



DEPARTMENT OF BOTANY
SYLLABUS FOR B.Sc BOTANY
UNDER CHOICE BASED CREDIT SYSTEM (CBCS)
FOR CANDIDATES ADMITTED IN THE ACADEMIC YEAR
2018 -2019



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.

		Core Prac. III	Major Practical – III	U16BY3P3	3	2	40	60	100
		Allied III	Allied Chemistry – I	U16CHY33	4	4	25	75	100
		Allied Prac. II	Volumetric and Organic analysis	U16CHYP2	3	--	--	--	--
	IV	NMEC I	Nursery Technology	U16BYPE1	2	2	40	60	100
IV	I	Tamil IV /*	செய்யுள்(மேற்கணக்கு, கீழ்கணக்கு), இலக்கிய வரலாறு, நாடகம், மொழிப்பயிற்சி	U15TM4L4	5	3	25	75	100
	II	English IV	English through Literature	U16EGPL4	5	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	Volumetric and Organic analysis	U16CHYP2	3	3	40	60	100
	IV	NMEC II	Mushroom Cultivation	U16BYPE2	2	2	40	60	100
		Soft skills	Life Skills	U16LFS41	2	1	-	-	100
	V	Extension Activities	NSS, NCC, Rotaract, Leo Club, etc...	U16ETA41	-	1	-	-	-
V	III	Core 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 Project	Project	U16BY5PJ	5	5	25	75	100
		Elective I	Biostatistics, Computer Applications and Bioinformatics	U16BY5:1	5	5	25	75	100
	IV	SBEC I	Mushroom and Nursery Technology	U16BYPS1	2	2	40	60	100
		SBEC II	Plant wealth for Human Life (Covid 19)	U18BYPS2	2	2	40	60	100
VI	III	Core VII	General Geology, Ecology and Phytogeography	U16BY607	6	6	25	75	100
		Core VIII	General Microbiology	U16BY608	6	5	25	75	100
		Core Prac. V	Major Practical V (Covid 19)	U18BY6P5	3	2	40	60	100
		Core Prac. VI	Major Practical VI	U16BY6P6	3	2	40	60	100
		Elective II	Plant Breeding, Pathology, Protection and Organic Farming	U16BY6:1	5	5	25	75	100
		Elective III	Molecular biology and Plant Biotechnology	U16BY6:2	5	5	25	75	100
	IV	SBEC III	Molecular and Plant Tissue culture Techniques (Covid 19)	U18BYPS3	2	2	40	60	100

V	Gender Studies	Gender Studies	U16GST61	-	1	-	-	100	
Semester I : U18HD1L1		U17SK1L1	U18FR1L1	Semester III : U18HD3L3		U17SK3L3	U18FR3L3		
Semester II: U18HD2L2		U17SK2L2	U18FR2L2	Semester IV : U18HD4L4		U17SK4L4	U18FR4L4		
Part I : 4	Core Theory : 8	Core Project : 1	Allied Theory : 4	NMEC : 2	Env. Studies : 1				
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						Total : 42

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) Caesalpiniaceae, 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 – II -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 (*Daucus*), 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 Raceme (*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

Semester : II

Course Code : U16BY202

Credits : 6

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

4.1.1. 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. Easu, 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.
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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.

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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 (4th 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	Course Code	: U16BY2P2
Credits	: 2	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
Credits : 6

Course Code : U16BY303
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 *In vitro* 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

Course code : U16BY3P3

Credits : 2

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

1. Bhatia, K.N. (2000). Algae. Chand and Co. New Delhi
2. Fritsch, F.E. (1965). The Structure and Reproduction of Algae 1945: Cambridge University press, Cambridge, U.K.
3. Kumar, H.D. and Sing, H. N. (1976):A Text book of Algae. Affiliated East West press Pvt. Ltd., New Delhi, Madras.
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5. Pandey, B.P. (2002). A Text book of Botany – Algae. S.Chand & Co., (P) Ltd., New Delhi
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1. Alexopoulos, C.J. and Delavoryas, T. (1987). Morphology of Plants and Fungi. Harper and Row, Publishers
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3. Mims, C.W. & Blackwell, M. (1996). Introductory Mycology. John Wiley & Sons, N.Y.
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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.
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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 Actinostele
 - 1.3.2. Plectostele and mixed stele
 - 1.3.3. Siphnostele
 - (a) Ectophloic siphnostele (b) Ambphiphloic siphnostele
 - 1.3.4. Solenostele
 - (a) Ectophloic solenostele (b) Ambphiphloic solenostele
 - 1.3.5. Distele and Polysteles
- 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. (2nd 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 (2nd 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.
8. Venkatachala, B. S., Shukla, M. and Sharma, M. (1992). Plant Fossils – a Link with the past (A Birbal Sahni Birth Centenary Tribute). Birbal Sahni Institute of Paleobotany, Lucknow, India

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

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; III 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. *Test Book of Fungi*. Tata McGraw-Hill Publishing C., 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_2 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_3 Cycle

2.6.0 Hatch and Slack Pathway

- 2.6.1 C_4 –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 CO₂ 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- N₂ 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 N₂ 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, Harmonal 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 5th Edition. Sunderland, Massachusetts, USA.

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

Jain, V.K. (1997). Fundamentals of Plant Physiology. S.Chand and Co., New Delhi.

Noggle, R. and Fritz. (1986). Introductory Plant Physiology. Prentice Hall of India. New Delhi.

Pandey, S.N. (2005). Plant Physiology. Vikas publishing House (P) Ltd., New Delhi.

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.

Jayaraman, J. (1981). Laboratory Manual of Biochemistry. Wiley Eastern Ltd., New Delhi.

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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
Credits : 6

Course Code : U16BY506
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 (Sandwich 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 : U18BY6P5

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 CO₂ concentrations.
9. Measurement of O₂ 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

1. De Robertis, E.D.P. and De Robertis, E.M.F. (1987) Cell and Molecular Biology (7th Ed.,) Holt-Saunders International Editions, Philadelphia and Tokyo.
2. Gupta, P.K. (1988) A text book of Cytology, Genetics and Evolution. Emkay Publication. Rastogi.
3. Verma, P.S. and V.K. Agarwal, (1998) Concept of Molecular Biology, S. Chand and Co. Ltd, New Delhi.
4. David Freifelder (2000) Molecular Biology, (2nd Ed.,) Narosa Publishing House, New Delhi.
5. Karvita B. Ahluwalia, (2000) Genetics, New Age International pvt. Ltd., Publishers, Chennai.
6. Periasamy, (2000) An Introduction to Cytology , Genetics and Evolution, Emkay Publication.
7. P.S. Verma and V.K. Agarwal, (2005) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, S. Chand and Co. Ltd., New Delhi.
8. Veer Bala Rastogi.(2015) Introductory cytology. KEDAR NATH RAM NATH Meerut.

Genetics

1. Dyansagar, V.R. (1990) Cytology and Genetics. Tata McGraw Hill Publishing Co., Ltd., New Delhi.

2. Gupta, P.K. (1988) Cytology and Genetics – A Text Book for University students 5th Edn., Rastogi Publishers Meerut, Rastogi, India.
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4. Sinha. U. and Sinha,S. (1976) Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House, New Delhi.
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6. Strickberger, Monroe.W. (2000) Genetics, Prentice Hall, New Delhi.
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Evolution

1. Savage Jay.M. (1969) Evolution (2nd 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.
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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*

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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

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12. Randhawa (1997). Ornamental Horticulture in India. Today and Tomorrow Publishers 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

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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 (2nd 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 6th 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 : 5

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

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2. Allard, (1960). Principles of Plant breeding. John Wiley Publications, N.Y,
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HORTICULTURE

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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 : 5

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- 3rd 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). (4th Ed.). Genetic engineering and Biotechnology. Concepts, Methods and Application.
6. Rastogi, S.C. (2010). Cell and Molcular 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- III- MOLECULAR AND PLANT TISSUE CULTURE TECHNIQUES

Semester : VI
Credits : 2

Course Code : U18BYPS3
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- II -PLANT WEALTH FOR HUMAN LIFE

Semester	: V	Course code	: U18BYPS2
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 Subramaniyan, 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 : 3

SYLLABUS:

Unit I: Plant Diversity

(12 Hours)

1.1 Structure, reproduction and life cycle of

(a) Algae - *Chlamydomonos*

(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 6th 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 : 2

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, causal 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. Gangully, 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 Cossec2 (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 Nagarcoil, 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 : 4

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** (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. 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 – C₃ 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- *Chlamydomonos*; 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.
3. Rao, K.N. Krishnamoorthy, K. and G.S. Rao. 1979. *Ancillary Botany*, Rajalakshmi Publication, Nagercoil.

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2. Fuller, H.J. and Tippon, O. 1967. *College Botany*, Henry Holt and Co., New York.
3. Gangully, A.K., 1971. *General Botany*, The New Book Stall Calcutta, Vol I and II. Rajalakshmi Publication., Nagercoil.

