



**DEPARTMENT OF BOTANY**  
**SYLLABUS FOR B.Sc BOTANY**  
**UNDER CHOICE BASED CREDIT SYSTEM (CBCS)**  
**FOR CANDIDATES ADMITTED IN THE ACADEMIC YEAR**  
**2017 -2018**



**Bishop Heber College (Autonomous)**  
(Nationally Reaccredited at the A Grade by NAAC with CGPA 3.58/4)  
(Recognized by UGC as “College of Excellence”)  
(Affiliated to Bharathidasan University, Tiruchirappalli)  
Tiruchirappalli- 620 017.

## **VISION**

Inculcate fundamental knowledge of the plant sciences that will transform the understanding about the planet earth, providing holistic approach on innovative teaching, entrepreneurship skills and research with social ethics that reaches the society with a focus on plants and their role in balancing and protecting the Environment.

## **MISSION**

- Our mission is to foster an ambience of distinction by attracting and supporting the outstanding students, faculty and staff needed to sustain our vision.
- Provision of knowledge that bestows academic environment that contribute towards creating socially responsible citizens who have adequate skills in reflective thinking, leadership, team play, scientific temper with lifelong learning affinity.
- Create a stimulating environment that facilitates intellectual growth of students; provide students with the time and freedom to experience 'powerful pedagogies' such as research, service-learning and internships; encourage students with scientific approach to learning.
- To foster an environment of excellence by providing a comprehensive set of courses in Botany that enhances the understanding, fundamental and in-depth knowledge and technical competency.
- To inculcate the students with an environment that fosters nature conscious stewardship responsibility and Entrepreneurial skill development, multidisciplinary research competency through interdisciplinary learning and teaching positions in biological science.

## B. Sc BOTANY COURSE STRUCTURE- 2017-2018

<b>* Other Languages :Hindi</b>	<b>Sanskrit</b>	<b>French</b>	<b>Hindi</b>	<b>Sanskrit</b>	<b>French</b>
Semester I: U18HD1L1	U17SK1L1	U18FR1L1	Semester III : U18HD3L3	U17SK3L3	U18FR3L3
Semester II: U18HD2L2	U17SK2L2	U18FR2L2	Semester IV : U18HD4L4	U17SK4L4	U18FR4L4

Sem.	Part	Course	Course Title	Course Code	Hours / week	Credits	Marks	Sem.	Part
I	I	Tamil I /*	செய்யுள், இலக்கிய வரலாறு, உரைநடை, மொழிப்பயிற்சியும் படைப்பாக்கமும்	U15TM1L1	6	3	25	75	100
	II	English I	English Communication Skills – I	U16EGPL1	6	3	40	60	100
	III	Core I	Angiosperm Morphology and Taxonomy	<b>U16BY101</b>	6	<b>6</b>	25	75	100
		Core Prac. I	Major Practical – I	<b>U16BY1P1</b>	3	<b>2</b>	<b>40</b>	<b>60</b>	<b>100</b>
		Allied I	Biology of Invertebrates and Chordates	U16ZYY11	4	3	25	75	100
		Allied Prac. I	Biology of Invertebrates ,Chordates and Commercial Zoology	U16ZYYP1	3	--	--	--	--
	Val. Edu.	Value Education (RI/MI)	U14VL1:1/ U14VL1:2	2	2	25	75	100	
II	I	Tamil II /*	செய்யுள், இலக்கிய வரலாறு, சிறுகதைத் திரட்டு, மொழிப்பயிற்சி மற்றும் படைப்பாக்கமும்	U15TM2L2	6	3	25	75	100
	II	English II	English Communication Skills – II	U16EGPL2	6	3	40	60	100
	III	Core II	Plant Anatomy and Embryology of Angiosperms	<b>U16BY202</b>	<b>6</b>	<b>6</b>	25	75	100
		Core Prac. II	Major Practical – II	<b>U16BY2P2</b>	<b>3</b>	<b>2</b>	<b>40</b>	<b>60</b>	<b>100</b>
		Allied II	Commercial Zoology	U16ZYY22	4	4	25	75	100
		Allied Prac. I	<b>Biology of Invertebrates ,Chordates and Commercial Zoology</b>	<b>U16ZYYP1</b>	<b>3</b>	<b>3</b>	<b>40</b>	<b>60</b>	<b>100</b>
	Env. Studies	Environmental Studies	U15EST21	2	2	25	75	100	
III	I	Tamil III /*	செய்யுள் - காப்பியங்கள் இ இலக்கிய வரலாறு இ நாவல் இ மொழிப்பயிற்சி	U15TM3L3	6	3	25	75	100
	II	English III		U16EGPL3	6	3	40	60	100
	III	Core III	Plant Diversity - I (Thallophytes and Bryophytes)	<b>U16BY303</b>	6	6	25	75	100
		Core Prac. III	Major Practical – III	<b>U16BY3P3</b>	<b>3</b>	<b>2</b>	<b>40</b>	<b>60</b>	<b>100</b>

		Allied III	Allied Chemistry – I	U16CHY33	4	4	25	75	100			
		Allied Prac. II	Allied Chemistry Practical	U16CHYP2	3	--	--	--	--			
		NMEC I	Nursery Technology	U16BYPE1	2	2	40	60	100			
IV	I	Tamil IV /*	செய்யுள்(மேற்கணக்கு, கீழ்கணக்கு), இலக்கிய வரலாறு, நாடகம், மொழிப்பயிற்சி	U15TM4L4	6	3	25	75	100			
	II	English IV		U16EGPL4	6	3	40	60	100			
	III	Core IV	Plant Diversity - II (Pteridophytes, Gymnosperms and Paleobotany)	U16BY404	6	5	25	75	100			
		Core Prac. IV	Major Practical – IV	U16BY4P4	3	2	40	60	100			
		Allied IV	Chemistry for Life Sciences	U16CHY44	4	4	25	75	100			
		Allied Prac. II	Allied Chemistry Practicals	U16CHYP2	3	3	40	60	100			
		NMEC II	Mushroom Cultivation	U16BYPE2	2	2	40	60	100			
V			Plant Physiology, Biochemistry and Biophysics	U16BY505	7	6	25	75	100			
		Core VI	Cell Biology, Genetics and Evolution	U16BY506	7	6	25	75	100			
			Core Prac. V	U16BY5P5								
			Project U16BY5PJ									
VI		Elective I	Biostatistics, Computer Applications and Bioinformatics	U16BY5:1	5	5	25	75	100			
		SBEC I	Mushroom and Nursery Technology	U16BYPS1	5	5	25	75	100			
			General Geology, Ecology and Phytogeography	U16BY607	6	6	25	75	100			
			General Microbiology	U16BY608	6	5	25	75	100			
		Core Prac. VI	Core Prac. VI	U16BY6P6	3	2	40	60	100			
		Elective II	Plant Breeding, Pathology, Protection and Organic Farming	U16BY6:1	6	5	25	75	100			
		Elective III	Molecular biology and Plant Biotechnology	U16BY6:2	6	5	25	75	100			
		SBEC II	Molecular and Plant Tissue culture Techniques	U16BYPS2	5	5	40	60	100			
		SBEC III	Plant Wealth for Human Life	U16BYPS3	5	5	40	60	100			
Part I : 4		Core Theory : 8		Core Project : 1		Allied Theory : 4		NMEC : 2		Env. Studies : 1		Total : 42
Part II : 4		Core Prac. : 6		Allied Prac.: 2		Elective : 3		SBEC : 3		Value Education : 1		
Soft Skills : 1		Extension Activities : 1		Gender Studies : 1								

NMEC offered by the Department: 1. Nursery Technology - U16BYPE1  
2. Mushroom Cultivation- U16BYPE2

## **CORE – I - ANGIOSPERM MORPHOLOGY AND TAXONOMY**

Semester : I  
Credits : 6

Course Code : U16BY101  
Hours per week : 6

### **Unit I: Vegetative Morphology: (18 Hours)**

- 1.1. Plant Habits
- 1.2 Root, Stem and its modification
- 1.3 Leaf structure and its modifications,
  - 1.3.1 Phyllotaxy
- 1.4 Inflorescence and types
  - 1.4.1 Racemose and Cymose
  - 1.4.2 Special types of Inflorescence.

### **Unit II: Floral Morphology (18 Hours)**

- 2.1 Floral morphology
  - 2.1.1 Types of flowers
- 2.2 Aestivation
- 2.3 Types of anthers and arrangement
- 2.4 Gynoecium – types
  - 2.4.1 Placentation.
- 2.5 Classification of fruits
  - 2.5.1 Description of simple, aggregate and multiple fruits and examples.

### **Unit III: Taxonomy (18 Hours)**

- 3.0 Importance of Taxonomy
- 3.1 Binomial nomenclature
- 3.2 Bentham and Hooker's classification, merits and demerits,
- 3.3 Hutchinson's classification – Merits and demerits.
- 3.3 Herbarium - importance and techniques.

### **Unit IV : Angiosperm Families (18 Hours)**

- 4.0 A detailed study of Angiosperm families with their economic importance.
- 4.1 **Polypetalae**
  - i) Annonaceae, ii) Capparidaceae, iii) Sterculiaceae, iv) Rutaceae, v) Fabaceae, vi) Caesalpineaceae, vii) Mimosaceae, viii) Cucurbitaceae, ix) Apiaceae.

**Unit V** Angiosperm families with their economic importance (contd.)

**(18 Hours)**

**5.0 Gamopetalae**

i) Rubiaceae, ii) Asteraceae, iii) Apocynaceae iv) Asclepiadaceae, v) Solanaceae, vi) Lamiaceae, vii) Verbinaceae

**5.1 Monochlamideae**

i) Euphorbiaceae, ii) Amaranthaceae,

**5.2 Monocotyledon**

i) Orchidaceae, ii) Liliaceae iii) Poaceae.

**REFERENCES**

**Taxonomy**

1. Lawrence, G.I.M.(1953): Taxonomy of Vascular Plants. Oxford & IBH Publishers, New Delhi.
2. Narayanaswamy, R.V. & Rao, K.N. (1976). Outlines of Botany. S. Viswanathan Printers & Publishers, Chennai.
3. Pandey, B.P.(1997). Taxonomy of Angiosperms. S.Chand & Co., (P) Ltd., New Delhi.
4. Sharma, O.P. (2000). Plant Taxonomy. Tata McGraw Hill Publishing Co., New Delhi.
5. Vashista, P.C. (1997). Taxonomy of Angiosperms. S.Chand & Co., New Delhi.

**Economic Botany**

1. Ashok Bendre and Ashok Kumar. (1999). Economic Botany. Rastogi Publications, Meerut, India
2. Pandey, B.P. (1999). Economic Botany. S. Chand and Co. New Delhi.
3. Verma, V. (1974). A Text Book of Economic Botany. Emkay Publications, New Delhi.
4. Sambamurthy, V.S. and Subrahmanyam, N.S (1989). A text book of Economic Botany.

**CORE PRACTICAL – I MAJOR PRACTICAL - I**

Semester : I  
Credits : 2

Course Code : U16BY1P1  
Hours per week : 3

## **I. Morphology**

**(6 Hours)**

### **1. Study of Root and its Modifications**

a) Tap root (*Acalypha*) b) Adventitious root (Grass) c) Storage roots – Conical (*Daucas*), Fusiform (*Raphanus*), Napiform (*Beta*) d) Stilt root (Maize/*Pandanus*) e) Aerial root (*Pothos*) f) Respiratory root (*Avicennia*)

### **2. Study of Stem and its Modifications**

**(6 Hours)**

a) Underground stem –Corm (Amorphophallus), Tuber (Potato), Bulb (Onion), Rhizome (Ginger) b) Sub aerial stem- Runner (Grass), Offset (Eichhornia). c) Aerial stem – Phylloclade (*Opuntia*), Cladode (*Asparagus*), Thorn (*Bougainvillea*), Stem tendril (*Passiflora*)

### **3. Study of Leaf and its diversity**

**(6 Hours)**

a) Types of leaf (Simple (Mango), Compound- Paripinnate (*Tamarindus*), Imparipinnate (Neem/Rose/*Clitoria*) b) Shape – Linear (Grass), Lanceolate (*Nerium*), Ovate (Hibiscus), Obcordate (*Bauhinia*), Elliptical (Guava) c) Venation – i) Reticulate- Unicostate (*Ficus*), Multicostate (*Cucurbita*) ii) Parallel- i) Unicostate/Pinnate (Canna), ii) Multicostate convergent (Bamboo/Grass) d) Phyllotaxy – i) Spiral (*Hibiscus*), ii) Opposite Decussate (*Calotropis/Ixora*), Opposite superimposed (Guava) iii) Ternate (*Nerium*) iv) Whorled (*Alamanda*) v) Radical (*Aloe*) vi) Leaf Mosaic (*Acalypha*) e) Modifications- i) Succulent leaf (Bryophyllum), ii) Reproductive leaf (*Kalanchoe*).

### **4. Study of Flower / Inflorescence**

**(6 Hours)**

a) Typical flower (*Hibiscus / Datura*), Inflorescence-i) Simple Receme (*Tephrosia*), Spike (*Achyranthes*), Corymb (*Caesalpinia*), Head/Capitulum (*Tridax*), ii) Cymose – Simple cyme (Jasmine), Monochasial Helicoid (*Haemelia*), Monochasial scorpoid (*Heliotropium*), Dichasial cyme (*Ixora*), Polychasial cyme (*Nerium*), iii) Special-Cyathium (*Euphorbia*), Thyrsus (*Ocimum*), Verticillaster (*Leucas*), Hypanthodium (Fig).

### **5. Study of Fruits & its Type**

**(6 Hours)**

a) Simple: i) Dry Dehiscent – Legume (*Tephrosia*), Follicle (*Calotropis*), Capsule (Ladies finger) ii) Dry Indehiscent – Cypsella (*Tridax*), iii) Splitting/Schizocarpic- Carcerulus (*Ocimum*) iii) Succulent – Pome (Apple), Berry (Brinjal), Hesperidium (Orange), Drupe (Mango) b) Aggregate (*Polyalthia*) c) Composite fruit- Sorosis (Jack).

## **II. Taxonomy**

**(15 Hours)**

Study of various angiosperm families mentioned in the syllabus by using MLS of flower and study of floral whorls with floral formula and floral diagram.

## **III. Economic Importance**

Binomials and Morphology of the useful parts of the Economic products belonging to the families studied.

## **IV. Submission**

Field visit & report, preparation and submission of 20 bonafied Herbarium sheets with Field Note Book and Record should be submitted during the end semester practical examination.

## **CORE- II- PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**

Semester : II  
Credits : 6

Course Code : U16BY202  
Hours per week: 6

## **Unit I : TISSUE SYSTEM**

**(18 Hours)**

### **1.1.0 Plant Tissues**

- 1.1.1. Plant Anatomy - History
- 1.1.2. Tissue – definition, Characteristics and Classification

### **1.2. Meristematic Tissue**

- 1.2.1. Characteristics, Classification of meristem based on stage of development, Origin of initiating cells, Position in plant body and function
- 1.2.3. Organization – Shoot Apex and Root Apex
- 1.2.4. Theories on apical organization – Apical Cell Theory, The Histogen Theory  
Tunica-Corpus Theory, Korper-kappae theory.

### **1.3. Simple Tissues**

- 1.3.1. Origin, Structure and Function of the following tissues – Parenchyma, Collenchyma, Sclerenchyma.

### **1.4. Complex Tissues**

- 1.4.1. Xylem and its Components
- 1.4.2. Phloem and its Components

### **1.5. Secretory Tissue**

- 1.5.1 Laticiferous tissue (a) Types- Nonarticulate Latex Ducts or Latex Cells and Articulate Latex ducts or Latex vessels.
- 1.5.2. Glandular Tissue (a) Types - Internal Glands and External glands

## **UNIT 2 EPIDERMAL AND VASCULAR TISSUE SYSTEM, NODAL ANATOMY**

**(18 Hours)**

### **2.1 Epidermal Tissue System**

- 2.1.1. Occurrence, Structure, Types and Functions of the following tissues - Epidermis, Stomata and Trichomes.

### **2.2 Fundamental or Ground Tissue System**

- 2.2.1. Structure and Functions of the following tissues- Cortex, Endodermis, Pericycle and Pith.

### **2.3. Vascular Tissue System**

- 2.3.1. Primary Vascular Tissues – Structure and Functions of the following tissues- Procambium, Xylem, Phloem and cambium.
- 2.3.2. Types of Vascular Bundles – Radial, Conjoint-Collateral, Bicollateral, Concentric

### **2.4. Stellar System – Definition,**

- 2.4.1 Types of stele (a) 1. Protostele- Haplostele, Actinostele, Plectostele and Mixed Pith stele (b) Siphonostele – i. Ectophloic ii. Amphiphloic (c) Solenostele (d) Dictyostele (e) Polycyclic stele (f) Eustele

### **2.5. Nodal Anatomy**

- 2.5.1 Definition- Leaf Trace, Leaf Gap,
- 2.5.2 Types of Nodes- Unilacunar, Trilacunar and Multilacunar.



**UNIT 3: PRIMARY AND SECONDARY GROWTH, ANOMALOUS SECONDARY GROWTH** (18 Hours)

**3.1. Primary Growth - Definition**

3.1.1. Structure of Monocot and Dicot Root, Stem and leaf

**3.2. Secondary Growth - Definition**

3.2.1. Secondary growth in dicotyledonous stem and root

3.2.2 Annual Rings

3.2.3 Heart Wood and Sap Wood

**3.3. Anomalous secondary thickening - Definition**

3.3.1. Anomalous secondary growth of the following Genus – *Dracaena*, *Aristolochia* and *Boerhaavia*

**UNIT 4 EMBRYOLOGY OF ANGIOSPERMS** (18 Hours)

**4.1. Flower and its parts**

**4.1. Stamen or Microsporangium**

(a) Microsporangium-Structure (b) Sporogenous Tissue (c) Microspore Tetrad

**4.2 Microgametogenesis**

(a) Development of male gametophyte (b) Pollen wall formation (c) Pollen Sterility

**4.3 Pistil or Megasporangium**

4.3.1. Megasporangium – Structure

4.3.2. Types of ovules - Orthotropous, Anatropous, Campylotropous, Hemianatropous and Amphitropous

**4.4 Megagametogenesis**

4.4.1. Development of female gametophyte

4.4.2. Types of Embryosac – Monosporic, Bisporic and Tetrasporic

4.4.3. Monosporic - *Polygonum* type – Development of *Polygonum* embryosac.

**UNIT 5: POLLINATION, FERTILIZATION, APOMIXIS AND POLYEMBRYONY** (18 Hours)

**5.1 Pollination**

5.1.1. Definition, Characteristics, Dehiscence of anther, Pollen transfer

5.1.2. Types of Pollination – Self Pollination, Cross Pollination

**5.2 Double Fertilization**

**5.3 Syngamy**

5.3.1. Types- Premitotic, Postmitotic and Intermediate

**5.4 Triple fusion**

**5.5 Post fertilization changes**

**5.6 Endosperm**

5.6.1 Definition, Characteristics,

5.6.2 Types – Nuclear, Cellular, Helobial and Cereal

**5.7 Embryo development**

5.7.1 Development of Embryo in Dicots

5.7.2 Types of Embryo in Dicots (a) Crucifer type (b) Asterad Type (c) Solanad type (d) Caryophyllad type (e) Chenopodial type.

5.7.3 Development of Dicot embryo in *Capsella bursa pastoris* - Stages

**5.8 Development of Monocot embryo in *Luzulla***

**5.9. Apomixis**

5.9.1. Definition (b) Types – Non-recurrent Apomixis, Recurrent Apomixis, Parthenocarpy

## 5.10 Polyembryony

### 5.10.1. Definition

- 5.10.2. Types i) Cleavage polyembryony ii) Origin of Embryos from Synergids or Antipodal cells iii) Origin of Embryos from Endosperm iv) Origin of Embryos from cell outside Embryosac

## REFERENCES

### PLANT ANATOMY

1. Easau, K. (1965). Vascular Differentiation in plants. Holt, Rinehart & Winson. N.Y.
2. Vashista, P.C. (1977). A Text Book of Plant Anatomy. S. Nagin & Co., Jalandhar.
3. Krishnamurthy, K.V. (1987). Wood, Tetrahedron Publications, Trichy, India.
4. Singh, V., Pandey, P.C. & Jain, D.K. (1982). Anatomy of seed plants, Rastogi Publications, Meerut, India.
5. Pandey, B.P. (1989). Plant Anatomy. S. Chand and Co., New Delhi.
6. Esau, K. (1964). Anatomy of seed plants, John Wiley & Sons. New York.
7. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

### EMBRYOLOGY

1. Maheswari, P. (1985). An introduction to the Embryology of Angiosperms Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Muneeswaran, A. (1990). Angiosperm Embryology. Titan Books, Madurai, India.
3. Bhojwani, S.S and Bhatnagar, S.P. (2002). The Embryology of Angiosperms (4<sup>th</sup> Edn.,) Vikas Publishing House (P) Ltd., UBS Publisher's Distributions, New Delhi.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
5. Annie Regland. (2000). Developmental Botany (Embryology of Angiosperms). Saras Publications, Nagerkoil, TamilNadu, India.

### CORE PRACTICAL – II- MAJOR PRACTICAL - II

Semester : II  
Credits : 2

Course Code : U16BY2P2  
Hours per week : 3

### PLANT ANATOMY AND EMBRYOLOGY – PRACTICAL (U16BY2P2)

#### PLANT ANATOMY:

(30 Hours)

1. Structure of shoot apex using hand section and preparation of temporary mounts-*Hydrilla* twigs with shoot tips.
2. Study of the distribution and function of permanent tissues. (i) Parenchyma (ii) Sclerenchyma and (iii) Collenchyma (iv) Xylem (v) Phloem
3. To study secretory tissue system through permanent slides: (i) Articulated Latex vessels (ii) Non-Articulated Latex Ducts
4. Study of Tracheary elements by maceration technique: (1) *Cycas* rachis (2) *Cucurbita* Stem
5. Study of Stomata from epidermal peels: (i) Actinocytic (ii) Diacytic (iii) Paracytic (iv) Anamocytic (v) Anisocytic (vi) Gramineous
6. Study of Nodal anatomy: (i) Unilacunar Node (ii) Trilacunar Node (iii) Multilacunar Node

7. Study of internal structure and preparation of T.S of Primary structure of Dicot and Monocot: Root - *Cicer, Canna*; Stem – *Tridax, Sorghum*, Leaf – *Tridax*, Grass. Secondary structure: Dicot Root – *Tridax* sp.; Dicot Stem – *Pongamia*.

8. Study of anomalous secondary thickening and preparation of T.S – (i) *Dracaena* (ii) *Aristolochia* (iii) *Boerhaavia*.

### **PLANT EMBRYOLOGY**

**(15 Hours)**

9. Study of floral parts using bisexual and unisexual flowers.

10. Isolation and mounting of embryo - (i) Globular embryo (ii) Cordate embryo - *Tridax* flower

11. Pollinium dissection – *Calotropis* flower

12. Structure of anther and microsporogenesis using permanent slides.

13. Study of ovule & its types – (i) Anatropous (ii) Orthotropous (iii) Circinotropous (iv) Amphitropous (v) Campylotropous using permanent slides and photographs.

14. Study of Embryosac & Fertilization using photographs.

15. Calculation of percentage of fertile pollens in a given medium.

16. Structure of pollen grains using whole mounts (*Catharanthus, Hibiscus, Acacia, Grass*).

## **CORE – III- PLANT DIVERSITY- I (THALLOPHYTES AND BRYOPHYTES)**

Semester : III

Course Code : U16BY303

Credits : 6

Hours per week : 6

### **Unit I: ALGAE**

**(18 HOURS)**

1.1 General Characters

1.2 F.E. Fritsch's Classification

1.3 Thallus Organization

(a) Motile and non-motile (Colony and Non-colony) (b) Coenobium (c) Palmelloid (d) Dendroid (e) Filamentous (f) Heterotrichous (g) Siphonous (i) Parenchymatous (j) Pseudoparenchymatous

1.4 Life Cycles

(a) Haplontic (b) Diplontic (c) Diplohaplontic (e) Hablobiontic (f) Diplobiotic

1.5 Economic Importance

(a) Food (b) Agriculture (c) Industry (e) Medicine (f) Sewage Treatment

1.6 Harmful effects

1.7 Algal Biotechnology - Definition and scope

1.7.1 Application

1.7.2 *Invitro* algae culture

(a) Fresh and Marine water algae (b) Culture medium- Knop's solution

### **Unit II: ALGAE - TYPE STUDY**

**(18 HOURS)**

- 2.1 Habit and habitat
- 2.2 External and internal structure
- 2.3 Asexual and sexual reproduction
- 2.4 Life cycles (Development not required)
  - (a) *Oscillatoria* (Vegetative reproduction) (b) *Volvox* (c) *Navicula* (d) *Dictyota* (e) *Gracillaria*

**Unit III: FUNGI (18 HOURS)**

- 3.1 Fungi
  - 3.1.1. General Characters
  - 3.1.2. Ainsworth's Classification
  - 3.1.3. Thallus organization
    - (a) Unicellular (b) Filamentous
  - 3.1.4. Mycelium
    - (a) Aseptate Mycelium (b) Septate Mycelium (c) Septal pore
  - 3.1.5. Fungal Flagella
    - (a) Structure (b) Kinds of Flagella (i) Whiplash (ii) Tinsel
  - 3.1.6. Reproduction
    - (a) Asexual (b) Sexual
  - 3.1.7. Economic Importance

- 3.2 Lichens
  - 3.2.1. General characters
  - 3.2.2. Thallus Structure
    - (a) Crustose (b) Foliose (c) Fruticose

3.2.3. Structure and reproduction of *Usnea*  
**Unit IV: FUNGI – TYPE STUDY (18 HOURS)**

- 4.0 Study of Selected fungal species in the following aspects
  - (a) *Phytophthora* (b) *Mucor* (c) *Peziza* (d) *Polyporus* (e) *Cercospora*
- 4.1 Habit and habitat
- 4.2 External and internal Structure
- 4.3 Asexual and sexual reproduction
- 4.4 Life Cycles (Development not required)

**Unit V BRYOPHYTE (18 HOURS)**

- 5.0 General Characters
- 5.1 Rothmaler's Classification
- 5.2 Study of Selected Bryophyte species in the following aspects
  - (a) *Riccia* (b) *Anthoceros* (c) *Funaria*
- 5.3 Habit and habitat,
- 5.4 External and internal structure
- 5.5 Reproduction and life cycle (Development not required)

**CORE PRACTICAL – III - PLANT DIVERSITY- I  
(THALLOPHYTES AND BRYOPHYTES)**

**Major Practical III**

Semester : III  
Credits : 2

Course code : U16BY3P3  
Hours per week : 3

**Algae (15 Hours)**

1. To describe the general characteristics of the algal specimens and identification with reasons- *Oscillatoria*, *Volvox*, *Navicula*, *Dictyota* and *Gracillaria*.
2. To train the students on taking section and giving structural features- *Dictyota* and *Gracillaria*.
3. Economic importance- *Laminaria*, *Gracillaria*, *Chondrus* and *Spirullina*

**Fungi (15 Hours)**

1. To study the fungal specimens in reference to plant disease and their spore structure *Phytophthora*, *Cersospora* and *Mucor*.
2. To disseminate the knowledge on fruiting bodied of *Peziza* and *Polyporus* and to study the morphological features.
3. Taking cross section and structural features- *Peziza* and *Polyporus*

**Lichens**

1. To study the morphological and general characteristics of lichens
2. To describe the fruiting bodies of Lichen- Apothecium

**Bryophytes (15 Hours)**

1. To study morphology of *Riccia*, *Anthoceros* and *Funaria*
2. To give knowledge about the development such as antheridia, archegonia in *Riccia*, *Anthoceros* and *Funaria*
3. To study the sporophyte of *Riccia* and capsule of *Anthoceros*, *Polytrichum* and *Funaria*

**REFERENCES**

**Algae**

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3. Kumar, H.D. and Sing, H. N. (1976):A Text book of Algae. Affiliated East West press Pvt. Ltd., New Delhi, Madras.
4. Kumaresan, V. (1997). Algae and Bryophytes. Saras Publications, Nagercoil, India.
5. Pandey, B.P. (2002). A Text book of Botany – Algae. S.Chand & Co., (P) Ltd., New Delhi
6. Sharma, O.P. (1990). Text book of Algae. Tata McGraw Hill Publishing Co., Ltd., New Delhi
7. Smith, G.M. (1938). Cryptogamic Botany (Vol.1 Algae, Fungi and Liches). McGraw Hill Book Co., New York.
8. Singh, V. (1992). Text book of Botany. 1<sup>st</sup> Meerut, Rastogi.
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10. Venkateswarlu, V. (1970). A Text Book of Algae. Maruthi Book Depot, Guntur, Hyderabad, India

### **FUNGI**

1. Alexopoulos, C.J. and Delavoryas, T. (1987). Morphology of Plants and Fungi. Harper and Row, Publishers
2. Vashista, B.R. (2000). Botany for Degree Students – Fungi. S.Chand and Co., New Delhi
3. Mims, C.W. & Blackwell, M. (1996). Introductory Mycology. John Wiley & Sons, N.Y.
4. Srivastava, J.O. Introduction to Fungi (2<sup>nd</sup> Edn.,) S.Nagin and Co., Meerut India
5. Sharma.O.P. (1992). Test Book of Fungi. Tata McGraw-Hill Publishing C., New Delhi

### **BRYOPHYTES**

1. Chopra, G.L. (1968). A class Book of Bryophyta. Hari Singh & Bros., Jullunder.
2. Kumra, P.K. (1988). Biology of Bryophytes. Wiley Easter Ltd., New Delhi.
3. Parihar, N.S. (1965). An introduction to Embrophyta –Vol.II. Bryophyta. Central Book Depot, Allahabad.
4. Srivastava, N.N. (1996). Bryophyta. Pradeep Prakashan, Meerut, India.
5. Vashista, B.R. (2000). Botany for Degree Students – Bryophytes. S.Chand and Co., New Delhi.

## **CORE – IV - PLANT DIVERSITY II PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**

Semester : IV  
Credits : 5

Course Code : U16BY404  
Hours / week: 6

### **Unit I : PTERIDOPHYTES**

**(18 HOURS)**

- 1.1 General characters
- 1.2 Sporne’s Classification

### 1.3 Stellar Types

1.3.1. Haplostele and Actinosteale

1.3.2. Plectosteale and mixed stele

1.3.3. Siphnostele

(a) Ectophloic siphnostele (b) Ambphiphloic siphnostele

1.3.4. Solenosteale

(a) Ectophloic solenosteale (b) Ambphiphloic solenosteale

1.3.5. Distele and Polysteale

### 1.4 Apospory

### 1.5 Apogamy

### 1.6 Heterospory

### 1.7 Seed habit

## **Unit II- PTERIDOPHYTES- TYPE STUDY**

**(18 HOURS)**

2.1 Habit and habitat,

2.2 External and internal morphology Structure,

2.3 Asexual and sexual reproduction

2.4 life cycles (Development not required)

(a) *Psiltoum* (b) *Lycopodium* (c) *Equisetum* (d) *Adiantum*

## **Unit III: GYMNOSPERMS**

**(18 HOURS)**

3.1 General characters

3.1.1. Comparison of Ferns and Gymnosperms

3.1.2. Comparison of Angiosperms and Gymnosperms

3.2 Sporne's Classification

3.3 Economic Importance

(a) Food (b) Medicine (c) Timber

## **Unit IV- GYMNOSPERMS – TYPE STUDY**

**(18 HOURS)**

4.2 External and internal structure,

4.3 Reproduction - asexual and sexual

4.4 Life Cycles (Development not required).

(a) *Cycas* (b) *Pinus* (c) *Gnetum*

## **Unit V: PALEOBOTANY**

**(18 HOURS)**

5.1 Fossils - Definition

5.2 Methods of fossilization

**5.2.1. Petrifications**

**5.2.2. Compressions**

**5.2.3. Impressions**

5.3 Geological time scale

5.4 Radio carbon dating

5.5 A study on fossil forms

(a) *Rhynia* (b) *Lepidodendron* (c) *Lepidocarpon* (d) *Calamites* (e) 5.4.5. *Willamsonia*

## **REFERENCES**

### **Pteridophytes**

1. Parihar, N.S. (1965). An introduction to Embryophyta Vol. 1 Pteridophyta. Central Book Depot. Allahabad.
2. Smith, G.M. (1956). Cryptogamic Botany Vol. II. (2<sup>nd</sup> Edn.). (Bryophytes & Pteridophytes). McGraw Hill Book Co., N.Y.
3. Sporne, K. R. (1970). The Morphology of pterdophytes. (The structure of Ferns and Allied Plants). Hutchinson University Library, London.
4. Sharma, O. P. (1990). Text Book of Pteridophyta. Macmillan India Ltd., Delhi.
5. Sundararajan, S. (2007). Introduction to Pteridophyta. New Age International Publishers, New Delhi.
6. Vashista, P.C. (2008). Botany for Degree Students - Pteridophyta. S. Chand and Co., Delhi.

### **Gymnosperms**

1. Coulter, J. M. and C. J. Chamberlain. (1964). Morphology of Gymnosperms. Central Book Depot, Allahabad.
2. Sporne, K. R. (1971). The Morphology of Gymnosperms. (The structure and Evolution of Primitive seed Plants). Hutchinson University Library, London.
3. Sharma, O.P. (1997). Gymnosperms. Pragati Prakashan, Meerut, India.
4. Vashista, P.C. (2006). Botany for Degree Students Gymnosperms (2<sup>nd</sup> Edn.) S. Chand & Co., New Delhi.

### **Paleobotany**

5. Arnold, C.A. (1947). An Introduction to Paleobotany. McGraw Hill Book Co., N.Y.
6. Delavoryas, T. (1962). Morphology and Evolution of Fossil Plants. Holt, Rinehart and Winston. N.Y.
7. Shukla, A.C. and Misra, S. P. (1975). Essentials of Paleobotany. Vikas Publishing House (P) Ltd., Delhi, Bombay, Kanpur.
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## MAJOR PRACTICAL- IV

Semester : IV  
Credits :2

Course code : U16BY4P4  
Hours per week : 3

### PTERIDOPHYTES

(15 HOURS)

1. A study of the morphology, anatomy and sori organization of the following genera- *Psilotum*, *Lycopodium*, *Adiantum* and *Equisetum*.
2. Cross section:- *Lycopodium*- stem, *Psilotum*, *Adiantum*- petiole and sporangia and *Equisetum*- stem.

### GYMNOSPERMS

(15 HOURS)

1. A study of the morphology, vegetative and reproductive parts of the of the genera- *Cycas*, *Pinus* and *Gnetum*
2. To train the students to take section on *Cycas*- corollid root, leaf and rachis and microsporophyll, *Pinus*- needle and stem and *Gnetum*- stem.

### PALEOBOTANY

(15 HOURS)

1. Fossil forms- *Rhynia*, *Lepidodendron* , *Lepidocarpon* and *Calamites*.
2. Field Trip to National fossil park.

## NMEC I - NURSERY TECHNOLOGY

Course Code: U16BYPE1

Credits: 2

Semester III

Hours/Week: 2

### Unit I: Introduction

(6 Hours)

- 1.1 Methods of Propagation-
- 1.2 Sexual Propagation,
- 1.3 Vegetative Propagation,
- 1.4 Cuttings,
- 1.5 Layering,
- 1.6 Grafting,
- 1.7 Budding.

### UNIT II : Tissue culture

(6 Hours)

- 2.1 Methods of Plant multiplication *in vitro*.
- 2.2 Basic parameters for propagation *in vitro*.

### UNIT III : Nursery Structures

(6 Hours)

- 3.1 Store House,
- 3.2 Potting and Packing Shed,
- 3.3 Nursery Bed,
- 3.4 Mist Chamber,
- 3.5 Manures,
- 3.6 Compost and vermicompost.

### UNIT IV:

(6 Hours)

- 4.1 Green houses for tropical countries – Management,

4.2 Pot culture, Pot mixture

**UNIT V :**

**(6 Hours)**

5.1 Harvesting,

5.2 Packing,

5.3 Storage and Marketing of Nursery Stock

**TEXT BOOKS:**

1. Kumar. N. 1997. *Introduction to Horticulture*. Rajalakshmi Publications Nagercoil, India.
2. Manibhushan Rao, K. 1991. *Text Book of Horticulture*. Macmillon India Ltd.

**NMEC II -MUSHROOM CULTIVATION**

**Semester IV**

**Course Code: U16BYPE2**

**Credits 2**

**Hours/Week: 2**

**Unit I Introduction**

**(6 Hours)**

1.1 Types of Mushroom-Identification of edible and poisonous Mushroom.

1.2 Nutritive values life cycle of common edible mushroom.

**Unit II**

**(6 Hours)**

2.1 Scenario of Mushroom cultivation

2.2 Prospects and Scope of Mushroom Cultivation.

**Unit III - Cultivation methods for different types of Edible mushroom (6 Hours)**

3.1 Paddy straw mushroom (*Volvariella* Sp.)

3.2 Button mushroom (*Agaricus* Sp.)

3.3 Oyster mushroom (*Pleurotus* Sp.)

**Unit IV**

**(6 Hours)**

4.1 Cultivation,

4.2 Pure Culture Preparation of Spawn and Compost

4.3 Spawn Running Cropping and its maintenance Harvesting and Marketing

**Unit V**

**( 6 Hours)**

5.1 Protection and Management Disease & Pests of Mushroom and their control measures

**TEXT BOOKS:**

1. Gardner, 1996. *Basic Horticulture* Mac Milan N Y.
2. Tavis Lynch, 2018. *Mushroom Cultivation: An Illustrated Guide to Growing Your Own Mushrooms at Home*. Quarry Books; Ill edition. ISBN-13: 978-1631594045

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1. Manibhushan Rao, K. 1999. *Text Book of Horticulture*. Macmillon India Ltd.
2. Sharma, O. P. 1982. *Text Book of Fungi*. Tata McGraw-Hill Publishing Co., New Delhi.

**REFERENCES:**

1. Edmond Musser and Andres. 1957. *Fundamentals of Horticulture*. McGraw Hill Book Co.
2. Gardener. 1996. *Basic Horticulture*. Mac Millan N.Y.

3. Lex Lauries and Victor H, Rice. 1979. *Floriculture – fundamentals and practices*. Mc. Graw Hill publishers N.Y.
4. Mukherjee. D. 1977. *Gardening in India*. Oxford IBH Publishing Co., New Delhi.
5. Randhawa. 1997. *Ornamental Horticulture in India*. Today and Tomorrow Publishers New Delhi.

## **CORE – V- PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS**

Semester : V  
Credits : 6

Course Code : U16BY505  
Hours per week: 7

### **UNIT 1: IMPORTANCE OF WATER & MINERALS (14 Hours)**

#### **1.1 Water – properties & role**

- 1.1.1. Structure, Physical and chemical properties
- 1.1.2. Importance of Water

#### **1.2 Osmotic & non-osmotic uptake of water**

- 1.2.1. Diffusion – Role in Plants
- 1.2.2. Kinds of Solution – Hypotonic, Hypertonic and Isotonic
- 1.2.3. Osmosis – role in plants, Diffusion Pressure Deficit, Turgor Pressure, Osmotic Pressure and Significance.
- 1.2.6. Plasmolysis – definition, Incipient, Deplasmolysis, Advantages
- 1.2.7. Imbibition
- 1.2.8. Water potential & Osmotic relations of plant cells – Water potential, Osmotic Potential and Pressure Potential
- 1.2.9. Mechanism of Absorption of water
  - (i) Types – Active – Osmotic and Non-Osmotic absorption, Passive, Symplastic and Apoplastic absorption.
- 1.2.10. Factors affecting absorption of water.
- 1.2.11. Ascent of sap
  - (a) Path of ascent of sap – Ringing Experiment
  - (b) Mechanism of ascent of sap – Vital force theory, Root pressure theory, Physical force theory, Transpiration pull and Cohesion of water theory

#### **1.3. Transpiration**

- 1.3.1. Definition, Kinds

#### **1.4. Stomatal transpiration**

- 1.4.1. Structure
- 1.4.2. Mechanism of Stomatal Transpiration
  - (i) Osmotic Diffusion of water in the leaf from xylem to intercellular spaces
  - (ii) Opening & Closing of Stomata
    - (a) Starch-Sugar Interconversion theory
    - (b) Synthesis of sugars or organic acids in guard cells
    - (c) ATP-driven Proton( $H^+$ ) –  $K^+$  Exchange pump Mechanism in Guard cells
    - (iii) Simple diffusion of water vapours from intercellular spaces to outer atm.
- 1.4.3. Advantages, factors affecting stomatal movements

1.4.4 Transpiration as a Necessary evil

### **1.5. Translocation of organic solutes & assimilates**

1.5.1. Definition, directions – downward, upward and radial, path – downward, upward and radial.

1.5.2. Mechanism of Translocation through Phloem - Munch's mass flow hypothesis

### **1.6 Mineral nutrition of plants**

1.6.1. Essential and Non-essential elements, Types- Essential – Major and Minor Elements and its function.

1.6.2. Specific roles & deficiency symptoms of Major and Minor elements.

### **1.7 Mineral salt absorption**

1.7.1. Definition, Mechanism – Contact Exchange theory, Carbonic Acid Exchange theory.

1.7.2. Types – Passive and Active

### **1.8 Determination of essentiality of mineral elements**

1.8.1. Solution Culture

1.8.2. Hydroponics – Definition, Types- Flood and Drain system, Drip System and Nutrient Film Growth System, Aeroponics.

## **UNIT 2: PHOTOSYNTHESIS**

**(21 Hours)**

### **2.1.0 Radiant energy & its role in photosynthesis**

2.1.1. Photosynthesis – definition, significance, Photosynthetic Apparatus

2.1.2. Photosynthetic Pigments, Location, Absorption and utilisation of light energy

### **2.2.0 Absorption Spectrum**

2.2.1. Absorption Spectra of Chlorophylls, Carotenoids and Phycobilins

### **2.3.0 Red drop & Emerson's Enhancement effect**

### **2.4.0 Photosystems**

2.4.1. Types – Photosystem I, Photosystem II

### **2.5.0 Mechanism of Photosynthesis**

2.5.1. Parts – Light / Hill's Reaction, Dark Reaction / Blackman's reaction

2.5.2. Light Reaction

Steps –Absorption of light energy by chloroplast pigments, Transfer of light energy from accessory pigments to Chlorophyll-a, Activation of Chlorophyll-a molecule by photons of light, Photolysis of water and O<sub>2</sub> Evolution, Electron Transport and production of Assimilatory power.

2.5.3. Photophosphorylation

Types – Non-cyclic Photophosphorylation, Cyclic Photophosphorylation

2.5.4. Products of light reaction & their utilization

2.5.5. Dark Reaction - Pathway of C<sub>3</sub> Cycle

### **2.6.0 Hatch and Slack Pathway**

2.6.1 C<sub>4</sub>–Dicarboxylic Acid Pathway and its Significance

### **2.7.0 CAM pathway**

2.7.1 Crassulacean Acid Metabolism(CAM) - Synthesis of malate during night or Dark CO<sub>2</sub> fixation, Consumption of malate in light.

### **2.8.0 Photorespiration**

2.8.1 Glycolate Pathway, Factors affecting photorespiration and Significance

## **UNIT 3: RESPIRATION AND NITROGEN METABOLISM**

**(21 Hours)**

### **3.1.0 Respiration**

3.1.1. Definition, Organelle involved, kinds – Aerobic and Anaerobic

### **3.2.0 Glycolysis**

3.2.1. Glycolysis / EMP Pathway

3.2.2. Stoichiometry of Glycolysis

### **3.3.0 Krebs cycle**

3.3.1. Krebs / TCA Cycle – pathway

3.3.2. Stoichiometry of TCA cycle

### **3.4.0 Electron Transport System & Oxidative Phosphorylation**

### **3.5.0 Nitrogen Metabolism**

3.5.1. Role, sources of Nitrogen to Plants.

3.5.2. Conversion of Nitrate into ammonia by the plants – Reduction of nitrate to Nitrite, Nitrite to ammonia

3.5.3. Biological Nitrogen Fixation-  $N_2$  fixing organisms- free living, symbiotic

3.5.4. Mechanism of Biological Nitrogen Fixation – role of nitrogenase, formation of root nodules in leguminous plants, factors controlling  $N_2$  fixation.

### **3.6.0 Nitrogen Assimilation**

3.6.1. Reductive amination, Transamination

### **3.7.0 Nitrogen Cycle**

3.7.1. Steps – Denitrification, Ammonification and Nitrification

### **3.8.0 Enzymes**

3.8.1. Definition, Nature, Structure and Properties

3.8.2. Mechanism of Enzyme Action – Lock and Key Theory and Induced Fit theory

## **UNIT 4: PLANT GROWTH**

**(14 Hours)**

### **4.1.0 Plant Growth**

4.1.1. Growth-Definition, Growth curve, Natural Growth Hormones, Growth Promoting substances – Auxin, Gibberellins and Cytokinins.

**4.2.0 Auxins** – Discovery, Chemical Nature, Physiological effects

**4.3.0 Gibberellins** - Discovery, Chemical Nature, Physiological effects

**4.4.0 Kinetin** - Discovery, Chemical Nature, Physiological effects

**4.5.0 Role of Hormones and Florigen in Flowering**

**4.6.0 Senescence in Plants**

4.6.1. Definition, Types – Overall, Top, Deciduous and Progressive

4.6.2. Programmed Cell Death

**4.7.0 Abscission of leaves** - Definition and Mechanism

**4.8.0 Photoperiodism**

4.8.1. Definition, Duration of Photoperiod – Short Day, Long Day, Day Neutral, Long Short Day, Short-Long Day Plants.

4.8.2. Photoperiodic Induction- definition, Continuous Inductive Cycle, Dis-Continuous Inductive Cycle

4.8.3. Perception of the photoperiodic stimulus & presence of a floral hormone

4.8.4. Importance of Photoperiodism

**4.9.0 Phytochrome**

4.9.1. Definition, Types- Red light absorbing form( $P_R$ ), Far-red light absorbing Form( $P_{FR}$ )

**4.10.0 Vernalization**

- 4.10.1. Definition, Perception of the cold stimulus and other conditions.
- 4.10.2. Mechanism of Vernalization- Phasic development theory, Hormonal theory, Devernalization and Practical utility

#### **4.11.0 Seed dormancy**

- 4.11.1. Definition, factors causing dormancy
- 4.11.2. Artificial methods of breaking the dormancy of seeds – Scarification, Pressure, Low temperature, alternating temperature, light, germination Stimulating Compounds and advantages.

#### **4.12.0 Seed Viability**

- 4.12.1. Definition, kinds- Microbiotic, Mesobiotic and Macrobiotic, Viability test

#### **4.13.0 Seed germinability**

- 4.13.1. Physiology, Physiological condition of quiescent seed, of seed germination
- 4.13.2. Physiological, Biochemical & other changes accompanying seed- Germination, Water uptake, Respiration and Mobilization of Reserve Materials, Emergence of seedling out of the seed coat.

### **UNIT 5: BIOCHEMISTRY AND BIOPHYSICS**

**(16 Hours)**

#### **5.1.0 pH and its determination**

- 5.1.1. pH-Definition, Measurement, Hydrogen ion Concentration and Importance

#### **5.2.0 Buffers**

- 5.2.1. Definition, Examples, Mechanism of Buffer action, Bicarbonate Buffer system

#### **5.3.0 Chromatography**

- 5.3.1. Principle, Types- Paper, TLC, Column, Affinity, Gas and HPLC and applications

#### **5.4.0 Centrifugation**

- 5.4.1. Principle, Types- Clinical, Ultra, Refrigerated and High speed.

#### **5.5.0 Carbohydrates**

- 5.5.1. Definition, Structure, Types – Monosaccharides, Oligosaccharides and Polysaccharides, Function.

#### **5.6.0 Lipids**

- 5.6.1. Definition, Structure, Types – Simple, compound and derived, functions.

#### **5.7.0 Proteins**

- 5.7.1. Definition, Structure, Types – Simple, Conjugated and derived, functions

#### **5.8.0 Elementary account on Secondary Metabolites**

- 5.8.1. Definition, Structure, Occurrence and properties of the following secondary Metabolites – Flavonoids, Terpenoids, Alkaloids

#### **5.9.0 Laws of Thermodynamics**

- 5.9.1. Thermodynamics – Definition, Laws, Entropy, Enthalpy and free energy

#### **5.10.0 Redox couples**

- 5.10.1. Definition, Redox Couple Reaction, Significance

#### **5.11.0 ATP- Bioenergetic**

- 5.11.1. Definition, ATP synthesis, Significance

### **REFERENCES**

#### **Plant Physiology**

Lincoln Taiz and Eduardo Zeiger (2010). Plant Physiology 5<sup>th</sup> Edition. Sunderland, Massachusetts, USA.

Devlin, R.M. (1969). Plant Physiology. Holt, Rinehart & Winston & Affiliated East. West press (p) Ltd., New Delhi.

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Srivastava, H.N. (1998). Plant Physiology. Pradeep Publications, Jalandhar, India.

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### **Biochemistry**

Arumugam, N. (1993). Biochemistry. Saras publications, Nagarkoil, Tamilnadu.

Harborne, J.B. (1997). Plant Biochemistry. Harcourt Asia (P) Ltd., India and Academic Press – Singapore.

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### **Biophysics**

Achermaan, K. (1987). Biophysical sciences, Prentice hall of India. New Delhi.

Annie and Arumugam, N. (2000). Biochemistry and Biophysics. Saras Publications, Nagarkoil, Tamil Nadu.

Epstein, H.T. (1963). Elementary Biophysics. Addison Wesley Publishers, U.S.A.

Narayanan, P. (2000). Essentials of Biophysics. New Age International Publishers (P) Ltd., New Delhi.

## **CORE – VI - CELL BIOLOGY, GENETICS AND EVOLUTION**

Semester : V

Course Code : U16BY506

Credits : 6

Hours per week : 7

### **UNIT I- CELL AND ITS INCLUSIONS**

**(14 HOURS)**

**1.1 Cell-** Definition and types- Prokaryotic cell and Eukaryotic cells

1.2 Cell theory and its significance

1.3 Cell Wall- Bacterial (a) Gram positive and (b) Gram negative cell wall

1.4 Plant cell wall – Ultra structure and functions

1.5 Cytoplasm- physical, chemical and biological properties

1.6 Plasma membrane – Ultrastructure, Models (Sand wich and Fluid mosaic model) functions

1.7 Endoplasmic Reticulum – Ultrastructure, types and functions

1.8 Mitochondria- ultrastructure and functions

1.9 Plastids- Types and functions

**2.0 Chloroplasts** – distribution, Ultrastructure and functions

2.1 Golgi Apparatus – Ultrastructure and functions

2.2 Ribosomes- Ultrastructure and functions- (a) Prokaryotic Ribosomes (70S)(b) Eukaryotic Ribosomes (80S)

## **UNIT II- NUCLEUS**

**(14 HOURS)**

**2:1 Nucleus** – Ultrastructure and functions

2.2 Chromosomes- types - Euchromatin and Heterochromatin (a) Facultative and (b) Constitutive heterochromatin

2.3 Special types of Chromosomes- (a) Lampbrush chromosomes (b) Polytene chromosomes

2.4 Components and Organization of Nucleic acid– DNA structure and Watson and crick's double helical DNA model and types- DNA -A, B and Z form of DNA

2.5. Ribonucleic acid -mRNA,rRNA,tRNA – Clover leaf model

2.6 Chromosomes

2.7 Cell division- Amitosis, Mitosis and Meiosis- Occurrence,Processes and Significances.

## **Unit – III GENETICS**

**(21 HOURS)**

**3:1 Definition of Genetics**, Scope and importance of genetics

3:2 Mendel's Laws of inheritance.- Law of segregation, Law of dominance and Law of independent assortment

3:3 Monohybrid cross, dihybrid cross, Back cross and Test cross

3:4 Variation in Dominance- Incomplete dominance, Co-dominance, Lethal factor,

3.5 Complementary gene 9:7

3:6 Epistasis-Definition and types- Dominant Epistasis (12:3:1), Recessive Epistasis (9:3:4)

3:7 Multiple alleles- Polygenic inheritance- Definition, Kernal Colour in wheat, Skin colour in human

3:8 Blood Group in human, Rh factor.

## **Unit IV – LINKAGE AND CROSSING OVER**

**(16 Hours)**

**4:1 Linkage** - Definition and types- complete and incomplete linkage and its Significance of linkage

4:2 Crossing over - Definition, Types –Single, double and Multiple crossing over and its significance

4:3 crossing over - Theories about the mechanisms of crossing over- Stern's experiment, Tetrad analysis and Crighton and Mc Clintocks experiment

4.4 Linkage Mapping

4.5 Cytoplasmic inheritance– Kappa particle (*Paramaceium*)

4.6 Sex linkage – Definition and *Drosophilla* (Bar eye)and human (colour blindness)

4.7 Sex determination -Definition and *Drosophilla* and human

4.8 *Neurospora* Genetics

## **UNIT V: EVOLUTION**

**(14 Hours)**



**5.1 Definition** of Evolution - Inorganic, Organic Evolution

5.2 Theories of Evolution of organic forms- Theory of Eternity, Theory of Special creation, Cosmozoic theory, Catastrophism and Modern theory

5.3. Theories of Evolution- inheritance of acquired characters (Lamarckism) and natural selection (Darwinism)

5.4 Modern Synthetic Theory

5.5 Isolation - Types of Isolation and Role

5.6 Speciation–Definition, Gradual Speciation - Allopatric Speciation and Sympatric Speciation.

**CORE PRACTICAL – V - Major practical V**

Semester : V  
Credits : 2

Course Code : U16BY5P5  
Hours per week : 3

**Physiology**

**(21 Hours)**

**For demonstration**

1. Colorimeter.
2. Measurement of pH.
3. Centrifuge.

**Experiments to be performed by each students**

1. Estimation of sugars (Colorimetric).
2. Estimation of lipids (Gravimetric).
3. Effect of light intensity on transpiration using Ganong's photometer.
4. Determination of stomatal frequency and index using cobalt chloride paper.
5. Comparison of stomatal and cuticular transpiration.
6. Determination of absorption and transpiration ratio in plants.
7. Separation of plant pigments by paper chromatography.
8. Determination of photosynthetic rate in water plants under different CO<sub>2</sub> concentrations.
9. Measurement of O<sub>2</sub> evolution under different color lights using Wilmott's bubbler.

10. Qualitative test for phytochemicals – Starch, sugar, protein, lipids, flavonoids and terpenoids.

### **CELL BIOLOGY**

**(3 HOURS)**

A study of cell structure of plants and its organelles using electron micrographs from standard publications. Study of Mitosis and Meiosis using squash and smear techniques.

### **GENETICS**

**(21 HOURS)**

Problems on simple monohybrid and dihybrid ratios. Simple problems on interaction of factors included in Theory.

### **REFERENCES**

#### **Cell Biology**

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5. Karvita B. Ahluwalia, (2000) Genetics, New Age International pvt. Ltd., Publishers, Chennai.
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#### **Genetics**

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7. Elrod Susan.L. (2010) Genetics 4<sup>th</sup> Edn., TataMcGraw Hill, New Delhi.

### **Evolution**

1. Savage Jay.M. (1969) Evolution (2<sup>nd</sup> Edn.,) Amarind publishing Co Pvt., Ltd., New Delhi.
2. Shukla, R.s. and P.S.Chandel (1980) Cytogenetics, Evolution and Plant Breeding, S.Chand and Co., New Delhi.
3. Verma P.S. and V. K. Agarwal. (1998) Concept of Evolution, S.Chand and Co., New Delhi.
4. Strickberger, Monroe.W.(1994) Evolution,CBS, New Delhi.
5. Moore Ruth, (2000) Evolution, Time World Press, Kulkutta.
6. Barton Nicholas.H., Briggs Derek E.G. and Eisen Jonathan. A. (2008) Evolution, Cold Spring Harbor laboratory Press, U.S.A

## **ELECTIVE – I-BIOSTATISTICS, COMPUTER APPLICATION AND BIOINFORMATICS**

Semester : V  
Credits : 5

Course Code : U16BY5:1  
Hours per week: 5

### **Unit I: BASIC CONCEPT OF BIOSTATISTICS**

**(18 Hours)**

- 1.1.0. Biostatistics
  - 1.1.1. Definition
  - 1.1.2 Scope
- 1.2.0. Data
  - 1.2.1. Definition
  - 1.2.2. Types- (a) Primary(b) Secondary
  - 1.2.3. Collection of data
- 1.3.0 Population
  - 1.3.1 Definition
  - 1.3.2.Types of population - (a) Finite population (b) Infinite population
- 1.4.0 Sample
  - 1.4.1. Definition
- 1.5.0 Sampling techniques
  - 1.5.1. Random sampling techniques
- 1.6.0 Frequency distribution
  - 1.6.1.Definition
  - 1.6.2. Discrete method & Continuous method
  - 1.6.3. Frequency graphs
- 1.7.0. Statistical table
  - 1.7.1. Rules, Organization and types of table
- 1.8.0. Graphical Representation of Data
  - 1.8.1. Importance and general guidelines
  - 1.8.3. Types of graphs - (a) Bar (b) Simple(c) Multiple(d) Percentage

- (e) Subdivided (f) Pie diagram (g) Pictogram (h) Cartogram
- 1.9.0. Central Tendency
  - 1.9.1. Mean
    - (a) Definition (b) Merits and demerits (c) Problems
  - 1.9.2. Median
    - (a) Definition (b) Merits and demerits (c) Problems
  - 1.9.3. Mode
    - (a) Definition (b) Merits and demerits (c) Problems

**Unit II: DESCRIPTIVE AND INFERENCE STATISTICS (18 Hours)**

- 2.1. Measure of dispersion
  - 2.1.1. Definition
  - 2.1.2. Types of dispersion
    - (a) Absolute measure of dispersion (b) Relative measure of dispersion
- 2.2. Probability
  - 2.2.1. Probability scale, Definition, Types and application of biological problems
- 2.3. Binomial distribution
  - 2.3.1. Introduction, Definition and Properties of binomial distribution
- 2.4. Poisson Distribution
  - 2.4.1. Introduction, Definition and Properties of Poisson distribution
- 2.5. Normal distribution
  - 2.5.1. Introduction, Definition and Properties
- 2.6. Test of Significance
  - 2.6.1. Introduction, Definition, Procedure and application of chi-square test

**Unit III: FUNDAMENTALS OF COMPUTER (18 Hours)**

- 3.1. Computer application in biology
  - 3.1.1. Introduction, Advantages, Evolution and Generations of Computer
- 3.2. Organization of a computer
  - 3.2.1. Input devices- (a) Keyboard (b) Mouse
  - 3.2.2. Output devices - (a) Monitors (b) Printers
- 3.3. Computer Memory - RAM and ROM
- 3.4. Storage devices – Floppy, Compact and Hard Disc
- 3.5. Central Processing Unit
- 3.6. Software
- 3.7. Hardware

**Unit IV: COMPUTER APPLICATIONS (18 Hours)**

- 4.1. Computer Network - LAN and WAN
- 4.2. Data – Representation
- 4.3. Number Systems- Binary and Arithmetic
- 4.4. Operating System - Windows
- 4.5. Word Processing Software - (a) MS Office (b) Word (c) Excel (d) Power point

**Unit V: BIOINFORMATICS (18 Hours)**

- 5.1.0. Bioinformatics

- 5.1.1. Definition and scope.
- 5.1.2. Role of Internet in Bioinformatics
- 5.2.0. Biological database
  - 5.2.1. Nucleotide sequence database
    - (a) European Molecular Biology Laboratory (EMBL)
    - (b) National Centre for Biotechnology Information (NCBI)
  - 5.2.2. Protein sequence database - (a) Protein Information resources (PIR) (b) Swiss-Prot
- 5.3.0. Role of Bioinformatics - Human genome project and *Arabidopsis thaliana*

## REFERENCES

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2. Gurumani. N. (2015). An introduction to biostatistics. 2<sup>nd</sup> Edition, MJP Publishers, Chennai, India.
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14. Sundararajan.S. & R. Balaji (2002). Introduction to Bioinformatics, Mumbai, Himalaya.

## **SBEC – I MUSHROOM AND NURSERY TECHNOLOGY**

Semester : V Course Code : U16BYPS1  
Credits : 2 Hours per week : 2

### **Unit I: INTRODUCTION TO MUSHROOMS (10 Hours)**

- 1.1.0. Introduction and Systematic position
- 1.2.0. Structure of mushroom
- 1.3.0. Types of mushrooms
  - 1.3.1. Edible mushroom - (a)Definition (b) Cultivation of Edible of mushroom
  - 1.3.2. Poisonous mushroom -(a) Introduction(b) Definition
- 1.4.0. Identification of edible and poisonous Mushrooms - Physical and Chemical method
- 1.5.0. Nutrient values of edible mushroom
- 1.6.0. Life cycle
- 1.7.0. Economic values

### **Unit II: CULTIVATION OF MUSHROOMS (10 Hours)**

- 2.0. Mushroom cultivation - Compost beds, Spawn types, Production and management of spawn, Spawn running
- 2.1. Disease and pest management – Insects, Nematodes, Mites, Virus, Bacteria and Fungi
- 2.2. Harvesting methods

### **Unit III: MUSHROOMS –POST HARVEST AND PROCESSING (10 Hours)**

- 3.1.0. Post harvesting technology – Cleaning, Freezing, Freeze drying, Packing and Marketing
- 3.2.0. Mushroom recipes preparation – Pickle, Soup, Gravy and Briyani

### **Unit IV: BASIC CONCEPTS AND TECHNIQUES OF NURSERY TECHNOLOGY (4 Hours)**

- 4.1.0. Nursery technology – Introduction, Definition
- 4.2.0. Methods of Propagation
  - 4.2.1 Sexual Propagation
  - 4.2.2. Vegetative Propagation –(a) Cuttings, (b) Stem cuttings–*Hisbiscus* ,(c) Root cuttings – Rose

4.2.3. Layering -(a) Simple layering, (b) Air layering – *Ixora*

4.2.4. Grafting-(a) Inarching – Guava (b) Wedge grafting - Mango

4.3.0. Garden implements - Garden Hose, Pick Axe, Trenching Hoe, Knapsac sprayer, Mist Chamber, Trowel, Sprinkler, Rose Kittle, Crow Bar, Garden scissor, Grafting Knife, Rake, Sprayer, Pruning saw, Plant cutter

## **UNIT V: COMPONENTS AND PREPARATION OF NURSERY BED (10 Hours)**

5.1.0. Nursery Structures - Store House, Potting, Packing Shed, Nursery bed preparation, Mist chamber, Manures preparation, Compost preparation, Vermicompost preparation

5.2.0. Green houses for tropical countries - Management, Pot mixture, Pot culture, Maintenance and Marketing of Nursery Stock

## **REFERENCES**

1. Bahl, N. (2002). Hand book on mushrooms. IV edition. Oxford and IBH publishing Co., Pvt. Ltd., New Delhi.
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## **CORE – VII -GENERAL GEOLOGY, ECOLOGY AND PHYTOGEOGRAPHY.**

Semester :VI

Hours per week : 6

Credits : 6

Course Code: U16BY607

### **Unit I : GEOLOGY**

**( 18 HOURS)**

- 1.1. Scope, subdivisions and importance of Geology
- 1.2. Solar system, origin and age of earth
- 1.3. Land distribution (Continental drift)
- 1.4. Interior of the earth
- 1.5. Soil
  - 1.5.1. Soil erosion and soil types of India.
- 1.6. Elementary knowledge of ground water
  - 1.6.1. Surface water systems.

### **Unit II : ECOLOGY**

**(18 HOURS)**

- 2.1. Scope and importance of studying ecology.
- 2.2. Approaches to the study of ecology
  - 2.2.1. Autecology
  - 2.2.2. Synecology
- 2.3. Plants and Environmental factors
  - 2.3.1 Plants and Climate
  - 2.3.2. Plants and Edaphic factors
  - 2.3.3. Plants and Biotic factors
  - 2.3.4. Topographic factors.

### **Unit III – EVOLUTION OF PLANT COMMUNITY**

**(18 HOURS)**

- 3.1. Development of vegetation
  - 3.1.1. Migration
  - 3.1.2 Ecesis and colonization.
- 3.2. Methods of studying vegetation
  - 3.2.1. Quadrat and transect
  - 3.2.2. Determination of Density, Frequency and Abundance
  - 3.2.3. Verification of Raunkier's Law



### 3.4. Plant succession

#### 3.4.1. Hydrosere and Xerosere.

## **Unit IV – PLANT RESPONSE**

**(18 HOURS)**

### 4.1. Ecological classification of plants

#### 4.1.1. Hydrophytes

#### 4.1.2. Xerophytes

#### 4.1.3. Epiphytes

#### 4.1.4. Halophytes

### 4.2. Morphological and anatomical features of plants and their correlation to their respective habitats

## **Unit V: PHYTOGEOGRAPHY**

**(18 HOURS)**

### 5. Definition and importance

#### 5.1. Types of distribution of plants(continuous and discontinuous)

#### 5.2. Climate of India and climatic zones.

#### 5.3. Forest types of India, characterization and its management.

#### 5.4. Vegetational types of Tamilnadu – Evergreen, deciduous, scrub and mangrove.

#### 5.5. Conservation of vegetation and its importance

## **REFERENCES**

1. Ambasht, R.S. (1974). Text Book of Plant Ecology (3<sup>rd</sup> Edition) Students & Friends Co., Varanasi.
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## **PHYTOGEOGRAPHY**

1. Cain, S.A (1944). Foundations of Plant Geography Harper & Brothers N.Y
2. Mani, M.S. (1974). Ecology & Biogeography of India. Dr. W. Junk Publishers, The Haque.
3. Good, R. (1977). The Geography of the flowering plant (2<sup>nd</sup> edition) Longmans Green & Co., Inc., London & Allied Science Publishers, New Delhi.

## **GENERAL GEOLOGY**

1. Krishnan, M.S. (1968). Geology of India and Burma. Higginbothams, Madras.
2. Mukarjee, P. K.(1996). Text Book of Geology. The World Press Pvt. Ltd., College Street, Calcutta.

3. Ramachandra Rao(1976). Out line of Geological Prospecting. Prasavanga University of Mysore.

### **CORE VIII- GENERAL MICROBIOLOGY**

Semester : VI  
Credits : 5

Course Code : U16BY608  
Hours per week: 6

#### **Unit I : Introduction to Microbiology**

**(18 Hours)**

- 1.1. Microbiology- Definition of Microbes, History and concepts
- 1.2 Scope of microbiology
- 1.3 Classification of Microorganisms: Bacteria –Morphology, Cell Structure, Growth, Nutrition, Reproduction – Asexul and sexual methods
- 1.4 Economic Importance of Bacteria,
- 1.5 Virus - Morphology, Cell Structure, Nutrition, Reproduction -Lytic and Lysogenic cycle
- 1.6 Yeast – Morphology, Cell Structure, Nutrition, Reproduction –Vegetative, Asexual and Sexual methods
- 1.7 Economic importance of Yeast.
- 1.8 Cyanobacteria –Morphology, Cell Structure, Nutrition, Reproduction, Vegetative and Asexual methods
- 1.9. Economic Importance of cyanobacteria.

#### **Unit II :METHODS IN MICROBIOLOGY**

**(18 HOURS)**

- 2.1 Microscope- Basic Principles of microscopy
- 2.2 Light Microscopes: Types – Principle, Structure and applications Simple, Compound and , Fluorescence microscopes
- 2.3 Electron microscopes -Principle, Structure and applications: SEM and TEM
- 2.4 Micrometer- Definition and types ( Ocular and Stage micrometer)
- 2.5 Staining- Definition, procedure and Types- Simple, Gram’s Negative and Acid fast staining.
- 2.6 Sterilization- Definition, Methods of sterilization-Heat, Chemical sterilization, Filtration, UV radiations, Aldehydes and Gases

2.7 Culture media- Definition and types- Batch culture, Plate culture and Differential culture

2.8 Pure culture- Definition and Methods - Serial dilution technique, Streak plate cultures Pour plate culture, Spread plate techniques, Enrichment culture, Selective medium culture, Differential medium culture and Single isolation culture

**Unit III :FOOD AND DAIRY MICROBIOLOGY (18 HOURS)**

3.1. Milk -Microorganisms in milk, Preservation of milk, Pasteurization, Sterilization and Dehydration.

3.3. Bacteriological standard - Grading of milk and Methylene Blue reduction test

3.4. Dairy Products – definition and Microorganisms, Fermented milk, Curd, Butter, Ghee and Cheese.

3.5. Food spoilage- Definition, Causes of food spoilage and Biochemical changes of food spoilage- Putrefaction, Rancidity, Fermentation and Autolysis

3.6. Food poisoning – definition and Types - Food intoxication ( Botulism, Staphylococcal food poisoning, Infantile gastroenteritis, Travelers diarrhea and Mycotoxicosis) and Food infection

3.7. Methods of Food preservation-Pickling, Salting, Smoking, Aseptic processing, Canning, Bottling, Pasteurization, Refrigeration, Sterilization, Dehydration, Lyophilization, High osmotic pressure, Chemical additives and Radiation

**Unit IV : MEDICAL MICROBIOLOGY (18 HOURS)**

4.1 Disease, Disease causing organism, symptoms and Prevention and control measure- Typhoid, Cholera, Hepatitis -B, Common cold, Mycosis –superficial, Amoebiasis and Malaria

**Unit V :ENVIRONMENTAL MICROBIOLOGY (18 HOURS)**

5.1 Biogeochemical cycle: Definition and Role of microorganisms in biogeochemical cycle and Types - Nitrogen cycle and Carbon cycle

5.2. Biofertilizers- definition and Importance of Biofertilizers

5.3 Common Microorganisms used as biofertilizers-Identification, Isolation, Mass culture and Commercial production-*Rhizobium*, *Azospirillum* and *Mycorrhiza*,

5.4 Biodegradation- Definition, Biodegrading agents, Degradation of Xenobiotics, Degradation of hydrocarbons and Degradation of Polychlorinated Biphenyl compounds

5.5 Bioremediation – definition and Advantages of biodegradation

5.6 Bioleaching-Definition and Types - Direct bioleaching, Indirect bioleaching, Heaps or dums method, *In situ* bioleaching, Bioreactor and Advantages of bioleaching

## REFERENCES

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2. Lansing M. Prescott, John P. Harley, Donald A. Klein, 2005. Microbiology 6<sup>th</sup> Edition, Published by Mc Grew Hill Companies, Avenues of the Americas, New York- 100 20.
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## CORE PRACTICAL – VI - Major Practical VI

Semester : VI

Hours per week : 3

Credits : 2

Course Code : U16BY6P6

### Ecology

(15 Hours)

Morphology and anatomy of Hydrophytes and Xerophytes. Study of vegetation- quadrat and line transect methods. Estimation of density, abundance, frequency and dominance. Determination of water and soil pH. Capillarity and Retentivity of soil. Study of Ecosystems -Pond, Grassland, Agricultural land and Scrub vegetation. Forest management and conservation in Tiger reserve - a case study – Submission of field report.

### Microbiology Practical:

(15 Hours)

Basic requirements of a microbiology laboratory

Preparation of temporary cotton plugs  
Preparation of culture media- Nutrient broth medium and PDA medium  
Methods of sterilization  
Fungal spore identification and germination  
Isolation of Microorganism from soil, air, water, food, vegetables and plants  
Techniques for pure culture of microorganisms  
Serial Dilution -Agar plate method  
Methods of culture, preservation and maintenance  
Measurement of Microorganisms using micrometer.  
Methylene blue reductase test.  
Measurement of fungal growth by colony diameter method.  
Completed Test for coliform bacteria.

**Plant Breeding:**

**(15 Hours)**

1. Selection methods- Explanation through charts
  - a. Mass selection
  - b. Pureline selection
  - c. Clonal selection
2. Hybridization and Emasculation- Class work

**Plant Pathology**

Name of the disease, casual organism, symptoms of the disease, control and prevention methods of the following diseases.

Live diseased specimens for spotters

1. Little leaf of Brinjal
2. Tobacco Mosaic Virus
3. Citrus canker
4. Red rot of Sugarcane

**Plant Protection- Spotters**

1. Knapsac Sprayer
2. Duster

**Organic farming- Photographs**

1. Compost
2. Vermicompost
3. Biopesticides
4. Integarted pest management.

**ELECTIVE – II- PLANT BREEDING, PLANT PATHOLOGY, PLANT PROTECTION AND ORGANIC FARMING**

Semester: :VI  
Credits : 5

Course Code: U16BY6:1  
Hours per week : 6

**Unit I : PLANT BREEDING**

**(15 HOURS)**

**1.1. Introduction to Plant breeding**

- 1.1.1. History
- 1.1.2. Objective

- 1.2.3. Importance
- 1.2. Plant Domestication
  - 1.2.1. Concepts of Domestication
  - 1.2.2. Center of Origin of Species- N. Vavilov
- 1.3. Basic principles of selection methods
  - 1.3.1. Mass Selection
  - 1.3.2. Pureline Selection
  - 1.3.3. Clonal selection
- 1.4. Hybridization
  - 1.4.1. Objectives
  - 1.4.2. Hybridization procedure
    - (a) Choice of parents (b) Emasculation (c) Bagging and Labelling
    - (d) Harvesting and Raising F1 generation
- 1.5. Heterosis
  - 1.5.1. Definition
  - 1.5.2. Genetic causes of heterosis
    - (a) Dominance theory (b) Over dominance theory
  - 1.5.3. Physiological causes of heterosis
  - 1.5.4. Effects of heterosis

## **Unit II- BREEDING METHODS**

**(15 HOURS)**

- 2.1. Mutation Breeding
  - 2.1.1. Definition – Mutation and Mutagenesis
  - 2.1.2 Types of mutation
    - (a) Spontaneous (b) Induction -Physical and Chemical
  - 2.1.3. Application and limitation
  - 2.1.4. Achievements
- 2.2. Polyploidy in breeding
  - 2.2.1. Types of Polyploidy
    - (a) Aneuploidy (b) Euploidy (c) Autopolyploidy (d) Allopolyploidy
  - 2.2.2. Application
  - 2.2.3. Achievements
- 2.3. Breeding for disease resistance
  - 2.3.1. Disease escape
  - 2.3.2. Disease resistance - Vertical and Horizontal
  - 2.3.3. Mechanisms of Disease resistance
    - (a) Mechanical (b) Hypersensitivity (c) Antibiosis (d) Nutritional
  - 2.3.4. Achievements
- 2.4. Breeding for drought tolerance
  - 2.4.1. Mechanisms of Drought Resistance
    - (a) Drought escape (b) Drought avoidance (c) Drought tolerance
    - (d) Drought resistance
  - 2.4.2. Achievements in Drought tolerance
- 2.5. Plant breeding achievements in India with reference to
  - 2.5.1. Rice
  - 2.5.2. Wheat
  - 2.5.3. Sugarcane

**Unit III: PLANT PATHOLOGY****(5 HOURS)**

## 3.1. Definition

3.1.1 Plant pathology

## 3.2. Classification of Plant diseases

3.3. Study of the following diseases with reference to casual agents, symptoms, and preventions and control methods.

3.3.1. Little leaf of Brinjal

3.3.2. Tobacco Mosaic virus

3.3.3. Citrus Canker

3.3.4. Red rot of Sugarcane

**Unit IV: PLANT PROTECTION****(5 HOURS)**

## 4.1. Principles of Plant Protection

## 4.2. Methods of plant protection

4.2.1. Prevention

4.2.2. Control

4.2.3. Eradication

## 4.3. Methods of control

4.3.1. Cultural practices

4.3.2. Quarantine methods

## 4.4. Methods of application of fungicides and pesticides

4.4.1. Sprayers

4.4.2. Dusters

## 4.5. Integrated Pest Management

4.5.1. Definition

4.5.2. Concepts and Principles

4.5.3. Approaches

4.5.3. Advantages

## 4.6. Seed treatment

## 4.6.1. Methods of Seed treatment

(a) Hot water, (b) Dry heat, (c) Aerated heat and (d) Radiation

## 4.6.2. Chemical and Biological treatment

## 4.7. Soil treatment

4.7.1. Sterilization

(a) Heating and (b) Fumigation

**Unit V: ORGANIC FARMING****(5 HOURS)**

## 5.1. Organic farming

5.1.1. Concepts and Importance

5.1.2. Land and seed preparation

5.1.3. Crop maintenance

5.1.4. Crop rotation

## 5.2. Biofertilizers

5.2.1. Role and Benefits of Biofertilizers

- 5.2.2. Different types of Biofertilizers
  - (a) *Rhizobium* (b) *Azotobacter* (c) *Azospirillum* (d) *Cyanobacteria*
  - (e) *Azolla* (f) *Mycorrhiza*
- 5.2.3 *Culture preparation and Methods of application*
- 5.3 Green manure
  - 5.3.1 Compost and Vermicompost
  - 5.3.2. Principles and Methods
  - 5.3.3. Benefits
- 5.4. Bio-pesticides
  - 5.4.1. Types of Biopesticides
    - (a) Bacteria, (b)Fungi and (c) Virus
  - 5.4.2. Benefits
- 5.5. Integrated farming
  - 5.5.1. Definition
  - 5.5.2. Scope and concepts
  - 5.5.3. Importance

## REFERENCES

### Plant breeding

1. Alex Laurie and Victor H. Ries (1942). Floriculture – fundamentals and practices McGraw Hill publishers N.Y
2. Allard, (1960). Principles of Plant breeding. John Wiley Publications, N.Y,
3. Agarwal, R.I. (1998). Fundamentals of Plant Breeding and Hybrid Seed Production. Oxford IBH Publications, New Delhi.
4. Baudai, M.M. (1974). Practical Plant Breeding. Oxford IBH Publications, New Delhi
5. Chaudhary, R.C. (1991). Introduction to Plant Breeding. Oxford IBH Publishing Ltd., New Delh
6. Chopra, V.I. (1998). Plant breeding – Theory and Practices (2<sup>nd</sup> Edn.) Oxford IBH Publishing Co., (P) Ltd., New Delhi 416pp.
7. George Acquaaah, (2007). Principles of Plant Genetics and Breeding. Blackwell Publishing, USA
8. Kumar, N. (1997). Introduction to Horticulture Rajalakshmi Publications Nagercoil, India.
9. Mukherjee, D. (1972). Gardening in India Oxford IBH Publishing co., Kolkatta, Mumbai, New Delhi.
10. Singh, B.D. (1996). Plant Breeding – Principles and Methods Kalyani Publishers.
11. Sandhu, M.K. (1989). Plant Propagation Wiley Easter Ltd., New Delhi.

### HORTICULTURE

1. Edmond Musser and Andres (1974). Fundamentals of Horticulture. McGraw Hill Book Co., Gardener. Basic Horticulture. Mac Millan N.Y
2. Randhawa (1978). Ornamental Horticulture in India. Today and Tomorrow Publishers New Delhi.
3. Naik(1963). South Indian Fruits and their culture. Varadhachary and Co., Madras



4. Sundararajan, J.S., Muthuswamy, J., Shanmugavelu, K.G. and Balakrishnan, R. A Guide to Horticulture. Thiruvankadam Printers, Coimbatore.

### **PLANT PROTECTION**

1. Chatterjee, P.B (1997). Plant Protection Techniques. Bharathi Bhawan, Patna, India.
2. Chattopadhyaya, S.B (1989). Principles and Procedures of Plant Protection (3<sup>rd</sup> Ed.), Oxford and IBII Publishing Co. (P) Ltd., New Delhi.
3. Joshi, N.C (1992). Plant Protection in India. Allied Publishers Ltd., New Delhi.

## **ELECTIVE – III -MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

Semester : VI

Course Code :U16BY6:2

Hours per week : 6

Credits : 5

### **Unit I: BASIC CONCEPT OF MOLECULAR BIOLOGY (18 HOURS)**

- 1.1. Denaturation and Renaturation
- 1.2. DNA replication
  - 1.2.1. Basic requirements
  - 1.2.2. Semi-conservative method- Proof for semi-conservative - Meselson and Stahl's experiment
  - 1.2.3. Rolling circle mechanism
  - 1.2.4. Theta replication
- 1.3. Semi-discontinuous replications
  - 1.3.1. Unwinding of double helix, RNA primer formation
  - 1.3.2. DNA polymerase in prokaryotes and eukaryotes  
DNA Polymerase I,II,III, Topoisomerase, SSB Protein
  - 1.3.4. Leading strand synthesis, Lagging strand synthesis, Okazaki fragments
  - 1.3.5. Origin of replication - Replicon and replication fork

### **Unit II GENE EXPRESSION (18 HOURS)**

- 2.0. Central dogma of molecular biology
- 2.1. Prokaryotic transcription
  - (a) RNA Polymerase in prokaryotes (b) Transcription unit (c) recognition of promoter region (d) Initiation of polynucleotide chain (e) Elongation of RNA polynucleotide (f) Termination of transcription
- 2.2. Eukaryotic transcription
  - 2.2.1. Eukaryotic RNA Polymerases - RNA Polymerase I,II and III
  - 2.2.2. Transcription factors and Promoters, Post Transcription modifications
  - 2.2.3. RNA capping, Poly A tailing, Intron splicing
- 2.3. Translation in Prokaryotes - Initiation, Elongation, Termination
- 2.4. Translation in Eukaryotes – Initiation, Elongation, Termination

2.4.1. Post Translation modifications - Protein folding , Biochemical modification

**Unit III: Methods of Genetic Engineering (18 Hours)**

3.0. Restriction endonucleases , Prokaryotic and eukaryotic cloning vectors, Genomic and c-DNA libraries

3.1. Gene cloning strategies - Screening of recombinants, Expression of cloned genes

3.2. Methods of Gene transfer - *Agrobacterium* mediated, Direct DNA transfer  
(I)Micro injection (II) Electroporation (III) Biolistics

**Unit IV: APPLICATIONS OF MOLECULAR BIOLOGY (18 HOURS)**

4.0. Nucleic acid hybridization

4.1 Blotting techniques - Southern, Northern, Western blotting

4.2 PCR – Principle, Techniques and Applications.

4.3 RFLP - Principle, Techniques, Applications, Advantages and Disadvantages

4.4 RAPD – Principle, Techniques, Applications, Advantages and Disadvantages

4.5 DNA Finger Printing

**Unit V : PLANT TISSUE CULTURE (18 Hours)**

5.0 Laboratory requirements of plant tissue culture

5.1 Preparation of Culture media –(a) Natural medium - Coconut milk (b) Synthetic medium - White medium and MS medium

5.2 Sterilization– Techniques.

5.3 Plant tissue culture techniques- Direct and Indirect.

5.4 Somatic embryogenesis

5.5 Production of synthetic seeds

5.6 Somoclonal variations

5.7 Protoplast isolation – Mechanical, Enzymatic

5.8 Protoplast fusion – Physical, Chemical and Advantages

5.9. GM foods - Varieties of GM foods, Advantages, Disadvantages

**REFERENCES**

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, I.D (2002). Molecular Biology of Cell. Garland Publishing Co., Inc., New York., USA.
2. Atherlay, A. G., Girton , J.R. and McDonald, J.F (1999). The Science of Genetics., Saunders College Publishing. Fort Worth, USA.
3. Freifelder, D (1998). Essentials of Molecular Biology- 3<sup>rd</sup> edison Narosa Publications House. New Delhi
4. Gupta, P.K (1999). A text Book of Cell And Molecular Biology. Rastogi Publications. Meerut, India.

5. V.L. Chopra and Anwar Nasim (1990). (4<sup>th</sup> Ed.). Genetic engineering and Biotechnology. Concepts, Methods and Application.
6. Rastogi, S.C. (2010). Cell and Molecular biology, Rastogi publications, Meerut, India.
7. Sant Saran Bhojwani, Prem Kumar Dantu. (2013). Plant Tissue Culture: An Introductory Text. Springer International Publishing AG.
8. Chawla, H.S. (2000). Introduction to plant Biotechnology. Oxford IBH Publishing co., New Delhi.
9. Dubey, R.C. (1999) A text book of Biotechnology. S. Chand and Co., New Delhi.
10. Ramawat, K.G. (2000). Plant Biotechnology. S. Chand & Co., New Delhi.
11. Ramawat, K.G. and Haily Goyal (2010). Molecular biology and Biotechnology. S. Chand & Co., New Delhi.

## **SBEC- II -MOLECULAR AND PLANT TISSUE CULTURE TECHNIQUES**

Semester : VI  
Credits : 2

Course Code : U16BYPS2  
Hours per week : 2

### **Unit I- Introduction and Laboratory organization (18 Hours)**

#### 1.1.0. Introduction

- 1.1.1. Plant tissue culture- Definition and importance
- 1.1.2. Molecular Biology- Definition and importance

#### 1.2.0. Laboratory organization

- 1.2.1: Laboratory design
- 1.2.2. Laboratory requirements
  - (a) Instruments
  - (b) Glass wares
  - (c) Chemicals
- 1.2.3: Laboratory safety
  - (a) Handling of Chemicals
  - (b) Storage of Chemicals
    - Room Temperature
    - Refrigerator
    - Deep Freezer
  - (c) Personal safety
  - (d) Disposal methods

### **Unit –II- Sterilization Techniques (18 Hours)**

#### 2.1.0. Sterilization techniques concepts and performance

- 2.1.1 Glass wares - Cleaning and sterilization
- 2.1.2. Medium
  - (a) Preparation - Murashige and Skoog
  - (b) Maintenance of pH
  - (c) Sterilization
- 2.2.0. Explant
  - 2.2.1. Washing
  - 2.2.2. Sterilization
- 2.3.0. Culture room
  - 2.3.1. Fumigation
  - 2.3.2. Laminar air flow chamber
    - (a) Cleaning (b) UV exposure
- Unit- III- Micropropagation (18 Hours)**
- 3.1.0 Micropropagation Techniques
  - 3.1. Micropropagation
    - 3.1.1. Direct
    - 3.1.2. Indirect
  - 3.2. Embryogenesis
  - 3.3. Synthetic seed
  - 3.4. Hardening
- 3.5. Field visit to Commercial Plant Tissue Culture Laboratory
- Unit –IV- Plant DNA Extraction and Quantification (18 Hours)**
- 4.1.0 Plant DNA
  - 4.1.1. Extraction
  - 4.1.2. Separation - Agarose Gel Electrophoresis
- 4.2. Plant Protein
  - 4.2.1. Extraction
  - 4.2.2. Separation –SDS -PAGE
- Unit- V - Genetic transformation techniques (18 Hours)**
- 5.1.0. Indirect DNA delivery
  - 5.1.1. Ti plasmid
  - 5.1.2. *Agrobacterium*-mediated transformation
- 5.2.0. Direct DNA delivery
  - 5.2.1. Biolistics
  - 5.2.2. Microinjection
  - 5.2.3. Electroporation

**REFERENCES:**

1. Rajini Sharma. 2000, Plant Tissue Culture, Campus books international, New Delhi.
2. Razdan, M.K. 2003. Introduction to Plant Tissue Culture, Second edition. Oxford and IBH publishing, New Delhi.
3. Misra, S.P. 2014. Plant Tissue Culture. Reprint Ane Books Pvt. Ltd.
4. Thara, K.M. Parctical Mannual series-4. 2009. Biotechnology, New India Publishing Agency, New Delhi.
5. Purohit , S.S. Practical Plant Biotechnology, Student edition, Jodhpur.

6. Bhojwani, S. S. and M. K. Razdan. 1996. Plant Tissue Culture: Theory and Practice, a revised edition. Elsevier Science, Netherlands.
7. Chawla, H.S. 2002. Introduction to plant biotechnology, second edition, Oxford & IBH Publishing, Co, Pvt. Ltd., New Delhi.
8. Rajendra Reddy and Abhay Shankar, J.P., 2008. Tissue Culture. Commonwealth Publishers, New Delhi.
9. Jwala Aggarwal and Shekhar K. Arora, 2014. Experiments in Plant Tissue Culture. Campus Book International, New Delhi.

### **SBEC- III- PLANT WEALTH FOR HUMAN LIFE**

Semester	: IV	Course code	: U16BYPS3
Credits	: 2	Hours per week	: 2

#### **Unit I : Flowers (8 Hours)**

- 1.1. Bouquet
- 1.2. Garlands and Strings
- 1.3. Regular and festival decorations
- 1.4. Hair designs

#### **Unit II : Vegetables and Fruits (8 Hours)**

- 2.1 Pickle (Lime / Mango / Ginger)
- 2.2. Juice (Lemon / Sweet lime)/ squash (Graph / Orange)
- 2.3. Drying (Direct & treated)
- 2.4. Vegetable, pith and grain carving

#### **Unit III : Fibers (8 Hours)**

- 3.1 Baskets and pans
- 3.2. Ropes and chords
- 3.3.Brushes and brooms
- 3.4 .Mats and Carpets

#### **Unit IV : Cosmetics and Medicines (8 Hours)**

- 4.1. Medicinal oils / Application – Hair oils
- 4.2. Preparation of Decoctions - Syrups
- 4.3. Herbal Remedies – Ointments, Pain balms

4.4. Cosmetics, Face packs & Skin care

**Unit V : Phytowastes to wealth**

**(8 Hours)**

5.1. Shells and rinds (Useful and ornamental articles )

5.2. Waste/used papers and wood (recycling)

5.3. Leaves (cups and plates)

5.4 Phyto jewellery (ear drops, studs, bangles / necklace)

(Details about the cultivation / procuring, processing uses and sales of these based on the availability will be dealt with the support of the field experts and field visits)

**REFERENCES**

1. Pandey, B.P. 2007. Economic botany. S. Chand and Co. New Delhi
2. Samba Murty, A.V.S. And Subramanian, N.S. 1989. A Text book of economic botany. Wiley Eastern Ltd. New Delhi.
3. Siddappa, G.S. and Tandon, G.L. 1998. Preservation of fruits and vegetables. ICAR, New Delhi.

**ALLIED BOTANY - I**

**Semester : I**

**Course Code : U16BYY11**

**Credits : 3**

**Hours/Week : 4**

**SYLLABUS:**

**Unit I: Plant Diversity**

**(12 Hours)**

1.1 Structure, reproduction and life cycle of

(a) Algae - *Chlamydomonas*

(b) Fungi - *Penicillium*

(c) Bryophytes - *Riccia*

(d) Pteridophytes - *Lycopodium*

(e) Gymnosperms - *Cycas*

**Unit 2: Morphology of Angiosperms**

**(12 Hours)**

2.1 Leaf shape and Phyllotaxy

2.2 Inflorescence

(a) Racemose, (b) Cymose (c) Special types

2.3 Terminologies in flower description.

**Unit 3: Plant Taxonomy:**

**(12 Hours)**

3.1 Bentham and Hooker Systems of Classification

3.2 Study of following Plant families

(a) Annonaceae, (b) Cucurbitaceae, (c) Lamiaceae, (d) Euphorbiaceae (e) Poaceae.

**Unit 4: Anatomy**

**(12 Hours)**

4.1 Meristematic - Definition, Types (Apical, Lateral and Intercalary) and Functions

- 4.2 Permanent Tissue - Parenchyma, Collenchyma, Chlorenchyma and Sclerenchyma  
Complex tissue – Xylem and Phloem  
4.3 Primary and Secondary structure of Dicot and Monocot - (a) Leaf (b) Stem (d) Root.

### **Unit 5: Embryology**

**(12 Hours)**

#### 5.1 Structure of Flower

5.1 Structure of male gametophyte (Anther- Internal Structure and Functions)

5.2 Structure of Female gametophyte (Ovules – Definition and Types of ovules Orthotropous, Anatropous, Campylotropous, Hemianatropous and Amphitropous)

5.3 Fertilization and Dicot Embryo (Polygonum)

#### **TEXT BOOKS:**

1. Sharma. O. P. 2011. *Algae*, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. Sha rma. O. P. 2006. *Text book of Fungi*, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Sharma. O. P. 2014. *Bryophytes*, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. Sharma. O. P. 2012. *Pteridophytes*. Tata McGraw Hill Education Pvt. Ltd., New Delhi.
5. Bhatnagar, S.P. and Alok Moitra. 2004. *Gymnosperms*, New age international Pvt. Ltd. Publishers, India.
6. Pandey. B.P. 2011. *Plant Anatomy*, Chand Pvt. Ltd.
7. Bhojwani, S.S., Bhatnagar, S. P. and Dantu, P. K. 2015. *The Embryology of Angiosperms 6<sup>th</sup> Edition*. Vikas Publishing House Pvt. LTD.
8. Verma, S. K and Mohit Verma, 2007. *A text book of Plant Physiology, Biochemistry and Biotechnology*. S. Chand and Company Ltd. New Delhi.

#### **REFERENCES BOOKS:**

- 1.S K Verma and Mohit Verma. 1995. *A Textbook of Plant Physiology, Biochemistry and Biotechnology*. S Chand Publications.
- 2.Vinod Kumar Jain. 2009. *Laboratory Manual of Plant Pathology*. Oxford Book Company.

## **Allied Botany II**

**Semester : II**

**Credits : 4**

**Course Code : U16BYY22**

**Hours/Week : 4**

### **SYLLABUS:**

#### **Unit I: Plant Propagation**

**(12 Hours)**

1.1 Asexual methods: (a) Cutting (b) Air layering (c) Grafting (d) Budding.

1.2 Micropropagation - Medium, Explants, Techniques and Application

#### **Unit-2: Plant Pathology**

2.1 Detailed study of following plant diseases, symptoms, causual agents, and control

(a) White rust disease (b) Citrus canker (c) TMV

2.2 Plant protection methods

Natural methods: (a) Prevention (b) control (C) Eradication (d) Plant quarantine  
Biological Control and methods of application  
(a) Pesticide (b) Fungicide

**Unit III: Ecology** (12 Hours)

- 3.1 climatic factors- (a) Edaphic (b) Biotic
- 3.2 Plant adaptations (a) Xerophytic (b) Hydrophytes (c) Halophytes
- 3.3 Vegetational types of Tamil Nadu.

**Unit IV: Plant physiology** (12 Hours)

- 4.1 Absorption of water and salts.
- 4.2 Role of mineral elements (Micro minerals and Macro minerals).
- 4.3 Nitrogen cycle.
- 4.4 Transpiration.

**Unit V: Photosynthesis** (12 Hours)

- 5.1 Light and Dark Reactions
- 5.3 Respiration – (a) Aerobic (b) Anaerobic
- 5.3 Krebs cycle and oxidative phosphorylation.

**TEXT BOOKS:**

- 1. Fuller, H.J. and Tippo, O, 1967. *College Botany*. Henry Holt and Co.
- 2. Ganguly, A.K, 1971. *General Botany*. The New Book Stall Calcutta. Vol I and II.
- 3. Muneeswaran, 2004. A. *Allied Botany*. Titan Nooks, Madurai, India.

**REFERENCE BOOKS:**

- 1. Chattopadhyaya, S.B. 1991. *Principles and Procedures of Plant protection (3rdE.d.,)* Oxford and IBH Publishing Cosec2 (P) Ltd., New Delhi.
- 2. Edmond Musser and Andres. 1957. *Fundamentals of Horticulture*. McGraw Hill Book Co
- 3. Kumar N, 1997. *Introduction to Horticulture*. Rajalakshmi Publications Nagarcovil, India.
- 4. Mathawat, G.S.P., D. Sharma and R.k. Sahni. 1996. *A text book of Botany*, Ramesh Book depot, Jaipur.
- 5. Pandey, B.P. 1999. *Economic Botany*. S. Chand and Co. New Delhi.
- 6. Verma, V. 1980. *A text book of Economic Botany*. Emkay Publications, New Delhi.



## Allied Botany Practical

Semester : I &2

Hours per week : 3

Credits : 3

Course Code : U16BY6P6

### Plant Bio-diversity

(20 Hours)

1. **Algae**-*Chlamydomonas*
2. **Fungi** - *Penicillium*
3. **Bryophyte**- *Riccia* – Habit, Thallus and Capsule.
4. **Pteridophyte** - *Lycopodium* – Habit, Stem,
5. **Gymnosperm**  
(a) *Cycas* – coralloid root – Entire, (b) *Cycas* – coralloid root - T.S.,  
(c) *Cycas* – Rachis – T.S., (d) *Cycas* – microsporophyll, (e) Microsporophyll – T.S  
(f) *Cycas* – Mega sporophyll
6. **Taxonomy** (12 Hours)  
(a) *Annonaceae* – *Polyalthia longifolia* (b) *Cucurbitaceae* – *Coccinia indica*  
(c) *Apocyanacea* – *Vinca rosea* (d) *Lamiaceae* – *Leucasaspera* (e) *Euphorbiaceae* –  
*Euphorbia heterophylla* (f) *Poaceae* – *Chloris barbata*
7. **Anatomy**  
(a) T.s of monocot root, (b) T.s of monocot stem (c) T.s of dicot stem,  
(d) T.s of dicot leaf (e) T.s of monocot leaf
8. **Embryology**  
(a) T.S of mature anther (b) Ovule (c) Fertilization (d) Globular – Embryo  
(e) Cordata Embryo
9. **Economic botany**
10. **Plant propagation** – (a) Air layering (b) Wedge grafting(c) Cleft grafting
11. **Plant protection** – (a) Knapsac sprayer (b) Cyanomag foot pump duster
12. **Plant pathology** – (a) White rust diseases (b) Citrus canker  
(c) Tobacco mosaic diseases

### 13. Plant Physiology

(12 Hours)

- (a) Osmosis -Thistle Funal Experiment (b) Bell jar experiment (c) Ganong's Photometer (d)  
Test Tube and Funal Experiment (e) Ganong's light screen Experment (f) Ganong's Respiroscope  
Experiment (g) Kuhne's Experiment.

## REFERENCES

1. Chattopadhyaya, S.B (1991). **Principales and Procedures of Plant protection** (3<sup>rd</sup>E.d., ) Oxford and IBH Publishing Cosec2 (P) Ltd., New Delhi.
2. Edmond Musser and Andres (1957). **Fundamentals of Horticulture**. McGraw Hill Book Co.,
3. Fuller, H.J. and Tipppo, O (1967). **College Botany**. Henry Holt and Co.
4. Gangully, A.K (1971). **General Botany**. The New Book Stall Calcutta. Vol I and II.
5. Kumar N (1997). **Introduction to Horticulture**. Rajalakshmi Publications Nagarcovil, India
6. Mathawat, G.S.P., D. Sharma and R.k. Sahni.(1996)**A text book of Botany**, Ramesh Book depot, Jaipur.
7. Mehrotra, R.S(19910. **Plant Pathology**. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
8. Muneeswaran, A(2004). **Allied Botany**. Titan Nooks, Madurai, India.
9. Pandey, B.P (1999). **Economic Botany**. S. Chand and Co. New Delhi.
10. Rao, K.N. K. Krishnamoorthy and G.S. Rao (1979). **Ancillary Botany**.
11. Verma, V (1980). **A text book of Economic Botany**. Emkay Publications, New Delhi.

## ALLIED I: ENVIRONMENTAL BOTANY

**Semester I**

**Code: U17ESBY1**

**Credits: 3**

**Hours/Week: 3**

### **Syllabus:**

#### **Unit I Plant Diversity**

**(12 Hours.)**

Structure, reproduction and life cycle of Algae - Chlamydomonos, Fungi - Penicillium, Bryophyte -Riccia, Pteridophyte – Lycopodium and Gymnosperm -Cycas.

#### **Unit II Morphology**

**(12 Hours.)**

Root, shoot system and its modification. Inflorescence – Simple and compound and Special types – one example each. Flower description. Taxonomy: Nomenclature (Binomial), Systems of

Classification (Bentham and Hooker), Study of following families – Annonaceae, Apocynaceae, Lamiaceae, and Poaceae.

**Unit III Anatomy**

**(12 Hours.)**

Tissue (Meristematic and Permanent), primary structures of Dicot and Monocot Stem and Root. Embryology: Structure of Anther and Ovule; Types of Pollination, Fertilization and development of Dicot Embryo.

**Unit IV Plant Physiology**

**(12 Hours.)**

Absorption of water and salts. Role of mineral elements; Transpiration. Photosynthesis, Light and Dark Reactions – C<sub>3</sub> Cycle, Respiration – aerobic, anaerobic, Krebs cycle.

**Unit V Plant as an ecological indicator**

**(12 Hours.)**

Plant as an ecological indicator – characteristics, type and physiological changes. Plant pathology: Detailed study of the following plant diseases, symptoms, causal agents and control measures of white rust, citrus canker and tobacco Mosaic disease.

**TEXT BOOKS:**

1. Mathawat, G.S.P., Sharma, D. and Sahni. R.K. 1996. *A text book of Botany*, Ramesh Book depot, Jaipur.
2. Muneeswaran, A., 2004. *Allied Botany*, Titan Books, Madurai, India.
3. Rao, K.N. Krishnamoorthy, K. and Rao. G.S. 1979. *Ancillary Botany*, Rajalakshmi Publication, Nagercoil.

**REFERENCES BOOKS:**

1. S K Verma and Mohit Verma. 1995. *A Textbook of Plant Physiology, Biochemistry and Biotechnology*. S Chand Publications.

## **Allied Practical I: ENVIRONMENTAL BOTANY LAB**

**Semester I**  
**Credits: 2**

**Code: U18ESBP1**  
**Hours/Week: 3**

### **SYLLABUS:**

**Unit I** **(12 Hours)**

Plant diversity: Habit, stem, root and reproductive parts of Algae- *Chlamydomonas*; Fungi – *Penicillium*; Bryophyte - *Riccia* – habit, thallus and Capsule; Pteridophyte - *Lycopodium* – habit and stem; Gymnosperm – *Cycas*.

**Unit II** **(12 Hours)**

Plant Taxonomy: Annonaceae – *Polyalthia longifolia*; Apocyanacea – *Vinca rosea*; Lamiaceae – *Leucas aspera*; Euphorbiaceae – *Euphorbia hirta* :Poaceae – *Chloris barbata*

**Unit III** **(12 Hours)**

Plant Anatomy: T. S of monocot root - monocot stem - dicot stem - dicot leaf - Embryology: T. S of mature anther - Ovule L. S – Fertilization - Globular – embryo - Cordate embryo

**Unit IV** **(12 Hours)**

Plant physiology (Demo only): Bell Jar, Thistle funnel, TA balance, Test tube funnel, Ganong light screen and respiroscope.

**Unit V** **(12 Hours)**

Plant specimens for the ecological indicators; Plant pathology: *White rust*, *Citrus canker* and *Tobacco Mosaic* disease.

### **TEXT BOOKS:**

1. Mathawat, G.S.P., Sharma, D. and R.K. Sahni. 1996. *A text book of Botany*, Ramesh Book depot, Jaipur.
2. Muneeswaran, A. 2004. *Allied Botany*, Titan Nooks, Madurai, India.
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### **REFERENCE BOOKS:**

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