

**Under- Graduate Programme
in Botany**

**Courses of study, Schemes of Examinations
& Syllabi**
(Choice Based Credit System)



DEPARTMENT OF BOTANY

BISHOP HEBER COLLEGE (Autonomous)
(Reaccredited with 'A' Grade (CGPA – 3.58/4.0) by the NAAC &
Identified as College of Excellence by the UGC)
DST – FIST Sponsored College &
DBT Star College
TIRUCHIRAPPALLI – 620 017
TAMIL NADU, INDIA

2016 – 2017

Under – Graduate Programme in Botany

Structure of the Curriculum

Parts of the Curriculum	No. of Courses	Credits
Part – I : Language	4	12
Part – II : English	4	12
Part – III		
Major		
Core(theory)	8	46
Core(practical)	6	12
Elective	3	15
Allied		
Allied – Zoology	3	10
Allied - Chemistry	3	11
Group Project	1	5
Part – IV		
SBEC	3	6
NMEC	2	4
VLOC	1	2
Env. Studies	1	2
SBC	1	1
Part – V		
Extension Activities	1	1
Gender Studies	1	1
Total	42	140

B.Sc. Botany – Programme Description
(For the students admitted from the year 2016 onwards)

Sem.	Part	Course	Course Code	Course Title	Pre requisites	Hours/ week	Credits	Marks		
								CIA	ESA	Total
I	I	Tamil I/*	U15TM1L1	செய்யுள், இலக்கிய வரலாறு, உரைநடை, மொழிப்பயிற்சியும் படைப்பாக்கமும்		6	3	25	75	100
	II	English I	U16EGNL1	English Communication Skills-I		6	3	40	60	100
	Core I	Core I	U16BY101	Angiosperm Morphology and Taxonomy		6	6	25	75	100
		Core Prac. I	U16BY1P1	Core Practical – I		3	2	40	60	100
	III	Allied I	U16ZYY11	Biology of Invertebrates and Chordates		4	3	25	75	100
		Allied Prac - I	U16ZYYP1	Biology of Invertebrates, Chordates and Commercial Zoology		3	--	--	--	--
	IV	Val. Edu.	U14VL1:1/ U14VL1:2	Value Education (RI/MI)		2	2	25	75	100
II	I	Tamil II/*	U15TM2L2	செய்யுள், இலக்கிய வரலாறு, சிறுகதைத்திரட்டு, மொழிப்பயிற்சி & படைப்பாக்கம்		6	3	25	75	100
	II	English II	U16EGNL2	English Communication Skills – II		6	3	40	60	100
	Core II	Core II	U16BY202	Plant Anatomy and Embryology of Angiosperm		6	6	25	75	100
		Core Prac. II	U16BY2P2	Core Practical - II		3	2	40	60	100
	III	Allied II	U16ZYY22	Human Physiology and Commercial Zoology		4	4	25	75	100
		Allied Prac - I	U16ZYYP1	Biology of Invertebrates, Chordates, Human Physiology and Commercial Zoology		3	3	40	60	100
	IV	Env. Studies	U16EST21	Environmental Studies		2	2	25	75	100
III	I	Tamil III/*	U15TM3L3	செய்யுள் - காப்பியங்கள், இலக்கிய வரலாறு, நாவல், மொழிப்பயிற்சி		6	3	25	75	100
	II	English III	U16EGNL3	English for Competitive Examinations		6	3	40	60	100
	Core III	Core III	U16BY303	Plant Diversity - I (Thallophytes and Bryophytes)	U16BY202	6	6	25	75	100
		Core Prac. III	U16BY3P3	Core Practical - III		3	2	40	60	100
	III	Allied III	U16CHY01	Allied Chemistry - I		4	4	25	75	100
		Allied Prac - II	U16CHYP2	Volumetric and Organic Analysis		3	--	--	--	--
	IV	NMEC I		<i>To be selected from the courses offered by other departments</i>		2	2	25/ 40	75/ 60	100

Sem.	Part	Course	Course Code	Course Title	Pre requisites	Hours/ week	Credits	Marks		
								CIA	ESA	Total
IV	I	Tamil IV/*	U15TM4L4	செய்யுள் - நாடகம், இலக்கிய வரலாறு, மொழிப்பயிற்சி		5	3	25	75	100
	II	English IV	U16EGNL4	English through Literature		5	3	40	60	100
	III	Core IV	U16BY404	Plant Diversity II (Pteridophytes, Gymnosperms & Paleobotany)	U16BY202	6	5	25	75	100
		Core Prac. IV	U16BY4P4	Core Practical - IV		3	2	40	60	100
		Allied IV	U16CHY44	Chemistry for Life Sciences		4	4	25	75	100
		Allied Prac - II	U16CHYP2	Volumetric and Organic Analysis		3	3	40	60	100
	IV	NMEC II		<i>To be selected from the courses offered by other departments</i>		2	2	25/40	75/60	100
		SBC	U16LFS41	Life Skills		2	1	100	--	100
V	Extension Activities	U16ETA41				1	-	-	-	
V	III	Core V	U16BY505	Plant Physiology, Biochemistry and Biophysics		7	6	25	75	100
		Core VI	U16BY506	Cell Biology, Genetics and Evolution		7	6	25	75	100
		Core Prac. V	U16BY5P5	Core Practical - V		3	2	40	60	100
		Project	U16BY5PJ	Project		5	5	25	75	100
	Elective I	U16BY5:1	Biostatistics, Computer Applications and Bioinformatics		6	5	25	75	100	
IV	SBEC I	U16BYPS1	Mushroom and Nursery Technology		2	2	40	60	100	
VI	III	Core VII	U16BY607	General Geology, Ecology and Phytogeography		6	6	25	75	100
		Core VIII	U16BY608	General Microbiology	U16BY303	6	5	25	75	100
		Core Prac. VI	U16BY6P6	Core Practical - VI		3	2	25	75	100
		Elective II	U16BY6:1	Plant Breeding, Pathology, Protection and Organic Farming	U16BY506	5	5	40	60	100
		Elective III	U16BY6:2	Molecular biology and Plant Biotechnology	U16BY506	5	5	25	75	100
	IV	SBEC II	U16BYPS2	Molecular and Plant Tissue culture Techniques		2	2	40	60	100
		SBEC III	U16BYPS3	Plant Wealth for Human Life		2	2	40	60	100
V		U16GST61	Gender Studies			1	20	80	100	
Total							140			4100

SBEC- Skill Based Elective Course
VLOC- Value added Life Oriented Course
CIA- Continuous Internal Assessment

NMEC- Non Major Elective Course
SBC- Skill Based Course
ESA- End Semester Assessment

* Other Languages	Hindi	Sanskrit	French		Hindi	Sanskrit	French
Semester I	U14HD1L1	U15SK1L1	U14FR1L1	Semester III	U14HD3L3	U15SK3L3	U14FR3L3
Semester II	U14HD2L2	U15SK2L2	U14FR2L2	Semester IV	U14HD4L4	U15SK4L4	U14FR4L4

NMEC offered by the Dept.: 1. Nursery Technology - U14BYPE1
2. Mushroom Cultivation - U14BYPE2

CORE I - ANGIOSPERM MORPHOLOGY AND TAXONOMY

Semester : I
Credits : 6

Course Code : U16BY101
Total Hrs. : 90

General objectives

1. To study and understand various Angiosperm plant habits.
2. To learn about vegetative and reproductive structural features of Angiosperms.
3. To understand various modifications and its purpose in plant parts.
4. To comprehend the concepts of Plant taxonomy and classification of Angiosperms.
5. To study various Angiosperm families and its economic value.

Unit I: Vegetative Morphology

- 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

- 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

- 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

- 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.)

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

Economic Botany

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

CORE PRACTICAL I – MORPHOLOGY AND TAXONOMY

Semester : I
Credits : 2

Course Code : U16BY1P1
Total Hrs. : 45

I. Morphology

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

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

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/lxora*), 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

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*), Monochasialscorpoid (*Heliotropium*), Dichasial cyme (*lxora*), Polychasial cyme (*Nerium*), iii) Special-Cyathium (*Euphorbia*), Thyrsus (*Ocimum*), Verticillaster (*Leucas*), Hypanthodium (Fig).

5. Study of Fruits & its Type

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

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 bonafide 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
Total Hrs. : 90

General Objectives

1. To decipher the basic concepts in anatomy.
2. To understand the various components of stem and wood during its secondary growth.
3. To study the mechanism of pollination and basic structure of embryo.

Unit I: TISSUE SYSTEM

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,
- 1.2.2. Origin of initiating cells, Position in plant body and function
- 1.2.3. Organisation – Shoot Apex and Root Apex
- 1.2.4. Theories on apical organisation – 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- Non-articulate 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

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

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

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

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

EMBRYOLOGY

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

CORE PRACTICAL II – PLANT ANATOMY AND PLANT EMBRYOLOGY

Semester : II
Credits : 2

Course Code : U16BY2P2
Total Hrs : 45

PLANT ANATOMY

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

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
Total Hours : 90

General Objectives

1. To study the structure and reproduction of certain selected algae, fungi and bryophytes.
2. To comprehend their importance in the plant diversity.

Unit I: ALGAE

- 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

- 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

- 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

- 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

- 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)

References

Algae

1. Bhatia, K.N. *Algae*. Chand and Co. New Delhi, 2000.
2. Fritsch, F.E. *The Structure and Reproduction of Algae*: Cambridge University press, Cambridge, London, 1965.
3. Kumar, H.D. and Sing, H. N.A *Text book of Algae*. Affiliated East West press Pvt. Ltd., New Delhi, India, 1976.
4. Kumaresan, V. *Algae and Bryophytes*. Saras Publications, Nagercoil, India, 1997.
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1. Chopra, G.L. *A class Book of Bryophyta*. Harisingh & Bros., Jullunder 1968.
2. Kumra, P.K. *Biology of Bryophytes*. Wiley Eastern Ltd., New Delhi 1988.
3. Parihar, N.S. *An introduction to Embrophyta –Vol.II. Bryophyta*. Central Book Depot, Allahabad, India, 1965.
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**CORE PRACTICAL III - PLANT DIVERSITY- I
(THALLOPHYTES AND BRYOPHYTES)**

Semester : III
Credits : 2

Course code : U16BY3P3
Total Hours : 45

Algae

1. To analyse the general characteristics of the algal specimens and identification with reasons- *Oscillatoria, Volvox, Navicula, Dictyota* and *Gracillaria*.
2. To understand taking section and giving structural features- *Dictyota* and *Gracillaria*.
3. To know the economic importance of *Laminaria, Gracillaria, Chondrus* and *Spirullina*

Fungi

1. To study the fungal specimens in reference to plant disease and their spore structure *Phytophthora, Cersospora* and *Mucor*.
2. To disseminate knowledge on fruiting bodies 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

1. To study morphology of *Riccia, Anthoceros* and *Funaria*
2. To comprehend 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*

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CORE IV - PLANT DIVERSITY II
(PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)

Semester : IV
Credits : 5

Course Code : U16BY404
Total Hours : 90

General Objectives

1. To learn the structure and reproduction of certain selected species of pteridophytes and Gymnosperms.
2. To study few representatives of fossil forms as well.

Unit I : PTERIDOPHYTES

- 1.1 General characters
- 1.2 Sporne's Classification
- 1.3 Stelar Types
 - 1.3.1. Haplostele and Actinostele
 - 1.3.2. Plectostele and mixed stele
 - 1.3.3. Siphnostele
 - (a) Ectophloicsiphnostele (b) Ambphiphloicsiphnostele
 - 1.3.4. Solenostele
 - (a) Ectophloicsolenostele (b) Ambphiphloicsolenostele
 - 1.3.5. Distele and Polystele
- 1.4 Apospory
- 1.5 Apogamy
- 1.6 Heterospory
- 1.7 Seed habit

Unit II- PTERIDOPHYTES- TYPE STUDY

- 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

- 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

- 4.1 Habit and habitat
- 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

- 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

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1. Parihar, N.S. *An introduction to Embryophyta* Vol. 1 Pteridophyta. Central Book Depot, Allahabad, India. 1965.
2. Smith, G.M. *Cryptogamic Botany* Vol. II. (2ndEdn.). (Bryophytes &Pteridophytes). McGraw Hill Book Co., N.Y 1956.
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5. Sundararajan, S. *Introduction to Pteridophyta*. New Age International Publishers, New Delhi, India, 2007.
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1. Coulter, J. M. and C. J. Chamberlain. *Morphology of Gymnosperms*. Central Book Depot, Allahabad, India, 1964.
2. Sporne, K. R. *The Morphology of Gymnosperms*. (The structure and Evolution of Primitive seed Plants). Hutchinson University Library, London, 1971.
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4. Vashista, P.C. *Botany for Degree Students Gymnosperms (2ndEdn.,)* S. Chand & Co., New Delhi, India, 2006.

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2. Delavoryas, T. *Morphology and Evolution of Fossil Plants*. Holt, Rinehart and Winston. New York, 1962.
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**CORE PRACTICAL IV - PLANT DIVERSITY II
(PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)**

Semester : IV
Credits : 2

Course code : U16BY4P4
Total Hours : 45

Pteridophytes

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

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

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

CORE V - PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

Semester : V
Credits : 6

Course Code : U16BY505
Total Hours : 105

General Objectives

1. To understand and appreciate the plant world we depend on
2. To ascertain the basic principles of plant function, metabolism, secondary products, cell physiology & principles of growth & development

UNIT 1 : IMPORTANCE OF WATER & MINERALS

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

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 O₂ 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 C₃ Cycle

2.6.0 Hatch and Slack Pathway

- 2.6.1. C₄ –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

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

- 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

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

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2. Devlin, R.M. *Plant Physiology*. Holt, Rinehart & Winston & Affiliated East. West press (p) Ltd., New Delhi 1969.
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1. Achermaan, K. *Biophysical sciences*, Prentice hall of India. New Delhi 1987.
2. Annie and Arumugam, N. *Biochemistry and Biophysics*. Saras Publications, Nagercoil, Tamil Nadu 2000.
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4. Narayanan, P. *Essentials of Biophysics*. New Age International Publishers (P) Ltd., New Delhi 2000.

CORE VI - CELL BIOLOGY, GENETICS AND EVOLUTION

Semester : V
Credits : 6

Course Code : U16BY506
Total Hours : 105

General Objectives

1. To study the basics of cell and its inclusions
2. To understand the basic concepts of mendelian genetics, its variations and applications
3. To have a clear knowledge on the various concepts of evolution

UNIT I- CELL AND ITS INCLUSIONS

- 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

- 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

- 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

- 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 McClintocks experiment
- 4.4 Linkage Mapping
- 4.5 Cytoplasmic inheritance– Kappa particle (*Paramecium*)
- 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

- 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.

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Evolution

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2. Shukla, R.s. and P.S.Chandel.*Cytogenetics, EvolutionandPlantBreeding*, S.Chand and Co., New Delhi 1980.
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5. Moore Ruth, *Evolution*, Time World Press, Kulkutta2000.
6. Barton Nicholas.H., Briggs Derek E.G. and Eisen Jonathan. A. *Evolution*, Cold Spring Harbor laboratory Press, U.S.A 2008.

Core Practical V – PHYSIOLOGY, CELL BIOLOGY AND GENETICS

Semester : V
Credits : 2

Course Code : U16BY5P5
Total Hours : 45

Physiology

For demonstration

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

Experiments to be performed by each student

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

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

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

Project

Sem. V
Total Hrs. : 75

Code : U16BY5PJ
Credits : 5

ELECTIVE I - BIOSTATISTICS, COMPUTER APPLICATION AND BIOINFORMATICS

Semester : V
Credits : 5

Course Code : U16BY5:1
Total Hours : 90

General objectives

1. To know the basic principles of biostatistics and computer applications in biology.
2. To understand the fundamental concepts of biostatistics.
3. To learn to use computers for biological data management and graphical presentation.
4. To comprehend the need for computer applications, programs and techniques for biology.

Unit I: BASIC CONCEPT OF BIOSTATISTICS

- 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

- 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

- 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

- 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

- 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
Credits : 2

Course Code : U16BYP51
Total Hours : 30

General Objective

To acquire sufficient theoretical and practical knowledge of mushroom cultivation and nursery ventures.

Unit I: INTRODUCTION TO MUSHROOMS

- 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

- 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

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

Unit IV: BASIC CONCEPTS AND TECHNIQUES OF NURSERY TECHNOLOGY

- 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 – *Hibiscus*, (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 Kettle, Crow Bar, Garden scissor, Grafting Knife, Rake, Sprayer, Pruning saw, Plant cutter

UNIT V: COMPONENTS AND PREPARATION OF NURSERY BED

- 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

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CORE VII - GENERAL GEOLOGY, ECOLOGY AND PHYTOGEOGRAPHY

Semester :VI
Credits : 6

Course Code: U16BY607
Total Hours : 90

General objectives

1. To understand the basic concepts of general Geology, Ecology and Phytogeography
2. To know the basic principles of Geology
3. To understand the importance of Ecology

Unit I : GEOLOGY

- 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

- 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

- 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

- 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

- 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. Ambasht, R.S. *Text Book of Plant Ecology* (3rd Edition) Students & Friends Co., Varanasi 1974.
- 2. Odum, E.P. *Ecology*, Holt, Rinert & Winston 1975.
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- 6. Newman, E.I. *AppliedEcology*. Blackwell scientific Publishers U.K 2000.

Phytogeography

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

General Geology

- 1. Krishnan, M.S. *Geology of India and Burma*. Higginbothams, Madras 1968.
- 2. Mukarjee,P. K. *Text Book of Geology*. The World Press Pvt. Ltd., College Street, Calcutta 1996.
- 3. Ramachandra Rao.*Out line of Geological Prospecting*. Prasavanga University of Mysore 1976.

CORE VIII - GENERAL MICROBIOLOGY

Semester : VI
Credits : 5

Course Code : U16BY608
Total Hrs. : 90

General Objective

1. To know the basic concepts, methods, scopes, classifications, characterization, Diseases and economic importance of microorganisms

Unit I : Introduction to Microbiology

- 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 – Asexual 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

- 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

- 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

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

UnitV: ENVIRONMENTAL MICROBIOLOGY

- 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 dumos method, *In situ* bioleaching, Bioreactor and Advantages of bioleaching

References

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CORE PRACTICAL VI - ECOLOGY, MICROBIOLOGY, PLANT BREEDING, PATHOLOGY AND PROTECTION AND ORGANIC FARMING

Semester : VI
Credits : 2

Course Code : U16BY6P6
Total Hours : 45

Ecology

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:

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:

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. Integrated pest management

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

Semester :VI
Credits : 5

Course Code : U16BY6:1
Total Hours : 75

General Objectives

1. To understand the fundamental aspects of plant breeding and plant pathology involving the principles, achievements, few diseases and their casual agents.
2. To learn the plant protection methods and organic farming systems,

Unit I : PLANT BREEDING

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

- 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

- 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

- 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

- 5.1. 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

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Plant breeding

1. Alex Laurie and Victor H. Ries. *Floriculture – Fundamentals and Practices*. McGraw Hill publishers New York, 1942.
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HORTICULTURE

1. Edmond Musser and Andres. *Fundamentals of Horticulture*. McGraw Hill Book Co., New York. 1974.
2. Randhawa. *Ornamental Horticulture in India*. Today and Tomorrow Publishers. New Delhi, India. 1978.

3. Naik. *South Indian Fruits and their culture*. Varadhachary and Co., Madras, Tamil Nadu, India. 1963.

PLANT PROTECTION

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

ELECTIVE III - MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Semester : VI
Credits : 5

Course Code: U16BY6:2
Total Hours : 75

General objective

1. To understand the basic concepts of molecular biology, genetic engineering and plant tissue culture and its applications.

Unit I: BASIC CONCEPT OF MOLECULAR BIOLOGY

- 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

- 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

- 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

- 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

- 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

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2. Atherlay, A. G., Girton , J.R. and McDonald, J.F. *The Science of Genetics*, Saunders College Publishing. Fort Worth, USA. 1999.
3. Freifelder, D. *Essentials of Molecular Biology*- 3rd edition Narosa Publications House. New Delhi 1998.
4. Gupta, P.K. *A text Book of Cell and Molecular Biology*. Rastogi Publications. Meerut, India. 1999.
5. V.L. Chopra and Anwar Nasim (4th Ed.). *Genetic engineering and Biotechnology. Concepts, Methods and Application*. 1990.
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7. Sant Saran Bhojwani, Prem Kumar Dantu. *Plant Tissue Culture: An Introductory Text*. Springer International Publishing AG, 2013.
8. Chawla, H.S. *Introduction to plant Biotechnology*. Oxford IBH Publishing co., New Delhi, 2000.
9. Dubey, R.C. *A text book of Biotechnology*. S. Chand and Co., New Delhi, 1999
10. Ramawat, K.G. *Plant Biotechnology*. S. Chand & Co., New Delhi, 2000.
11. Ramawat, K.G. and Haily Goyal. *Molecular biology and Biotechnology*, S. Chand & Co., New Delhi, 2010.

SBEC II - MOLECULAR AND PLANT TISSUE CULTURE TECHNIQUES

Semester : VI
Credits : 2

Course Code : U16BYPS2
Total Hours : 30

General Objective

1. To comprehend the basic concept, technical skills, hands-on experience and training in plant tissue culture and molecular biology.

Unit I- Introduction and Laboratory organization

- 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

- 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

- 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

- 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 – Photographs and video presentation

- 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. *Plant Tissue Culture*, Campus books international, New Delhi,2000.
2. Razdan, M.K. *Introduction to Plant Tissue Culture*, Second edition. Oxford and IBH publishing, New Delhi, 2003.
3. Thara, K.M. *Practical Manual series-4. Biotechnology*, New India Publishing Agency, New Delhi, 2009.
4. Bhojwani, S. S. and M. K. Razdan. *Plant Tissue Culture: Theory and Practice*, a revised edition. Elsevier Science, Netherlands, 1996.
5. Chawla, H.S. *Introduction to plant biotechnology*, second edition, Oxford & IBH Publishing, Co, Pvt. Ltd., New Delhi.2002.
6. Rajendra Reddy and Abhay Shankar, J.P., *Tissue Culture*. Commonwealth Publishers, New Delhi, 2008.
7. Jwala Aggarwal and Shekhar K. Arora, *Experiments in Plant Tissue Culture*. Campus Book International, New Delhi, 2014.

SBEC III - PLANT WEALTH FOR HUMAN LIFE

Semester : IV
Credits : 2

Course code :U16BYP3
Total Hours : 30

General Objectives

1. To know how to use the plant resources to produce valuable products.
2. To know scope and potential of medicinal and aromatic plants
3. To know the potential plants for income generation.

Unit I : Flowers

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

Unit II : Vegetables and Fruits

- 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

- 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

- 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

- 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 Phyt 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. *Economic botany*. S. Chand and Co. New Delhi, 2007.
2. Samba Murty, A.V.S., Subramaniyan, N.S. *A Text book of economic botany*. Wiley Eastern Ltd. New Delhi, 1989.
3. Siddappa, G.S. and Tandon, G.L. *Preservation of fruits and vegetables*. ICAR, New Delhi, 1998.

**Allied Botany Courses offered to students of
Under Graduate Programme in Zoology
(For the candidates admitted from the year 2016 onwards)**

Sem.	Course	Code	Title	Hrs./week	Credits	Marks		
						CIA	ESA	TOTAL
I	I	U16BYY11	Allied Botany – I	4	3	25	75	100
II	II	U16BYY22	Allied Botany – II	4	4	25	75	100
II	III	U16BYYP1	Allied Botany Practical Plant Bio-diversity	3	3	40	60	100

ALLIED BOTANY - I

Semester : I
Credits : 3

Course Code : U16BYY11
Total Hours : 60

General Objectives:

1. To study the character and life cycle of Algae
2. To understand the various forms of Fungi
3. To know the characters of Bryophytes
4. To analyze the character of pteridophytes and gymnosperms.
5. To understand the structure of various tissues and their functions
6. To study the internal structure of stem and root

Unit I: Plant Diversity:

- 1.1 Structure, reproduction and life cycle of
(a) Algae (*Chlamydomonas*) (b) Fungi (*Penicillium*)(c) Bryophytes (*Riccia*)
(d) Pteridophytes (*Lycopodium*) (e) Gymnosperms (*Cycas*).

Unit II: Morphology:

- 2.1 Leaf shape and Phyllotaxy,
2.3 Inflorescence
(a) Racemose, (b) Cymose (c) Special types,
2.4 Terminologies in flower description.

Unit III: Plant Taxonomy:

- 3.1 Binomial Nomenclature
3.2 Bentham and Hooker Systems of Classification
3.3 Study of following Plant families
(a) Annonaceae, (b) Cucurbitaceae, (c) Apocynaceae, (d) Lamiaceae,
(e) Euphorbiaceae (f) Poaceae.

Unit IV: Anatomy:

- 4.1 Meristematic and Permanent Tissue
4.2 Primary structure of Dicot and Monocot - (a) Leaf (b) Stem (d) Root.
4.3 Normal secondary growth in dicot stem and root.

Unit V: Embryology:

- 5.1 Structure of Flower
5.2 Structure of Anther (*Capsella bursa-pastoris*)
5.3 Development of male gametophyte - ovule
5.4 Development of Female gametophyte
5.5 Types of Pollination
5.6 Fertilization and development of Dicot Embryo (*Polygonum*).

References

1. B.P Pandey, *College botany Volume III*. S Chand and company pvt.ltd. New delhi. 2015.

2. Inderjeetkaursethi, Surinderkaurwalia. *Textbook of fungi and their allies*. Macmillam publishers india ltd. Newdelhi. 2011.
3. B.P Pandey, *Taxonomy of Angiosperms*. S. Chand and company ltd. Newdelhi 2009.
4. B.R Vashishta , A.K Sinha. *Botany for degree student's Fungi* S Chand and company pvt.ltd. New Delhi. 2003.
5. B.P Pandey, *College botany Volume I*. S Chand and company pvt.ltd. New delhi. 2015.

ALLIED BOTANY – II

Semester : II
Credits : 4

Course Code : U16BYY22
Total Hrs. : 60

General Objectives

1. To comprehend the plant propagation techniques.
2. To understand the plant pathology and plant protection techniques
3. To identify various angiospermic plants
4. To understand the plant ecology
5. To study the mechanism of absorption of water by plants
6. To acquire knowledge on photosynthesis

Unit I: Plant Propagation

- 1.1 Asexual methods: (a) Cutting (b) Air layering (c) Grafting (d) Budding.
 - 1.1.1 Micropropagation - Induction of rooting and flowering.

Unit II: Plant pathology:

- 1.1 Detailed study of the following plant diseases, symptoms, Causal agents and control measures.
 - (a) White rust (b) Citrus canker (c) Tobacco Mosaic
- 2.2 Plant protection Methods
 - 2.2.1 Natural Methods:
 - (a) Prevention, (b) Control (c) Eradication, (d) Plant Quarantine,
 - 2.2.2 Biological control and methods of application
 - (a) Pesticide (*Malathion*), (b) Fungicide (*Bordeauxmixture*)

Unit III: Ecology:

- 3.1 Climatic factors – (a) Edaphic (b) Biotic.
- 3.2 Plant Adaptations
 - (a) Xerophytes (*Opuntia*) (b) Hydrophytes (*Eichhornia*) (c) Halophytes (*Rhizophora*)
- 3.3 Vegetational types of Tamilnadu

Unit IV: Plant physiology:

- 4.1 Absorption of water and salts.
- 4.2 Role of mineral elements.
- 4.3 Nitrogen cycle.
- 4.4 Transpiration.

Unit V: Photosynthesis,

- 5.1 Light and Dark Reactions
- 5.2 C₃ and C₄ Cycles,
- 5.3 Respiration – (a) Aerobic (b) Anaerobic
- 5.4 Krebs cycle and oxidative phosphorylation.

References

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

Allied Practical I - Plant Bio-diversity

Semester : I & II
Credits : 3

Course Code: U16BYYP1
Total Hours : 45

1. **Algae**-*Chlamydomonas*
2. **Fungi** - *Penicillium*
3. **Bryophyte**- *Riccia* – Habit, Thallus and Capsule.
4. **Pteridophyte** - *Lycopodium* – Habit, Stem,
5. **Gymnosperm**
(a) *Cycas* – corolloid root – Entire, (b) *Cycas* – corolloid root - T.S.,
(c) *Cycas* – Rachis – T.S., (d) *Cycas* – microsporophyll, (e) Microsporophyll – T.S
(f) *Cycas* – Mega sporophyll
6. **Taxonomy**
(a) Annonaceae – *Polyalthialongifolia* (b) Cucurbitaceae – *Coccinia indica*
(c) Apocyanaceae – *Vincarosea*(d) Lamiaceae – *Leucas aspera*
(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**
(a) Osmosis -Thistle Funnel Experiment (b) Bell jar experiment (c) Ganong's Photometer
(d) Test Tube and Funnel Experiment (e) Ganong's light screen Experiment
(f) Ganong's Respiroscope Experiment (g) Kuhne's Experiment.

UG – Skill Based Courses (SBC)

Sem.	Course	Code	Title	Hrs.	Credits	Marks		
						CIA	ESA	TOTAL
IV	SBC- I	U16LFS41	Life Skills	2	1	100	-	100

LIFE SKILLS

Semester IV
Credit 1

Course code: U16LFS41
Total Hrs : 30

General objectives

1. To acquire skills and abilities for adaptive and positive behavior that helps to deal effectively with the demands and challenges of everyday life.
2. To develop creative, communicative and critical thinking skills necessary for employability

Unit I Basics of Communication skills & Effective Communication

Features of Communication – Process of Communication Verbal, nonverbal, Body Language – Postures & Etiquette – Listening & speaking Skills- Communication Barriers – Listening & speaking Skills.

Unit II Personal Effectiveness

Maslow's theory – Self-esteem- Role Conflict – Intra & Inter personal Skills – Efficiency Vs effectiveness – Team Building – Emotional Intelligence & Quotient

Unit III Interview Skills

Types of Interviews – Resume Formats & preparation - Cover letters – Simple rules to face interviews – Dos & Don'ts in an Interview – Telephonic Interview and Etiquette - Group Discussions – Types – Methods – Ingredients and Tips for a Successful Group Discussion.

Unit IV Test of Reasoning & Numerical Ability

- A. Numerical Ability: Problems related to Average – Percentage – Profit /Loss – Simple & Compound Interest- Time & Work – Boats & Streams etc.
- B. Logical reasoning: Logical Detection – Nonverbal reasoning – Problems related to seating arrangements – Relationship model – Assertion & Reasoning etc.
- C. Online Tests: Aptitude – Logical Reasoning – Problem Solving – Time management in Online tests- Online tests on Language skills- Aptitude and technical rounds

Unit V Outbound Learning

Physical, Mental, and emotional exercises

References

1. Barun.K.Mitra, Personality Development and Soft Skills, 6th edition, Oxford University press Noida 2012.
2. M.Sarada, The complete Guide to Resume Writing, Sterling Publishers Pvt Ltd, New Delhi 2012.
3. Gloria J.Galances & Katherine Adams, Effective Group Discussions, Theory & practice, 12th Edition, Tata McGrawHill Pvt Ltd 2012.
4. Francis Soundararaj, Basics of Communication in English, SoftSkills for Listening Speaking, Reading & Writing, Macmillan Publishers India Ltd. 2013.

Scheme of Evaluation

1.	EQ test	10 Marks
2.	Resume	10 Marks
3.	Numerical Ability Test	10 Marks
4.	Online test 1(aptitude)	10 Marks
5.	Group Discussion	10 Marks
6.	Team Work	10 Marks
7.	OBL Observation / Work book	40 Marks
	Total	100 Marks

**UG - Non Major Elective Courses (NMEC)
(Offered to Students of other Disciplines)**

Sem.	Course	Code	Title	Hrs./ week	Credi ts	Marks		
						CIA	ESA	TOTAL
III	NMEC- I	U16BYPE1	Nursery Technology	2	2	40	60	100
IV	NMEC- II	U16BYPE2	Mushroom Cultivation	2	2	40	60	100

NMEC I - NURSERY TECHNOLOGY

Semester III
Credits 2

Course Code : U16BYPE1
Total Hours : 30

General objectives

1. To know methods of plant multiplication and nursery structures
2. To know Greenhouse forming, Methods of Harvesting, Packaging and Marketing

THEORY

Unit I

Introduction, Methods of Propagation-Sexual Propagation, Vegetative Propagation, Cuttings, Layering, Grafting, Budding.

UNIT II

Tissue culture – Methods of Plant multiplication *in vitro*. Basic parameters for propagation *in vitro*.

UNIT III

Nursery Structures – Store House, Potting and Packing Shed, Nursery Bed, Mist Chamber, Manures, compost, vermicompost.

UNIT IV

Green houses for tropical countries – Management, Pot culture, Pot mixture

UNIT V

Harvesting, Packing, Storage and Marketing of Nursery Stock

PRACTICAL

1. Layering-Jasmine, Mussaenda, Ixora
2. Cutting – Crotons, Hibiscus, Bougainvillea
3. Grafting – Mango, Citrus
4. Vermicomposting.

References

1. Edmond Musser and Andres, .Fundamentals of Horticulture. McGraw Hill Book Co., 1957
2. Gardener,. Basic Horticulture. Mac Millan N.Y, 1996
3. Kumar N, Introduction to Horticulture. Rajalakshmi Publications Nagercoil, India, 1997

4. Lex Lauries and Victor H, Rice. Floriculture – fundamentals and practices,.Mc.Graw Hill publishers N.Y, 1979
5. Manibhushan Rao,K, Text Book of Horticulture. Macmillon India Ltd., 1991
6. Mukherjee D, Gardening in India. Oxford IBH Publishing Co., New Delhi, 1977
7. Randhawa, Ornamental Horticulture in India. Today and Tomorrow Publishers New Delhi, 1997.
8. Sandhu M.K, Plant Propagation. Wiley Easter Ltd., New Delhi, 1989.
9. Sundararajan, J.S., Muthuswamy, J., Shanmugavelu, K.G. and Balakrishnan, R. A Guide to Horticulture. Thiruvankadam Printers, Coimbatore.

NMEC II - MUSHROOM CULTIVATION

Semester IV
Credits 2

Course Code : U16BYPE2
Total Hours : 30

General objective

To know the methods of cultivation of mushroom, protection and disease control measures

THEORY

Unit I

Introduction-Types of Mushroom-Identification of edible and poisonous Mushroom. Nutritive values life cycle of common edible mushroom.

Unit II

Scenario of Mushroom cultivation – Prospects and Scope of Mushroom Cultivation.

Unit III

Cultivation methods for different types of Edible mushroom Paddy straw mushroom (*Volvariella* Sp.) Button mushroom (*Agaricus* Sp.) Oyster mushroom (*Pleurotus* Sp.)

Unit IV

Cultivation, Pure Culture Preparation of Spawn and Compost and Spawn Running Cropping and its maintenance Harvesting and Marketing

Unit V

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

PRACTICAL

1. Setting up of Cultivation room
2. Preparation of Spawn, Spawning & Spawn running
3. Preparation of Compost
4. Harvest and Packing methods

References

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