromosome: Structure and types (Euchromatin and Heterochromatin), packing of DNA, Nucleosome organization, Molecular organization of centromere and telomere. Giant chromosomes (polytene and lambrush). Cell division: Mitosis, Meiosis, Cell cycle - Cell differentiation, control mechanism, role of cyclins and cyclin dependent kinases, cell-cell interaction.

### **UNIT -III:**

Central Dogma of cell: Replication of prokaryotic and eukaryotic DNA: enzymes involved, origin of replication, Priming and DNA polymerases, Rolling circle and theta models; DNA damage and its types (endogenous, oxidation, alkylation, methylation and exogenous damage); DNA repair - base excision repair, recombination repair and mismatch repair system.

#### **UNIT –IV:**

Transcription in prokaryotes and eukaryotes: Transcription apparatus and their role, Initiation, elongation and termination, RNA processing, structure and types of RNA, Translation in prokaryotes and eukaryotes: Ribosomal assembly, Initiation, elongation and termination. Translational and post translational control. Targeting, protein folding and processing chaperones.

#### **UNIT –V:**

Cell signaling in plants: concepts, photoproteins-light, responsive proteins, Receptor / threonine kinase, Ethylene activated two component signaling pathway, plant wound signaling pathway.

#### **Books for studies:**

1. Ajoy Paul, (2009). Text book of Cell and molecular biology, Books and Allied (p) Ltd Kolkata.
2. David Freifelder, (1985). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
3. Kumar, H.D. (1999). Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
4. Satyesh Chandra Roy and Kalyan Kumar De. (1999). Cell Biology. New Central Book Agency (P) Ltd. Calcutta.
5. Verma P.S. and Agarwal V.K. (2007) Cell biology, Genetics, molecular biology and evolution, S.Chand and company Ltd, New Delhi.

#### **Books for studies:**

1. De Robertis and De Robertis, (1998). Cell and Molecular Biology. B.I. Waverly Pvt. Ltd. New Delhi.
2. Geoffrey M. Cooper. (1997). The Cell - A Molecular approach. ASM Press, Washington.
3. Grierson, D. and Covey, S.N. (1984). Plant Molecular Biology. Blackie and sons, London.
4. Karp.G. (2008) Cell and Molecular Biology. 5th Edn. John Wiley & sons, London.
5. Lewin (2007). Gene IX. Jones and Barlett Pub. ISBN. O 7637 5222 3
6. Lodish, et al. (2000). Molecular and Cell Biology. W.H. Freeman & Co. New York.

7. Walker J.M and Rapley, R (2006). Molecular biology and biotechnology (4th Edn) Panima publishing corporation, New Delhi.
8. William, D. Stansfield, et al., (1996). Schaun's outline of theory and problems of Molecular and Cell biology. McGraw Hill, New York.

**COURSE OUTCOME:**

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

- Explain the structure of organelles
- Identify the special types of chromosomes
- Describe the pattern of regulation gene expression in prokaryotes and eukaryotes

SEM	BOTANY	CT	HOURS	CREDITS
II	<b>PLANT BIOCHEMISTRY</b>	CC-VII.	6	4

**COURSE OBJECTIVES:**

- To afford knowledge on function of various biomolecules and their function
- To learn structural and functional properties of carbohydrates, proteins and lipids
- To elucidate the interrelationship of the cellular components

**Unit-I:**

Principles of Biochemistry: Basic principles: structure of atoms, molecules and chemical bonds, Hydrogen bonding, Electrostatic, Buffer solutions, pH, concentration of solutions and colligative properties, principles of thermodynamics, free energy Redox potentials, Dissociation and association constants, activation energy, Binding energy.

**Unit –II:**

Carbohydrates and Lipids : Carbohydrates: classification, structure and properties. Metabolism –Gluconeogenesis, Glycogenolysis, and Glycogenesis . Lipids: classification, structure and properties. Biosynthesis and oxidation of fatty acids. Plant waxes, cholesterol, and lecithin

**Unit –III:**

**Proteins and Aminoacids:** Aminoacids: structure, classification and properties, Nitrogen metabolism: Nitrogen uptake, NOD factor, root modulation and Nitrogen fixation. Protein- definition and classification – Simple, Conjugate and Derived protein, Structure - Primary, Secondary, Tertiary and Quaternary and its significance and Ramachandran's plot. Biosynthesis and degradation of aminoacids.



## Unit –IV.

Enzymes and Vitamins: Enzymes: Definition- Nature, Properties, Classification, Isoenzymes, Enzyme Kinetics – Michalis –Menton equation., Model for explaining enzyme action- Lock and key model and Induced fit model, Enzyme action- Exergonic, Reversible and Endergonic reaction, Enzyme , Enzyme Inhibition -Competitive, Non competitive, Uncompetitive and Allosteric inhibition and factors affecting enzyme activity. Vitamins: – Definition and types, Fat soluble- Vitamin A, D, E and K water soluble vitamins- B, C, H O- occurrence, Structure and properties.

## Unit –V.

Secondary metabolites and Pigments: secondary metabolites: classification, functions, and biosynthesis of Alkaloids , Phenols, Terpenoids, and Flavonoids . Plant pigments –structure, classification, and function of chlorophyll, anthocyanins, carotenoids, antho-xanthins

### Books for studies:

1. Jain J.L. et al., (2008). Fundamentals of Biochemistry, Chand, New Delhi.
2. Rastogi, S.C. (2003). Outlines of Biochemistry, CBS Publishers & Distributors, New Delhi.
3. Satyanaryana, U. Chakrapani U. (2006). Biochemistry. Books and Allied (P) Ltd.
4. Stryer, L., (1988). Biochemistry. WH Freeman & Co., NY.

### Books Reference:

1. David L. Nelson and Michael M. Cox. (2015) Lehninger Principles of Biochemistry 7th edition . Published by W.H. Freeman company, 41 Madison Avenue, New York,.
2. Murray, R.K, Granner, D.K ., Mayes, P.A and Roadwell , V.W. (2003). Harpers illustrated Biochemistry (26<sup>th</sup> ed ) The McGraw Hill companies, USA.
3. Wey, P.M and Harbone, J.B.2000. Plant Biochemistry . Panima Edicatioanl Book agency, New Delhi
4. Zubay, G.1988. Biochemistry . Macmilan Publishing Co., New York
5. Lehninger, A.C. (2005). Principles of Biochemistry. 4th Edition, W.H. Freeman, New York.

6. Nelson D.L, Cox M.M. (2012). Lehninger Principle of Biochemistry, W.H. freeman and Company, New York.
7. Rawn, D. (1989). Biochemistry, Neil Patterson.
8. Voet. D. and Voet. J.G. (2004), Biochemistry. 3rd Edition, John Wiley and sons, Inc.
9. Zuley G.L., (1998). Biochemistry, Wm. C. Brown Publishers, USA.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Describe the catabolic and anabolic pathway of primary metabolites of the plants
- Acquire knowledge on properties, and nature of protein and method of isolating and characterizing
- Illustrate the mechanism of enzyme action and interpret the plots of enzyme kinetics
- Understand the secondary metabolites and its biosynthesis pathways

SEM	BOTANY	CT	HOURS	CREDITS
II	<b>Developmental Botany, Plant cell and Molecular biology, Plant Biochemistry (Practical –II covering - CC-VI to CC-VIII)</b>	CP-II.	6	4

### LEARNING OBJECTIVES:

- To create an overall knowledge on identification of all group of plants including fossil
- To impart knowledge on advanced biological and molecular techniques
- To provide hands on experience on various advanced Instruments used for biological and molecular studies
- To develop the skills on quantitative and qualitative analysis of various biochemical components of plants
- To estimate the various biochemicals and their importance in plants

### **Developmental Botany:**

1. T.S of anthers.
2. Examination of pollen morphology
3. *In vitro* pollen germination in different concentration of sucrose solution ( demonstration)
4. Identification of different types of embryos, endosperm, pollen grains.
5. Examination of haustorial endosperm in *Cucumis* through dissections and staining.
6. Dissection and study of various stages of embryo development in *Tridax*.
7. To study the pollen viability by histo-chemical test.
8. Pollen germination hanging drop method

### **Cell and Molecular Biology:**

1. Squash and smear techniques –Onion root tip (mitosis) *Rheo* flower bud (Meiosis).
2. Microscopic view of cell organelles in plant cells – viewing Cystolith & Raphides, Chloroplast (*Hydrilla* leaf).
3. Isolation of plant organelles by centrifugation techniques (Demonstration).
4. Separation of giant chromosome (*Chironomus* larvae).
5. Colorimetric estimation of DNA & RNA.
6. Regulation of gene expression (With the help of models /Charts /Book diagram.)
7. Protein biosynthesis with the help of models /chart/ Book diagram.

## **Plant Biochemistry:**

1. Preparation of Phosphate and Citrate buffers
2. Estimation of reducing sugars by DNS Method (Dinitrosalicylic acid).
3. Estimation of Carbohydrate by Anthrone method.
4. Estimation of proteins by Lowry's method
5. Estimation of DNA by Diphenylamine method
6. Estimation of free fatty acid by titration
7. TLC separation of dyes.
8. Separation of proteins by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS -PAGE)
9. Estimation of flavonoids by colorimetric method

### **COURSE OUTCOME:**

- Evaluate and discuss groups of plants in terms of their diversity and describe their Evolution, phylogeny.  
Analyse the anatomical and embryological stages of plants and their development
- Provides skill in structural and functional characteristics of various plant parts
- Acquire practical knowledge on identification of various groups of plants
- Analyze the biochemical components of any plant samples
- Understand in-depth knowledge on Electrophoretic techniques
- Familiar with Chromatographic and Spectrophometric techniques

SEM	BOTANY	CT	HOURS	CREDITS
II	Farm Science	CEC- II (A)	6	4

### **LEARNING OBJECTIVES:**

- To understand the methods of plant breeding techniques and various methods of Farming
- To understand the pros and cons of organic and inorganic farming.

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

Agriculture and Farm practices: Farm practices - Traditional, Modern with special reference to India. Threat to Agriculture, Labour problems and mechanization. Land use (Urbanization), Agro economic concepts and policies, Agricultural information, forecasting systems, Green card systems and subsidies.

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

Organic farming - Concept and Scope of organic farming, Compost, Decomposition manure. Vermicompost, Scope and importance, Types and uses. Vermi castings. Potentials and constraints for vermiculture in India.

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

Application and Mass cultivation: Chemical fertilizer, Definition, Scope and importance, Types: N,P,K. Biofertilizers, Definitions, Scope and uses; Mass production - Blue green algae, Azospirillum and Azolla; Bio pesticides and Neem products; Leguminous plants in green manuring.

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

Horticulture and its management - Horticulture: Definitions, Objective, Scope and its role, Classification and Management – Floriculture, Olericulture, Arboriculture and Pomiculture

## Unit V:

Integrated Farming System: Definitions and Scopes - Types of integrated farming and cultural methods, Practices in Agriculture water management - Drip irrigation, Fertigation

### Books for studies:

1. Stiling, P. 2002. Ecology – Theory and applications. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Sheela VL. Horticulture MJP Publishers, Chennai, 2011.
3. Kumaresan V. Horticulture Saras publication, Nagercoil, 2014.
4. Gurevitch, J., Scheiner S.M and Fox G.A. 2002. The Ecology of Plants. Sinauer Associates Inc Publishers, Massachusetts.
5. Cunningham, W.P. and Cunningham, M.A. 2002. Principals of environmental science. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
6. Agarwal, K.C. 2000 Biodiversity. Agrobios (India). Jodhpur

### Books for reference:

1. Bugdol, M. and Jedynek, P. Integrated Management Systems. Springer International Publishing Switzerland. 2015.
2. Gupta, P.K. Vermicomposting for sustainable Agriculture. Agrobios, Jodhpur, India. 2012.
3. Kumar, N. Introduction to Horticulture. Oxford & IBH Publishing Co. Pvt. Ltd., India. 2010.
4. Lee, T. H., Shiba, S. and Wood, R. C. Integrated Management Systems: A Practical Approach to Transforming Organizations. John Wiley & Sons, Inc., India. pp 336. 1999. Maheshwari, D. K. Composting for Sustainable Agriculture, Springer International Publishing Switzerland, pp 290. 2014.
5. Narasaiah, M. Agriculture and Water Management. Discovery publishing House, New Delhi. pp. 36-38. 2006.
6. Palaniappan, S. P. and Annadurai, K. Organic Farming – Theory & Practice. Scientific Publishers, India. 2012.
7. Tandon, H. L. S. Fertilizers, Organic Manures, Recyclable Wastes and Biofertilizers. Fertilizer Dev. Corporation, New Delhi. pp 15. 1992

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Demonstrate a working knowledge and appreciation of the diversity of plants, their culture and utilization.
- Apply horticultural principles to the successful growth and production of horticultural plants.
- Demonstrate the knowledge, skills and attributes to be successful contributing members of the horticulture profession.

SEM	BOTANY	CT	HOURS	CREDITS
II	Plant Tissue culture	CEC – II (B)	6	4

### **COURSE OBJECTIVES:**

- Familiar with the basic principles and techniques in tissue culture
- Know about the various techniques employed in plant tissue culture
- Develop the practical skills and confidence of students to successfully culture plant cells and tissues.

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

Plant Tissue Culture – Introduction, Scope, Objectives, Totipotency, pluripotency, cytodifferentiation. Nutritional requirements of the explants in PTC, role of PGRs and additives

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

Micropropagation – Stages and pathways, Organogenesis and Embryogenesis – Direct and indirect, zygotic and somatic, Study of different culture systems with respect to introduction, types, protocol, factors affecting and applications – callus, single cell, suspension, apical meristem, shoot tip, axillary bud, leaf, nodal sectors, root tip culture.

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

Anther, pollen, ovary, ovule, embryo, endosperm, seed culture. Protoplast Culture & Somatic hybridization - Isolation, culture, fusion, selection. Somatic hybrids (symmetric and asymmetric), cybrids, Somaclonal variation – introduction, types, causes, selection methods.

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

Applications – Micropropagation, production of disease/virus free plants, production of useful mutants/somaclonal variants, production of haploids and triploids, synthetic seeds, embryo rescue, production of secondary metabolites, germplasm conservation (Short term & long term storage, cryopreservation)

#### **Unit V:**

Advantages of tissue culture technique over conventional methods of crop improvement, transgenic plants/G M crops. Applications of PTC in Agriculture, Horticulture, Floriculture, Forestry, Medicinal and Aromatic plants etc.



**Books for studies:**

1. Islam, A.S. (1996). Plant tissue culture. Oxford & IBH Publ.
2. Purohit S.S.(2010). Plant tissue culture, Student edition, Jodhpur.
3. Sathyanarayana, U, (2005). Biotechnology, Books and allied (P) Ltd, Kolkata.

**Books for references:**

1. Bhojwani, S. S. and M. K. Razdan. 2004. Tissue Culture: Theory and Practice, Elsevier, New Delhi.
2. Purohit, S. S. 2010. Plant tissue culture, Student edition, S.S. Publication, Jodhpur.
3. Smith, R. 2012. Plant Tissue Culture, Techniques and Experiments, Third Edition, Academic Press, San Diego.
4. Bhojwani, S. S. and P.K. Dantu. 2013. Plant Tissue Culture: An Introductory Text, Springer, India.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Understand the basic knowledge about tissue culture tools, medium, sterilization and techniques of tissue culture.
- Learn about the production of Synthetic seeds & significance
- Study about the role of tissue culture in crop improvement

SEM	BOTANY	CT	HOURS	CREDITS
III	<b>Plant Physiology</b>	CC-VIII	6	4

### **LEARNING OBJECTIVES:**

- To learn the mechanism involved in plant growth
- To know the energy production and its utilization in plants
- To be familiar with the hormones and its metabolism in plants
- To study about the movements in plants

#### **Unit I:**

Water relations: Physical and chemical properties of water significance. Mechanism of absorption of water, apoplast and symplast concept, Ascent of sap, SPAC concept, translocation of solutes. Transpiration: Stomatal physiology and mechanism, Transpiration and guttation. Mineral nutrition and its deficiency symptoms in plants, Absorption of mineral salts, mechanism.

#### **Unit II:**

Photosynthesis: Chloroplast and Pigment systems in Photosystem I and Photosystem II, light reaction, Z-scheme of photosynthetic electron transport chain and photophosphorylation, Carbon assimilation C<sub>3</sub>, C<sub>4</sub> and CAM pathways, Photorespiration and its significance. Respiration: Mitochondria and its functions, Glycolysis and TCA cycle, Oxidative Phosphorylation

#### **Unit III:**

Plant hormones: Structure, Physiological role and mode of action (in brief) of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid. Phytochromes: Photochemical and biochemical properties, photomorphogenetic effects, mode of action. Flowering : Photoperiodism and its significance, Short day, long day and day neutral plants, regulation of flowering, Vernalization. Biological rhythms: Endogenous clock mechanism – Circadian rhythm.

#### **Unit IV:**

Dormancy: Seed, bud, and tuber dormancy. Seed germination: hormonal regulation of germination and dormancy. Senescence : Physiology of senescence, delay of senescence, Fruiting, mechanism of fruiting, role of ethylene, hormonal control of fruiting and storage of fruits.

#### **Unit V:**

Stress Physiology : Classification of stress, response of plants to salt, heavy metals, drought, freezing, heat, oxidative and UV stresses, mechanism of stress resistance.

#### **Books for studies:**

1. Pandey, S.N and Sinha, B .K (2001). Plant Physiology. Third revised edition, Vikas Publishing House Pvt. Ltd, New Delhi
2. Devlin, R.M., (1974), Plant Physiology, Affiliated East West Press Pvt. Ltd
3. Noggle, G.R. and Fritz, G.J., (1976). Introductory Plant Physiology, Prentice Hall, India.
4. Jain, V.K (2007).Fundamentals of plant physiology, S. Chand & Company Ltd, New Delhi.
5. Nobel, P.S (1970) Introduction to Biophysical Plant Physiology. W. H. Freeman and Company, San Francisco
6. Verma, V.(2008).Text book of plant Physiology, Ane's student edition, New Delhi

#### **Books for references:**

1. Bidwell R.G.S (1979). Plant Physiology, Mac Millan Publishing Company. New Delhi.
2. Hess, D. (2012). Plant Physiology: Molecular, Biochemical, and Physiological Fundamentals of Metabolism and development. Springer Science & Business Media, New York.
3. Lehninger, A.L. (1971). Bioenergetics: The Molecular Basis of Biological Energy Transformation. Addison Wiley. Salil Bose, S. (1982). Elementary Biophysics. Vijaya Printers, Madurai.
4. Salisbury, F, B and Ross, C.W (1986). Plant Physiology. Third edition, CBS Publishers and Distributors, New Delhi

5. Taiz, L and Zeiger, E (1991) Plant physiology. The Benjamin/Cummings Publishing company, Inc., California, New York.
6. Taiz, L. and Zeiger, E. (2010). Plant Physiology. Sinauer Associates, India.
7. Fang, F. K. (1982). Light Reaction Path of Photosynthesis. Vol. 35. Molecular Biology, Biochemistry and Biophysics. Springer Verlag.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Define the physiological metabolic processes in plants.
- Explain the role of hormones for plant growth
- Depict the interaction and functioning of various organelles
- do the functional behaviors of plant growth under different environments.

SEM	BOTANY	CT	HOURS	CREDITS
III	<b>Plant Systematics</b>	CC-IX	6	4

### COURSE OBJECTIVES:

- To acquire the fundamental values of plant systematics
- To know about the basic concepts and principles of plant systematics
- To establish a suitable method for correct identification and adequate characterization of plants
- To be aware of the importance of taxonomic relationship in plant systematic studies

#### Unit I:

Angiosperm classification: Basic principle, outline, merits and demerits for the following Systems: Bentham and Hooker, Charles E. Bessey, Engler and Prantl and Hutchinson. Taxonomy Hierarchy: Species, Genus, Family and other categories ; Species concepts and intraspecific categories –subspecies, varieties and forms

#### Unit II:

ICBN – Nomenclature Principles – Nym's concept: Synonym, Homonym, Tautonym – Principle of priority – Effective and valid publication – Author citation – Retention and rejection of names; Typification concept and application; Chemotaxonomy and numerical taxonomy – Molecular Taxonomy and data bases

#### Unit III:

Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Polypetalae of dicotyledons: Magnoliaceae, Nymphaeaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnaceae, Combretaceae, Aizoaceae, Passifloraceae

#### Unit IV:

Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Gamopetalae of dicotyledons: Solanaceae, Gentianaceae, Boraginaceae, Bignoniaceae, Scrophulariaceae, Verbenaceae

## Unit V:

Key family characters, floral characters, floral variations, affinities with other families and economic importance of the following families, grouped under Monochlamydeae of Dicots and Monocotyledonous families: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperaceae

### Books for studies:

1. Bennet, S.S.R. (1989). An Introduction to Plant Nomenclature. International Book Distribution, India.
2. Heslop J. Harrison, (1970). New Concepts in Flowering Plants - Taxonomy. Heinemann Educational Books, India, Revised Edition.
3. Heywood VH. (1967). Plant Taxonomy, Edward Arnold, London.
4. Jeffery C. (1982). An introduction to Plant Taxonomy, J& A Churchill Ltd., London
5. Lawrence, GHM. (1995). The Taxonomy of Vascular Plants (Vol I-IV), Central Book, Dept., Allahabad
6. Mathew, K.M. (1983). The Flora of Tamil Nadu Carnatic, The Rapinat Herbarium, Trichy.
7. Pandey, B.P. (1997). Taxonomy of Angiosperms, S.Chand & Co., New Delhi.
8. Pandey, S.N. and Misra, SP. (2008). Taxonomy of Angiosperms, Ane Books India, New Delhi.
9. Rendle A.R. (1979). A Classification of Flowering Plants. Vol. I and II., Cambridge University Press.
10. Sambamurty AVSS. (2005). Taxonomy of Angiosperms, I.K. International Pvt. Ltd., New Delhi.
11. Saxena NB. and Shamindra Saxena (2001). Plant Taxonomy, K.K. Mittal for Pragati Prakasham, Meerut.
12. Sharma OP. (2009). Plant Taxonomy-Tata McGraw-Hill Education Private Limited, New Delhi.
13. Singh, V. & Jain, K.K. (1989). Taxonomy of Angiosperms – Rastogi, Meerut
14. Sivaraajan, V.V. (1989). Introduction to Principles of Plant Taxonomy, Oxford and IBH, New Delhi.
15. Sokal S.R. and Sneath P.H. (1977). Principles of Numerical Taxonomy, N.H. Freeman

& Co.

16. Solbrig. (1985). Principles and methods of Plant Biosystematics, The MacMillan Company, Delhi.

17. Stace Clive A. (1989). Plant Taxonomy and Biosystematics, Edward Arnold, London, Second Edition.

18. Vashista, P.C. (1990). Taxonomy of Angiosperms – S.Chand & Co., New Delhi.

**Books for references:**

1. Davis, P.H and Heywood, V.M. (1965). Principles of Angiosperm Taxonomy, Oliver and Boyd Edinburgh.

2. Gamble, J.S, Fisher, L.E.F. (1967). The Flora of The Presidency of Madras (Vol□III) BSI, Calcutta

3. Hutchinson, J. (1973). The Families of Flowering plants, Oxford University press, London

4. Kress J.W, Wurdack, K.J., E.A C., Zimmer, L.A .Weigt and Janzen D.H. (2005). Use of DNA bar codes to identify flowering plants. Proc. Natl. Acad. Sci. USA 102, 8369□8374.

5. Simpson M.G.(2006). Plant systematics, Elsevier Academic Press, USA

6. Stoeckle , M.(2003).Taxonomy ,DNA and the barcode of life .Bioscience 53: 796□797.

7. Takhtajan, A.L. (1969). Flowering Plants – Origin and dispersal – Oliver & Boyd

8. Takhytajan A.L. (1991). Evolutionary trends in flowering plants, Bishen Singh Mahendra Pal Singh, Dehra Dun.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Understand the taxonomic principles and to understand the different systems of plant classification
- Demonstrate understanding of evolutionary processes and patterns in the major plant groups
- Demonstrate the ability to handle and analyze plant materials in the laboratory and herbarium in the field

SEM	BOTANY	CT	HOURS	CREDITS
III	Plant Physiology, Plant systematics, Plant ecology and Phytogeography, Plant Biotechnology	CP-III	6	4

### LEARNING OBJECTIVES:

- To develop the skill on the identification of lower and higher plants with their salient features
- To develop the skill on preparation of herbarium and microslides for identification
- To estimate the various biochemicals and their importance to the physiology of plants
- To understand the various physiological actions of plants

### **Plant Physiology:**

1. Determination of Osmotic potential of Rhoeo cell sap by plasmolytic method
2. Determination of Water Potential of Potato tuber by Gravimetric method
3. Determination of Water Potential of Potato tuber by falling drop method
4. Quantitative estimation of total chlorophyll, anthocyanin pigment content in leaves
5. Effect of Detergent on membrane permeability.
6. Measurement of stomatal Index.
7. Differentiation of C3 and C4 plants by starch test

### **Plant Systematics:**

1. Identification of the family for the given fresh plant specimen by describing the key morphological and floral characters with diagrams and constructing the floral formula

Plants belong to Polypetalae of Dicots: Magnoliaceae, Nymphaeaceae, Brassicaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnaceae, Combretaceae, Aizoaceae, Passifloraceae

Plants belong to Gamopetalae of Dicots: Rubiaceae, Asteraceae, Apocynaceae, Gentianaceae, Boraginaceae, Bignoniaceae, Verbanaceae

Plants belong to Monochlamydeae of Dicots, and Moncots: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperaceae

- 2) Identify the binomial for the given two fresh plant specimens/herbarium specimens



3) Submission of i) Records, ii) Field observation note and iii) minimum of 20 Herbarium sheets stacked with the dried plant specimen with appropriate identification label for external evaluation.

4.) Three day field trip to study the vegetation types and submission of minimum of 25 herbarium sheet in end semester practical.

#### **Plant Ecology and Phytogeography:**

1) Water analysis: Salinity, Alkalinity, BOD, COD, DO and free CO<sub>2</sub>.

2) Vegetation analysis using Quadrat and Transect (Line & Belt) method. Calculation of Frequency, Abundance and Density

3) Determination of Biodiversity indices: Shannon's – Weiner index, Simpson's index.

#### **Plant Biotechnology;**

1. Sterilization techniques in plant tissue culture

2. Media preparation – MS, white media

3. Inoculation of explants leaf, node, internode, seed.

4. Isolation of protoplasts by mechanical and enzymatic method

5. Callus and Cell suspension culture

6. Immobilization of seeds by synthetic seed technique.

#### COURSE OUTCOME:

- Provides skill in structural and functional characteristics of various plant parts
- Acquire practical knowledge on identification of various groups of plants
- Understand the photosynthetic mechanism and related events of plants
- Understand the role of various growth promoting substances and their action
- Acquire knowledge on physiological response of plants to various factors

SEM	BOTANY	CT	HOURS	CREDITS
IV	<b>Plant Ecology and Phyto geography</b>	CEC-III- (A)	6	4

### **COURSE OBJECTIVES:**

- To understand the nature- in all its forms, their formation and reactions to individual and groups of plants, their threats and management.
- To know about the different biomes from an ecological perspective.
- To study the importance of ecological interactions in the ecosystem

#### **Unit I:**

Basic concepts in Ecology: Ecosystem Dynamics, Components explaining the functioning of ecosystem, biosphere, biotic interactions; Ammensalism, Commensalisms, Predation, Symbiosis, Parasitism, habitat and niche. Ecosystem structure and function: Grassland, pond and estuarine. Mineral cycling: carbon, nitrogen and phosphorus; role in ecological stability and contribution to climate change, ecological succession: concept, categories and significance

#### **Unit II:**

Population and Community Ecology: Characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), Communities; nature and structural attributes, methods of studying floristic communities, Quadrat and transect methods, Ranquires life forms Physiognomy classification of vegetation community, Phyto diversity indices: Jaccard's Similarity Co-efficient, Berger and Parker Index, Shannon's Diversity Index, Simpson's Dominance Index, and Margalef's Richness Index.

#### **Unit III:**

Biodiversity and Conservation: Categories of biodiversity, species concepts: keystone spp, flagship, dominant and co-dominant, Biogeography: Major terrestrial biomes, theory of island biogeography, Biogeographical zones of India, Principles and approaches of conservation; *In situ* conservation: National parks, Wildlife Sanctuaries, Biosphere reserves; *Ex-situ* conservation: Botanical and herbal gardens, zoological parks, seed orchards and gene banks.

#### **Unit IV :**

Environmental problems and Management: Pollution: primary and secondary pollutants ( air, water and land) Global warming and green-house effect, Ozone depletion, Habitat changes, GMO's, Invasive species, Environmental impact assessment, Bio-remediation and phyto-remediation, Biosensors: Application of remote sensing and GIS in environmental management and disaster management.

#### **Unit V:**

Phytogeography: Definition, Importance, Types and Principles. Environment and Plant responses, Migration, Ecesis and Colonization, Distribution of flora: Wides and endemics, Factors affecting Distribution of species; Vegetational types in India and Tamil Nadu (Altitudinal and Longitudinal variations). Phytogeographic regions of India, continental drifts ( Basic concepts).

#### **Books for studies:**

1. Ambasht, R.S. (1988). A text books of plant ecology. Students, Friends & Co., Varanasi
2. Kumar, H.D. (1997). General ecology, Vikas Publication company, New Delhi
3. Pandey, K. and Shukla, J.P. (2009). Elements of toxicology, Wisdom press, New Delhi
4. Sharma, P.D. (2009).Ecology and Environment, Rastogi Publishers, Meerut.

#### **Books for references:**

1. Edward J. Kormondy, (1996). Concept of Ecology, Prentice Hill of India Pvt, Ltd. New Delhi.
2. Emil T. Charlett. Environmental Protection Tata McGraw Hill New Delhi.
3. Gangopadhyay, A. (2007). Plant diversity, Gene tech book, New Delhi.
4. George L. Clarke (1954). Elements of Ecology. John Wiley & sons. Inc., New York.
5. Gupta, P.K (2009). Soil, plant, water and fertilizer analysis. Agrobios (India), Jodhpur.
6. Jadhar, H.V, Purohit, S.H. (2008).Global pollution and environment monitoring, Himalaya Publishing house ,New Delhi

7. Michael. P. (1984). Ecological methods for field and laboratory investigations, Tata McGraw Hill publishing company Ltd., New Delhi.
8. Misra K.C. (1980). Manual of plant ecology (second edition) Oxford and IBH Publishing Co., New Delhi.
9. Misra, R. (1986). Ecology work book, Oxford and IBH publishing company, New Delhi.
10. Myers A.A, Giller, P.S (1988). Analytical biogeography, Chapman & Hall, London.
11. Odum E.P. (1971). Fundamentals of ecology, W.B. Saunders Co., Philadelphia, London.
12. Perkins H.C. (1974). Air pollution, McGraw Hill Kongotusta Ltd, Tokyo.
13. Robert Smith, (1977). Elements of ecology and field biology, Harper and Row Publishers, New York, London.
14. Russell, P.J Wolfe, S.L, Hertz P.E Starr, C McMillan, B. (2008). Ecology, Brooks and Cole cengage learning, U.S.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- To have the clear understanding of ecology and environmental concepts.
- Undertake the ecological conservation
- Perform analytical methods in environmental and biodiversity management
- Equip on the methods to adapt in sustainable environmental management related research and development

SEM	BOTANY	CT	HOURS	CREDITS
III	<b>Bioinformatics</b>	<b>CEC III. (B)</b>	6	4

### **COURSE OBJECTIVES**

- An- in depth study on Bioinformatics, microbial genomics and proteomics
- To make the students to understand genome analysis, sequence analysis and protein analysis
- To make the students to know the tools used in Bioinformatics

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

Introduction: **Bioinformatics, Scope and applications. Types of computers- mini-macro systems. Anatomy of computers. I/O devices. Operation systems. DOS files, Internal and external DOS commands. File management. Editor, package- Basic, Sequence files- Text file, direct access files, sequence symbols. Internet and Email.**

#### **Unit: II**

Analysis of **DNA and Protein sequences-distributions, frequency statistics- nucleic acid sequence and protein databases- Genbank, DDBJ, EMBL, PIR, SwissProt, TrEMBL- pattern and motif searches- BLOCKS, PRINTS, PFAM. Structural databases-PDB- structure- classification, alignment and analysis- SCOP, CATH, FSSP.**

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

**Sequence alignment: Scoring matrices- PAM and BLOSUM- local and global alignment concepts-dynamic programming methodology - Needleman and Wunsch algorithm, Smith and Waterman algorithm, Global and local alignment- statistics of alignment score- multiple sequence alignment- Progressive alignment- Databases searches for homologous sequences- FASTA and BLAST.**

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

**Protein secondary structure prediction: Chou- Fasman methods, predicting 3D structure comparative (homology) modeling, Threading (fold recognition) and *Abinitio* methods. Protein structure visualization tools- RasMol, Swiss PDB viewer. Phylogenetic tree (Clustal-W and Phylip).**

**Unit: V:**

Fragment assembly- Genome sequence assembly- Gene finding methods: Content and signal methods- Background of transform techniques- Fourier Transform and gene prediction- Analysis and prediction of regulatory regions, Gene identification and other applications.

**Books for study:**

1. Attwood T K and Parry Smith D J, (1999). Introduction to Bioinformatics Addison Wesley Longman Limited, England
2. Chiranjib Chakraborty. 2010. Bioinformatics: Approaches & Applications, Daya Publishing, New Delhi.
3. Bryan Bergeron. 2006. Bioinformatics Computing, Prantice-Hall of India Pvt. Ltd., New Delhi
4. Attwood, T.K. and Parry-Smith, D.J, Introduction to Bioinformatics, Pearson Education Ltd., New Delhi, 2004
5. Lesk, A.M, An introduction to Bioinformatics, Second edition, Oxford University Press. New Delhi, 2006. T.B-
6. Mani, K and Viyaraj, N, Bioinformatics for beginners, Kalaikathir Achchagam, Coimbatore, India, 2002

**Books for references:**

1. JinXiong. Essential of Bioinformatics. Published by Cambridge University press, Daryaganj, New Delhi, 2006.
2. Teresa K. Attwood and David J. Parry –Smith. Cell and Molecular Biology in action series: Introduction to Bioinformatics. Published by Pearson education (Singapore) Pvt.Ltd., Indian branch, Patparganj, New Delhi, 2003.
3. Vittal R. Srinivas. Bioinformatics a modern approach. Published by Asoke K. Ghosh, PHI learning Private Limited, Connaught Circus, New Delhi, 2009.
4. Rastogi, S.C., Mendiratta, N. and P. Rastogi. 4th Edition Bioinformatics methods and applications. Published by Asoke K. Ghosh, PHI learning Private Limited, Industrial estate, New Delhi.

5. Prakash S.Lohar. Bioinformatics. Published by MJP publisher, 47 Nallathambistreet, Triplicane, Chennai, 2009.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Learn the phylogenetic analysis –molecular evolution
- Studied the application of Bioinformatics in Drug designing
- Students understand whole genome analysis methods
- Students know the computational tools used for sequence analysis tools

SEM	BOTANY	CT	HOURS	CREDITS
III	Biofertilizers Technology	CEC-IV (A)	6	4

### LEARNING OBJECTIVES :

- To develop the skill on the biofertilizer production by using various microorganisms
- To learn the plant protection methods and organic farming systems,

#### **Unit I:**

Biofertilizers: Definition and types, importance of biofertilizers over chemical fertilizers in agriculture. Characteristics of biofertilizers: Rhizobium, Azotobacter, Azospirillum, Phosphate solubilizing microorganisms, cyanobacteria - Azolla, Mycorrhizae. Symbiosis: Physiology, biochemistry and molecular genetics of symbiosis. Enzymes and their regulation: Nitrogenase, hydrogenase.

#### **Unit II:**

Production technology: Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers . Symbiotic N<sub>2</sub> fixers: Rhizobium - Isolation, characteristics, types, inoculum development, mass production and field application legume / pulses and non-leguminous crops, Cyanobacteria, Azolla - Isolation, characterization, mass production, Role in rice cultivation, Crop response, field application.

#### **Unit III:**

Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of AM, field applications of Ectomycorrhizae and AM.

#### **Unit IV:**

Organic farming – Nutrient management, weed and disease management. Advantages of organic farming. Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application



## **Unit V:**

Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Extension, promotion and marketing: Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system

### **Books for studies:**

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.

### **Books for references:**

1. The Complete technology book on biofertilizers and organic farming. NIIR, New Delhi.
2. Somani, L.L., P. Shilpkar and D. Shilpkar. 2011. Biofertilizers commercial production technology and Quality control. Agrotech Publishers Academy, Udaipur
3. The complete technology book on Vermiculture and vermicompost. NIIR, New Delhi

### **COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Isolate, identify and mass multiply biofertilizers
- Explain the benefits of organic farming
- To give an overview of relevance use of microbial biofertilizers

SEM	BOTANY	CT	HOURS	CREDITS
III	Pharmacognosy	CEC-IV (B)	6	4

**LEARNING OBJECTIVE:**

- To understand the various systems of treatment and herbal products
- To understand the effect of various phyto-constituents to cure various ailments
- To learn the preparative methodologies of various drug formulations to control diseases and symptoms

**Unit-I:**

Brief history, Definition and scope of Pharmacognosy. Classification of Drugs of Natural origin. Indian System of Medicine (Ayurveda-Siddha). General cultivation, collection and processing of Herbal drugs

**Unit-II:**

Analytical Pharmacognosy-Drug adulteration-Drug evaluation (organoleptic, microscopical, physical, chemical and biological evaluation of crude drugs as per WHO). Methods of preparation of drugs from various plant materials- extraction of plant constituents (including the traditional method of preparation)-separation and isolation of constituents distillation, chromatography-TLC. Quality control of herbal drugs.

**Unit -III:**

Pharmacological action of plant drugs-action on the autonomic nervous system, central nervous system, heart muscle, blood vessels, the respiratory system, gastro-intestinal tract and on the uterus

**Unit -IV:**

Basic study on the source, structure, Qualitative chemical tests and medicinal value of the following phytochemicals-glycosides, alkaloids, phenolics, saponins and steroidal saponins. Natural steroid production for pharmaceuticals –*Dioscorea*.

**Unit -V:**

Medicinal uses and Drugs obtained from Roots and underground parts- *Rauwolfia*, *Aconitum*, *Sarsaparilla*, *Curcuma*, *Asparagus* and *Acorus*. Leaves-*Eucalyptus*, *Adhatoda*, *Solanum trilobatum*, *Digitalis*, *Andrographis* and *Leucas aspera*. Fruits- *Embellica*, *Cuminum*, *Tribulus*, *Terminalia chebula* and *Piper longum*

**Books for study:**

1. Pharmacognosy (2008-Vol-1) by Mohammed Ali, CBS Publishers and Distributors
2. Pharmacognosy (2008)- C.K. Kokate, A.P. Purohit & S.B. Gokhale, Nirali Prakashan
3. Pharmacognosy and Pharmacobiotechnology (2007)-Ashutosh Kar, New Age.
4. Textbook of Pharmacognosy and Phytochemistry by Biren Shah and Seth. Elsevier

**Books for references:**

1. Pharmacognosy by G.E. Trease, W.C. Evans, ELBS.
2. Pharmacognosy by Varro E.Tyler, Lynn. R.Brady, James E.Robbers.
3. Text Book of Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.
4. Indian Medicinal Plants by Kirthikar, Basu.

**COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Know about history and relevance of herbal drugs in Indian system of medicine
- Learn the macroscopic and microscopic characters, chemical constituents, adulterants,
- Therapeutically and pharmaceutical uses of medicinal plants
- Understand the techniques for drug evaluation (Chemical, Physical and Biological),

SEM	BOTANY	CT	HOURS	CREDITS
IV	Research Methodology	CC X	5	5

## **COURSE OBJECTIVE**

- To know the state of art of research in botany
- To learn to plan and carry out short term research projects
- To understand the protocols in writing research papers and its impact values
- To present the collected data as thesis, publication, seminar presentation and know the value of research

### **Unit- I**

Research planning and Literature Collection: Research - Objectives and its Types- Basic, Applied, Quantitative and Qualitative and Problem oriented, Essential steps in Research and its Significance. Introduction for the research work, Review of Literature - Need for review, Objectives, Sources - Primary, Secondary and Tertiary sources. Collection of Literature: Internet basics - web browsing, web sites (Biological website), web pages –links, Bibliometrics databases, Monographs and Reprints

### **Unit -II**

Methodology and data collection: Sample – Definition, Types, Sampling Techniques – Survey and Questionnaires. Hypothesis – Definition, Qualities of a good Hypothesis, its characteristics and Types – Null, Alternative, Formulating, Simple, Complex and Statistical. Level of significance. Principles of experiments – Definition, Types of field Experiments- Provenance, Progeny, Clonal, fertilizer and Agronomic. Components in Experiments- (a) Randomization (b) Replication (c) Local control (d) Size and shape of the plot (e) experimental Errors

### **Unit- III**

Experimental Design - Completely Randomized Design (CRD) and Randomized Complete Block Design(RCB). Collection of Primary Data (a) Observation Method (b) Interview Method (c) Collection of Data through Questionnaires (d) Collection of Data through Schedules (e) Difference between Questionnaires and Schedules. Collection of Secondary Data

## Unit - IV

Structure of thesis: Report writing. Thesis chapterization- (a) Title (b) Abstract (c) Introduction (d) Materials and methods (e) results (f) discussion (g) conclusion (h) Bibliography. Data representation: Tables –Need and use of for table, Introduction and Placement of a table, Format of a table. Figures- Need and use of Figures, Placement of Figures, Numbering and Caption, Preparation of Statistical Diagrams

## Unit V

Manuscript for publication and Presentation: Research publications – Writing – Reviews, research article and short communication. Presentation – Oral and Poster presentation. Indexing and abstracting- indexes and evaluation tools (h-index, Page Rank, Impact Factor), Evaluation of the Impact Factor, Collective platforms with Free Access, Use of bibliometrics in research - Citation Research, Citation Indexing, Plagiarism.

### Books for study:

1. N. Gurumani. (2011) Research methodology for biological Science, MJP, Publishers, Triplicane, Chennai.
2. Kothari, C.R. (1991). Research Methodology: Methods and Techniques. Wiley Eastern Ltd., New Delhi

### Books for references:

1. Kothari, C.R. (2000) Research Methodology – Methods and Techniques. WishwaPrakashan.
2. Misra, R.P. (2000) Research Methodology - A handbook, Concept. Publ. Co., New Delhi, India.
3. Gupta, S.P., (1990). Statistical Methods. Sultan Chand and Sons, New Delhi, India,
4. Hawkins, C and Sorgi, M. (2000). Research. Narosa Publishing House, New Delhi, India.
5. Ball and Philip. Index aims for fair ranking of scientists. Nature 436 (7053):900.2005
6. Connor and Peter Woodford (1979) Writing Scientific Paper in English Pitman. Medical Publishing Co. Ltd., England.

## COURSE OUTCOME

On successful completion of course, the students will be able to

- Training and participating in active research activities for their academic and professional levels
- Creation of novel ideas and simple techniques useful to the society (R/D)
- Acquire background knowledge in research publication and thesis writing

SEM	BOTANY	CT	HOURS	CREDITS
IV	<b>RESEARCH METHODOLOGY</b>	CP-IV	5	5

**LEARNING COURSE OBJECTIVE:**

- Students should be familiar with current uses of the terms reliability and validity in educational research.
- Students should know how to create a quantitative codebook for organizing their data.
- Students should know the types of descriptive statistics typically reported in educational research studies.
- . Students should know how to conduct a statistical test of a hypothesis

1. Data Collection methods

2. Sampling by Random Number Table

3. Measures of Central Values: Mean, Median and Mode

4. Data classification Discrete, continuous and cumulative.

5. Statistical diagrams: Histogram, Frequency curve, Bar chart and Ogive curve

6. Measures of Dispersion: Range, Mean Deviation and Standard Deviation.

7. Exercises with Tests of Significance

8. Preparation of Index cards

9. Preparation of Bibliography

10. Proof correction

11. Exercises in the calculation of Citation Index.

12. Identification of instruments/their parts and their applications

13. Determination of Impact Factor of Author, Article and Journal.

**COURSE OUTCOME:**

- Assess critically the following methods: literature study, case study, structured surveys, interviews, focus groups, participatory approaches, narrative analysis, cost-benefit analysis, scenario methodology and technology foresight.
- Critically assess research methods pertinent to technology innovation research.

SEM	BOTANY	CT	HOURS	CREDITS
IV	<b>PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING</b>	CEC-V (A)	5	5

**LEARNING OBJECTIVES:**

- Perform the techniques involved in plant genetic engineering
- Explain the transgenic plants and plant tissue culture experiments
- Apply the knowledge of biotechnology in exploitation of plants for human welfare

**Unit I:**

Biotechnology as Interdisciplinary and Multidisciplinary approach - Plant Tissue Culture – Introduction - Objectives and Goals – Laboratory organisation – Nutrient medium – Sterilization Techniques – Types of Cultures (seed, embryo, Root, callus, organ, cell, protoplast and axillary bud cultures) – Cell suspension culture and Secondary metabolites - Plant Micropropagation - Somatic embryogenesis – embryogenesis - Organogenesis – Protoplast Isolation and Fusion.

**Unit II:**

Application of tissue culture in agriculture – crop improvement – horticulture and forestry. Application of Biotechnology in Conservation of plant genetic resources – Gene banks – Cryopreservation – Germplasm Conservation – Application in Genetically Modified Organisms (Fruits, Vegetables, Crops and Cereals) – Transgenic plants.

**Unit III:**

Tools of Genetic engineering – Restriction types of Enzymes (Exo and Endo nucleases) – Different types of enzymes used in Genetic engineering (Methylase, SI nuclease, Ligase, Alkaline Phosphatase, Reverse transcriptase, T4 kinase, Terminal transferase, adapters and Linkers) – Vectors and their types – Plasmid (pBR 322, pUC Vectors), Agrobacterium based Plasmids, Bacteriophage vectors, Cosmids, Phagemids, YAC, CaMV, Gemini Virus, Shuttle and Expression vectors

#### **Unit IV:**

Cloning Strategies – Basic Methods – rDNA technology – Genomic and cDNA library – Hybridization techniques – Labelling methods – Gene transfer mechanisms direct and indirect methods – Application of plant genetic engineering in various fields.

#### **Unit V:**

Intellectual Property (IPR): General principles of biosafety in genetic engineering; Benefits, ethical, legal and social implications (ELSI) aspects. Intellectual Property Rights, Intellectual Property Protection, IPR and Plant Genetic Resources, Patent Systems: Sources of patent Information, Patenting Methods, Patenting of higher plants, genes and DNA sequences, Plant Breeders Rights and Farmers Rights, A brief account on Geographical Indication (GI).

#### **Books for studies**

1. Dubey, R.C., (2001). A text book of biotechnology. S. Chand & Co., New Delhi.
2. Gupta, P.K. (1994). Elements of Biotechnology. Rastogi Publications, Meerut.
3. H.K. Dass. 2005, Text book of Biotechnology, Second edition, Wiley Dreamtech, India (P) Ltd.
4. Ignacimuthu, S.J. (2003). Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
5. Kalyankumar De, (2008). Plant tissue culture. New Central Book Agency, Calcutta.
6. Kumar H.D. (1993). Molecular Biology and Biotechnology. Vikas Publishers, New Delhi.
7. Sathyanarayana, U, (2005). Biotechnology, Books and allied (P) Ltd, Kolkata.
8. T.A. Brown-2001. Gene cloning and DNA analysis: An introduction, sixth edition Wiley- Blackwell publication.



### **Books for references**

1. Bhojwani, S.S. & Razdan, M.K. (2004). Plant Tissue Culture, Read Elsevier India Pvt. Ltd.
2. Glick, B.R. & J.J. Pasternak. (2009). Molecular biotechnology, Panima Pub. Co.
3. Hammond, J.C. McGarvey and V. Yusibov, (2009). Plant Biotechnology, Springer Verlag, New York
4. Islam, A.S. (1996). Plant tissue culture. Oxford & IBH Publ.
5. Lewin, (2007). Genes IX, Oxford University press.
6. Purohit S.S.(2010). Plant tissue culture, Student edition, Jodhpur.
7. Sambrook J and Russel DW, (2001). Molecular Cloning A laboratory Manual. Cold Spring Harbour Publ.

### **COURSE OUTCOMES:**

On successful completion of course, the students will be able to

- Perform the techniques involved in plant genetic engineering
- Explain the transgenic plants and plant tissue culture experiments
- Apply the knowledge of biotechnology in exploitation of plants for human welfare

SEM	BOTANY	CT	HOURS	CREDITS
IV	<b>Bioinstrumentation and Biotechniques</b>	CEC-V (B)	5	5

### **LEARNING OBJECTIVES:**

To enable the students:

- To understand the working principles and applications of instruments used in the studies related to various disciplines of biological sciences.
- To understand the theoretical and practical knowledge of instruments in modern biology.

#### **Unit - I**

Basic principles and uses of various microscopes - Light, Compound, Phase contrast, Confocal, Scanning, Transmission Electron microscopes and Atomic force Microscope, Principle and applications of Camera Lucida, Stage and Ocular micrometer and Haemocytometer, Microtomy

#### **Unit- II**

Basic principles of pH meter, types of Electrodes, Measurement of pH, Preparation of buffers, Chromatography: Basic principles, types – Paper, Column, Thin layer, Gas liquid, Affinity, and High Pressure Liquid chromatography.

#### **Unit -III**

Principle and Application: Spectrophotometer - UV and visible, Flame photometer, Atomic absorption spectrophotometer, IR, NMR. Centrifugation: Rotors, Bench top, Low speed, High speed, Cooling, Ultracentrifuge. Radioactivity: GM counting, Scintillation counting, Autoradiography.

#### **Unit -IV**

Electrophoresis (SDS –PAGE and Agarose), two dimensional Electrophoresis, Gel documentation, Blotting techniques: Southern, Northern and Western Blotting, Immunological Techniques: ELISA, ELISPOT Test, Immunodiffusion, Immunoprecipitation,

#### **Unit: V**

Molecular Markers: DNA Microarrays, RAPD, RFLP, AFLP, SSR Polymorphisms, Microsatellite-primed PCR, DNA Fingerprinting technique, QTL mapping.

**Books for studies:**

1. Jain, J. L. (2000). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
2. Satyanarayana, U. and U. Chakrapani, (2013). Biochemistry. Elsevier Co-published with, Books and Allied Press, New Delhi
3. Khan, I.A., and Khannum, A., (1994). Fundamentals of Biostatistics, Vikas, Pub., Hyderabad.
4. Marimuthu, R. (2008). Microscopy and Microtechnique. MJP Publishers, Chennai.
5. Moorthy. C.S.V. (2004). Bioinformatics, Himalaya publishing house.
6. Sree Ramulu, V.S., (1988). Thesis Writing, Oxford& IBH Pub. New Delhi.
7. Wilson K, Walker, J. (1994). Principle and techniques of practical Biochemistry, 4thEdn.) Cambridge university press, Cambridge

**Books for references:**

1. Johanson, D.A.(1940). Plant Microtechniques,Mac graw Hill
2. Stock,R and Rice, C.B.F.(1980).Chromotographic methods ,Chapman and Hall
3. Ruzin, Z.E.(1999).Plant Microtechnique and Microscopy,Oxford university press,new york
4. Kierman, J.A. (1999). Histological and Histochemeical methods,Butterworth Publications,London
5. Burdan R.H.Knippenbergh P.H. (1989).Techniques in Biochemistry and Molecular Biology -2nd Ed,Elsevier.
6. Daphne J.O and Michael, B.J. (1989). Cell separation in Plants physiology,Biochemistry and Molecular Biology.Springer-verlag,Berlin
7. Jeffrey.M.Backer et al., (1986). Biotechnology-A laboratory course.Academic Press.Newyork

**COURSE OUTCOMES :**

On successful completion of course, the students will be able to

- Gain skill on working principles of pH meter, colorimeter and centrifuge
- Learn the technique of Electrophoresis & Chromatography
- Understand general laboratory procedures and maintenance of research equipments, microscopy, pH meter and preparation of different buffers
- Describe the pH measurement in soil and water samples Understand how to isolate cellular constituents

SEM	BOTANY	CT	HOURS	CREDITS
IV	Project Work	-	15	10

**Course Objectives:**

- To provide training in scientific skills.
- To prepare students for professional training programmes or entry level jobs in any area of Botany

Each candidate shall be required to take up a Project Work; submit Project Report at the end of the second year. The Head of the Department shall assign the Guide who in turn will suggest the Project Work to the student in the beginning of the second year. One typed copy of the Project Report shall be submitted to the controller of examinations through Head of the Department on or before the date fixed by the controller .

The project report will be evaluated by an Internal Examiner and an External Examiner, nominated by the Controller of Examinations. The candidate concerned will have to defend his project in a Viva– Voce examination.

**Project Outcomes:**

- At the end of the project, students should have increased: their capacity to think critically; - their ability to design, analyse and execute an experiment;
- Their confidence and ability in communication skills (in writing and oral).
- Acquiring the literature collection methods, and interpreting the data of their scientific experiments etc