

# **THANTHAI HANS ROEVER COLLEGE**

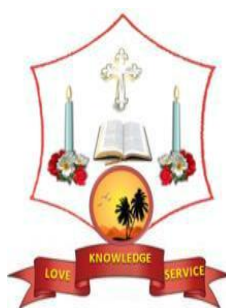
**(Autonomous)**

*Accredited by NAAC*

*UGC Recognized 2(f) and 12(B) Institution*

*Affiliated to Bharathidasan University, Tiruchirapalli*

**Perambalur – 621 220, Tamil Nadu, India**



**B.Sc., BOTANY**

**CHOICE BASED CREDIT SYSTEM SYLLABUS**

**SEMESTER PATTERN**

**DEPARTMENT OF BOTANY**

**(2018-2019 ONWARDS)**



**Bachelor of Botany Course Structure under CBCS**

(For the candidates admitted from the academic year 2018-2019 onwards)



SEMESTER	PART	SUBJECT CODE	COURSE	TITLE	HOURS/WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
								INTERNAL	EXTERNAL	
I	I	18UT1	Language course-I	Tamil-I/Other language	6	3	3	25	75	100
	II	18UE1	Language course-II	English-I	6	3	3	25	75	100
	III	18UBO1CC1	Core course-I	Plant diversity-I	5	5	3	25	75	100
		18UBO1CP1	Core course practical-I	Plant diversity-I & Plant Pathology and Plant Protection (P)	3	-	***	-	-	-
		18UZO1AC1	Allied course-I	Zoology-I	5	4	3	25	75	100
	IV	18UZO1AP1	Allied practical-I	Zoology-I(P)	3	-	***	-	-	-
	IV	18UVE	Value education	Value Education	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>17</b>				<b>500</b>
II	I	18UT2	Language course-II Tamil/	Tamil-II/ Other language	6	3	3	25	75	100
	II	18UE2	Language course-II	English-II	6	3	3	25	75	100
	III	18UBO2CC2	Core course-II	Plant Pathology and Plant Protection	5	5	3	25	75	100
		18UBO2CP1	Core course practical-I	Plant diversity-I & Plant Pathology and Plant Protection (P)	3	4	3	40	60	100
		18UZO2AC2	Allied course-II	Allied Zoology-II	5	4	3	25	75	100
	IV	18UZO2AP1	Allied practical-I	Allied Zoology-I(P)	2	4	3	40	60	100
	IV	18UES	Environmental studies	Environmental studies	3	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>25</b>				<b>700</b>
III	I	18UT3	Language course-III	Tamil-3/ Other language	6	3	3	25	75	100
	II	18UE3	language course-III	English-III	6	3	3	25	75	100
	III	18UBO3CC3	Core course-3	Plant Diversity-II	6	5	3	25	75	100
		18UBO3CP2	Core course practical-II	Plant Diversity –II and Anatomy and Embryology	3	-	***	-	-	-
		18UCH3AC3	Allied course-III	Chemistry-III	5	4	3	25	75	100
	IV	18UCH3AP2	Allied practical-II	Chemistry-II(P)	2	-	***	-	-	-
	IV	18UBO3NME1	Non–Major elective- I	Bio fertilizers and Bio pesticides	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>17</b>				<b>500</b>
IV	I	18UT4	Language course-IV	Tamil-IV/ Other language	6	3	3	25	75	100

	II	18UE4	Language course-IV	English-IV	6	3	3	25	75	100
	III	18UBO4CC4	Core course-IV	Anatomy and Embryology	5	5	3	25	75	100
		18UBO4CP2	Core course practical-II	Plant Diversity –II and Anatomy and Embryology	3	4	3	40	60	100
		18UCH4AC4	Allied course-IV	chemistry-IV	4	4	3	25	75	100
		18UCH4AP2	Allied practical-II	chemistry-II(P)	2	2	3	40	60	100
	IV	18UBO4NME2	Non- Major elective II	Horticulture	2	2	3	25	75	100
		18UBO4SBE1	Skill based elective-1	Greenhouse technology	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>25</b>				<b>800</b>
V	III	18UBO5CC5	Core Course – V	Cell and Molecular Biology	5	5	3	25	75	100
		18UBO5CC6	Core Course – VI	Genetics, Biostatistics and Evolution	5	5	3	25	75	100
		18UBO5CC7	Core Course – VII	Morphology, Taxonomy and Economic Botany	4	4	3	25	75	100
		18UBO5CP3	Core Practical – III	Cell and Molecular Biology & Genetics, Biostatistics and Evolution & Morphology, Taxonomy of Angiosperms and Economic Botany(P)	6	5	3	40	60	100
		18UBO5MBE1	Major Based Elective – I	Medical Botany	4	4	3	25	75	100
	IV	18UBO5SBE2	Skill Based Elective – II	Plant tissue culture and Molecular techniques	2	2	3	25	75	100
		18UBO5SBE3	Skill Based Elective – III	Plant wealth for human life	2	2	3	25	75	100
		18USSD	Soft Skills Development	Soft Skills Development	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>29</b>				<b>800</b>
VI	III	18UBO6CC8	Core Course – VIII	Plant Physiology, Biochemistry and Biophysics	6	6	3	25	75	100
		18UBO6CC9	Core Course – IX	Plant Ecology and Phytogeography	6	6	3	25	75	100
		18UBO6CP4	Core Practical – IV	Plant Physiology, Biochemistry and Biophysics & Plant Ecology and Phytogeography (P)	6	4	3	40	60	100
		18UBO6MBE2	Major–Based Elective II	Plant Breeding, Horticulture and Landscaping	6	5	3	25	75	100
		18UBO6MBE3	Major–Based Elective III	Plant Biotechnology and Bioinformatics	5	4	3	25	75	100
	V		Extension Activities	NCC,NSS & etc..	-	1	--	--	--	-
		18UGS	Gender Studies	Gender Studies	1	1	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>27</b>				<b>600</b>
<b>GRANT TOTAL</b>					<b>180</b>	<b>140</b>				<b>3900</b>

## List of Allied Courses

### Group – I

Zoology

### Group – II

Chemistry

Language Part – I	-	4
English Part –II	-	4
Core Paper	-	9
Core Practical	-	4
Allied Paper	-	4
Allied Practical	-	2
Non-Major Elective	-	2
Skill-Based Elective	-	3
Major-Based Elective	-	3
Environmental Studies	-	1
Value Education	-	1
Soft Skill Development	-	1
Gender Studies	-	1
Extension Activities	-	1 (Credit only)

#### Note:

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

#### FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30 marks]

#### FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for University Examinations shall be 40% out of 60 marks [i.e. 24 marks]

#### Note :

1. As a part of Botany Degree Course every student shall undertake a tour and Field study of Vegetation under the guidance of the staff for not less than (FIVE DAYS within the state) in the III year and submit a minimum number of 25 Herbarium sheets. Students shall submit duly certified record of their practical Work for all the practical examinations and those who do not submit the record shall not be permitted to the concerned practical examination.
2. The IA components for the practicals are skill – 10 marks, Test 2 x 10 = 20 Marks, Observation – 10 Marks [for Taxonomy practicals Herbarium marks to be included in the IA component in the place of skill Marks]

## SEMESTER – I

### CORE COURSE – I

#### **PLANT DIVERSITY-I (BACTERIA, VIRUSES, ALGAE, FUNGI AND LICHENS)**

<b>Core course:</b>	<b>I</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UBO1CC1</b>	<b>Credit</b>	<b>: 5</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### **Objectives:**

1. To understand the structure, reproduction, culture, classification and economic importance of bacteria and viruses.
2. To study the classification, ecology, distribution, morphology, life-cycle and economic importance of Algae and Fungi.
3. To impart knowledge on distribution, classification, structure, physiology, reproduction and function of lichens and significance of ectomycorrhiza and endomycorrhiza.

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

Bacteria History- General characteristics- and cell structure- Nutritional types of bacteria (based on carbon- nitrogen- and energy sources)- Reproduction vegetative- asexual- and recombination (conjugation, transformation and transduction)-bacterial culture and staining (simple and differential)- Economic importance.

#### **Unit II: Viruses**

Viruses History- general structure-transmission of plant viruses- replication of plant virus (tobacco mosaic virus)- structure- and multiplication of bacteriophages- structure- and multiplication of virus- Economic importance.

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

General characteristics -Range of thallus organization- and reproduction- Outline classification of algae (F. E. Fritsch 1935)- Morphology and life cycles of the following: *Oscillatoria*-*Chlamydomonas*-*Oedogonium*-*Caulepra*-*Diatoms*-*Ectocarpus*-*Dictyota*-*Polysiphonia*-Economic importance of algae.

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

General characteristics range of thallus organization- cell wall composition- nutrition-reproduction- classification (Alexopolous1962)- True Fungi General characteristics- life cycle of *Rhizopus* (Zygomycota)- *Penicillium*- *Alternaria* (Ascomycota)- *Puccinia*- *Agaricus* (Basidiomycota)-Economic importance.

## Unit V: Lichens

Symbiotic Associations Lichens- General account- types- occurrence- thallus organization- classification- structure- reproduction- and role in environmental pollution and uses.

### REFERENCE BOOKS:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology* (4th edition). John Wiley and Sons (Asia), Singapore.
2. Kumar, H.D. (1999). *Introductory Phycology* (2nd edition). Affiliated East-West Press Pvt. Ltd. Delhi.
3. Pandey, B.P. (2001). *College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta*. S. Chand & Company Ltd., New Delhi.
4. Sambamurthy, A.V.S.S. (2006). *A Textbook of Algae*. I.K. International Pvt. Ltd., New Delhi.
5. Sethi, I.K. and Walia, S.K. (2011). *Text book of Fungi & Their Allies*. MacMillan Publishers Pvt. Ltd., Delhi.
6. Tortora, G.J., Funke, B.R., Case, C.L. (2010). *Microbiology: An Introduction* (10th edition). Pearson Benjamin Cummings, U.S.A.
7. Vashishta, B.R. (1990). *Botany for Degree Students: Fungi*. S. Chand & Company Ltd., New Delhi.
8. Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) *Botany for Degree Students: Algae*. S. Chand & Company Ltd., New Delhi.

Total No. of topics	Local	Regional	National	Global
54	0	0	0	54

## SEMESTER – II

### CORE COURSE II

### PLANT PATHOLOGY AND PLANT PROTECTION

<b>Core course:</b>	<b>I</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UBO2CC2</b>	<b>Credit</b>	<b>: 5</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To understand plant pathogenesis, classification and host-parasite interaction.
2. To study plant diseases in crops and their management, significant contributions of plant pathologists and usage of various techniques in plant protection.
3. To impart knowledge on distribution, classification, structure, physiology, reproduction and function of lichens and significance of ectomycorrhiza and endomycorrhiza.

#### Unit I Plant Pathology

Plant Pathology History- importance of study of Plant pathology- Classification of plant diseases based on (a) Major causal agents biotic- and abiotic- (b) General Symptoms- Process of infection and pathogenesis- (a) Penetration and entry of pathogen into host tissue- mechanical- physiological- and enzymatic- (b) Host parasite interaction- enzymes- and toxins in pathogenesis.

#### Unit II Plant Disease Management

Chemical means of disease control Fungicides: Definition- classification- characters of an ideal fungicide- antibiotics- and nematicides- Biological Control of Plant Diseases: Definition- Importance.

#### Unit III Common Plant Diseases

Study of plant diseases with respect to symptoms- causal organism- disease cycle -and their management- (a) Cereals: Rice blast disease- (b) Vegetables: Brinjal Little leaf- (c) Fruits: Banana bacterial leaf blight- Citrus bacterial canker- (d) Oil seeds: Groundnut Tikka disease- (e) Sugar yielding: Sugarcane red rot.

#### Unit IV Plant Protection

Scope- Importance- equipments used in plant protection -Sprayers - dusters - soil injector - seed dressing drum- Seed treatment- objectives of seed treatment- Traditional and modern methods of seed treatment- Soil sterilization-Traditional and modern methods of soil sterilization techniques- Role of soil sterilization in Polyhouse farming.

#### Unit V Methods of Plant Protection

- a) Cultural: Tillage- sowing- and planting dates- crop hygiene- crop rotation- trap crops- fertilizer.
- b) Mechanical: Field sanitation, collection- and destruction of diseased plant debris- For pests hand picking- and destruction of egg masses- shaking of plants- rope dragging- netting- bagging-physical barriers- use of sticky bands- tinbands- and light traps.
- c) Physical: Heat and soil solarizations.

- d) Chemical: Brief account and uses of Bactericides- Fungicides- Insecticides- Nematicides- Acaricides- Molluscicides- Rodenticides- and Herbicides.
- e) Biological: Introduction- biological control of Insect pests and diseases
- f) Legal Plant Introduction- domestic quarantine- need of plant quarantine -quarantine in India

**REFERENCE BOOKS:**

1. Bap Reddy, D. and Joshi, N.C. (1991). *Plant Protection in India* (Second Edition). Allied Publishers Ltd., New Delhi.
2. Bilgrami, K.S. and Dubey, R.C. (1985). *Text book of Modern Plant Pathology*. Vikas Publishing House Private Limited, New Delhi.
3. Mehrotra, R.S. (2003). *Plant Pathology* (Second edition). Tata McGraw-Hill Education, New Delhi.
4. Pandey, B.P. (2001). *Plant Pathology*. S. Chand & Company Limited, New Delhi.
5. Rangasami, G. and Mahadevan, A. (1998). *Diseases of Crop Plants in India*. Prentice Hall of India Ltd. New Delhi.

Total No. of topics	Local	Regional	National	Global
77	10	0	11	56

## CORE PRACTICAL- I

### PLANT DIVERSITY-I

(BACTERIA, VIRUS, ALGAE, AND FUNGI AND LICHENS & PLANT PATHOLOGY AND PLANT PROTECTION) (P)

<b>Core course</b>			
<b>(Practical):</b>	<b>I</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code:</b>	<b>18UBO2CP1</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### Practicals to be done:

Tools and equipments used in microbiology, Spirit lamp, Inoculation loop, Hot air oven, Autoclave, Pressure cooker, Laminar air flow chamber, Incubator etc.

Types of Bacteria from temporary/permanent slides/photographs; EM bacterium, Binary Fission, Conjugation, Structure of root nodule.

EMs/Models of viruses : T Phage and TMV Line drawing/Photograph of Lytic and Lysogenic Cycle.

Study of vegetative and reproductive structures of *oscillatoria- Chlamydomonas* (electron micrographs)- *Oedogonium- Caulepra- Diatoms- Ectocarpus- Dictyota- and Polysiphonia* through temporary preparations and permanent slides.

*Rhizopus- and Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.

*Alternaria*: Specimens/photographs and Permanent slide

Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.

*Agaricus*: Specimens of button stage and full grown mushroom, Sectioning of gills of *Agaricus*.

Lichens: Structure (crustose, foliose, and fruticose)

#### Field visit

Conduct field visit for direct observation of algae, fungi and other specimen

Total No. of topics	Local	Regional	National	Global
17	11	0	3	3

## SEMESTER – III

### CORE COURSE III

#### PLANT DIVERSITY-II

(BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)

Core course:	III	Hours	: 6
Course code:	18UBO3CC3	Credit	: 5
		Max.Marks	: 100
		Internal	: 25
		External	: 75

#### Objectives:

1. To understand the salient features of Bryophytes, Pteridophytes and Gymnosperms.
2. To study the structure and reproduction of various genera mentioned in the syllabus.
3. To understand the salient features and importance of fossils and fossilization process in tracing evolution.

#### Unit I: Bryophytes

General Characteristics- Classification- Morphology- Structure- Reproduction -and life history of the following genera: *Riccia- Marchantia- Anthoceros-* and *Polytrichum*.

#### Unit II: Pteridophytes

General characteristics- and classification by Smith(1955)- Morphology-Structure- Reproduction- and life cycle of the following genera *Psilotum- Lycopodium- Selaginella-* and *Equisetum*.

#### Unit III:

Morphology- structure- Reproduction- and life cycle of *Adiantum- Marsilea-* Stellar evolution in Pteridophytes- Heterospory- and origin of seed habit.

#### Unit IV: Gymnosperms

General characteristics- and classification of Gymnosperms by Sporne(1965)- Morphology-structure- mode of reproduction- and life cycle of the following genera: *Cycas- Pinus-* and *Gnetum*.

#### Unit V: Paleobotany

Fossils and methods of fossilization - Geological time scale - an elementary knowledge of the computation of the age of fossils - Radio Carbon dating technique- A brief study of the following fossil forms: *Rhynia- Lepidodendron- Lepidocarpon- Calamite-* and *Williamsonia*.

#### REFERENCE BOOKS:

#### BRYOPHYTES

1. Rashid, A. (1998). *An Introduction to Bryophyta*. Vikas Publishing House (P) Ltd., New Delhi.
2. Srivastava, N.N., (1996). *Bryophyta*. Pradeep Prakashan, Meerut.

## PTERIDOPHYTES

1. Rashhed, A. (1999). *An Introduction to Pteridophyta*. Vikas Publishing House (P) Ltd., New Delhi.
2. Sharma, O.P. (1990). *Textbook of Pteridophyta*. MacMillan India Ltd., New Delhi.
3. Sundara Rajan, S. (1994). *Introduction to Pteridophyta*. New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi.
4. Vashista, P.C. (1997). *Botany for Degree Students Pteridophyta*. S. Chand and Company Ltd., New Delhi.

## GYMNOSPERMS

1. Bhatnagar, S.P. and Alok M. (1997). *Gymnosperms*. New Age International (P) Ltd., Publisher, New Delhi.
2. Sharma, O.P. (1997). *Gymnosperms*. Pragati Prakashan, Meerut.
3. Srivastava, H.N. (1998). *Gymnosperms*. Pradeep Publications, Jalandhar.
4. Vashishta, P.C. (1996). *Botany for Degree Students-Gymnosperms (2nd Edn.)*. S. Chand and Company Ltd., New Delhi.

## PALEOBOTANY

1. Stewart, W.N. (1983). *Paleobotany and the Evolution of Plants*. Cambridge University Press, Cambridge, London.
2. 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.

Total No. of topics	Local	Regional	National	Global
43	0	0	0	43

## NON-MAJOR ELECTIVE I

### BIOFERTILIZERS AND BIOPESTICIDES

NME	: I	Hours	: 2
Course code:	18UBO3NME1	Credit	: 2
		Max.Marks	: 100
		Internal	: 25
		External	: 75

#### Objectives:

1. To understand the basics of biofertilizers and their cultivation
2. To study about mycorrhiza and their isolation and production
3. To impart knowledge on pesticides and their control by biopesticides, including their production and commercialization

#### Unit I

Biofertilizers: Definition- kinds of microbes as bio fertilizers- Rhizobium isolation- mass multiplication- commercialization- and field application.

#### Unit II

Cultural method- and isolation- mass multiplication of *Azospirillum*- *Azotobacter*- *Azolla*- and *Anabaena*- and their field application.

#### Unit III

Mycorrhiza -VAM association- types- isolation- inoculum production- and application.

#### Unit IV

Pesticides- Introduction- concept-types of pesticides- Biological Magnification concept.

#### Unit V

Biopesticides - Bacterial origin (*Bacillus thuringiensis*)- mechanism of action- and application- fungal origin- and viral origin-commercialization.

#### REFERENCE BOOKS:

1. Subba Rao, N.S. (2000). *Soil Microbiology*. Oxford and IBH Publishing Co. Ltd., New Delhi.
2. Varma, A. and Hock, B. (1995). *Mycorrhiza*. Springer-Verlag, Berlin.
3. Wicklow, D.T. and Soderstrom, B.E. (1997). *Environmental and Microbial Relationships*. Springer-Verlag, Berlin.
4. Yaaco Vokan (1994). *Azospirillum/Plant Associations*. CRC Press, Boca Raton, FL.

Total No. of topics	Local	Regional	National	Global
31	11	0	1	19

## SEMESTER-IV

### CORE COURSE IV ANATOMY AND EMBRYOLOGY

Core course:	IV	Hours	: 5
Course code:	18UBO4CC4	Credit	: 5
		Max.Marks	: 100
		Internal	: 25
		External	: 75

#### Objectives:

1. To inculcate the basics of tissues and anatomical features of plants.
2. To impart the knowledge about the various aspects of morphogenesis.
3. To understand the key aspects of embryology of Angiosperms

#### Unit I

Anatomy: Plant tissue - classification- Meristems- apical meristems- and lateral meristems- intercalary meristem- various Concepts of apical meristem theories- apical cell theory- Tunica Corpus- and Histogen theory.

#### Unit II

Epidermal tissue system- stomatal types- Permanent tissue simple Parenchyma- collenchyma - and sclerenchyma- Complex Permanent Tissues: Xylem Components- Phloem Components- Laticifer types.

#### Unit III

Primary structure of root- stem- and leaf in dicot- and monocot- Normal Secondary growth in stem- and root- annual rings heart Wood- sapwood- Periderm formation- Anomalous Secondary thickening in dicot stems: *Nyctanthes*- and *Boerhaavia* -and monocot stem *Dracaena*- Nodal anatomy uni- and trilacunar types.

#### Unit IV

Embryology Structure- and development of anther- Ultrastructure of pollen wall- Microsporogenesis- microgametogenesis- megasporogenesis- megagametogenesis- (*Polygonum* type of embryo sac development)-structure- development and types of ovules- Fertilization.

#### Unit V

Endosperm: Nuclear- cellular- helobial- and Ruminant- Development of embryo dicot- and Monocot- Basic concepts of apomixis-apospory- Polyembryony- and Parthenogenesis

#### REFERENCE BOOKS:

##### ANATOMY

1. Cutter, E.G. (1978). *Plant Anatomy Part-I: Cells and Tissues* (2<sup>nd</sup> Edn.), *Plant Anatomy Part-II: Experiments and Interpretations*. Edward Arnold, London.
2. Esau, K. (1965). *Vascular Differentiation in Plants*. Holt, Rinehart and Winston, New York.
3. Esau, K. (1980). *Plant Anatomy* (2nd Edition). Wiley Eastern Ltd., New Delhi.
4. Fahn, A. (1997). *Plant Anatomy*. Pergamon Press, Oxford.
5. Foster, A.S. (1960). *Practical Plant Anatomy*<sup>1</sup>. Van Nostrand and East-West Press, New Delhi.

6. Govindarajulu, A. (1980). *“Marangal” (Trees)* (In Tamil). Tamilnadu Textbook Society, Chennai.
7. Krishnamurthy, K.V. (1980). *Wood*. Tetrahedron Publications, Tiruchirappalli.
8. Vasishta, P.C. (1977). *A Text Book of Plant Anatomy*. S. Nagin and Co., New Delhi.

### **EMBRYOLOGY**

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). *The Embryology of Angiosperms* (4th Edition). Vikas Publishing House (P) Ltd., UBS Publisher’s Distributors, New Delhi.
2. Johri, B.M. (1982). *Experimental Embryology of Vascular Plants*. Springer – Verlag, Heidelberg.
3. Maheswari, P. (1985). *An Introduction to the Embryology of Angiosperms*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Maheswari, P. (1963). *Recent Advances in the Embryology of Angiosperms*. International Society of Plant Morphologists, University of Delhi.
5. Rogland, A. (2000). *Developmental Botany (Embryology of Angiosperms)*. Saras Publications, Nagercoil.
6. Swamy, B.G.L. and Krishnamoorthy, K.V. (1980). *From Flower to Fruit*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Total No. of topics	Local	Regional	National	Global
53	0	0	0	53

## CORE PRACTICAL- II

### PLANT DIVERSITY-II (BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY) & ANATOMY AND EMBRYOLOGY

Core course

(Practical): II

Course code: 18UBO4CP2

Hours : 3

Credit : 4

Max.Marks : 100

Internal : 40

External : 60

#### PTERIDOPHYTES

<i>Psilotum</i>	:	Demonstration only
<i>Lycopodium</i>	:	Stem and Cone only
<i>Selaginella</i>	:	Stem and Cone only
<i>Equisetum</i>	:	Stem cone slide Demonstration only
<i>Adiantum</i>	:	Rachis Sorus
<i>Marsilea</i>	:	Stem Sporocarp slides

#### GYMNOSPERMS

<i>Cycas</i>	:	Rachis Leaflet T.S Coralloid root male cone Microsporophyll Megasporophyll Demonstration only
<i>Pinus</i>	:	Needle T.S Young stem T.S.; Male & Female cone Demonstration only
<i>Gnetum</i>	:	Stem T.S.; Male & Female Strobilus Demonstration only

#### PALEOBOTANY

*Rhynia, Lepidodendron, Lepidocarpon, Calamites (slides), Williamsonia*

#### ANATOMY

T.S. of monocot stem  
T.S. of monocot root  
T.S. of dicot stem  
T.S. of dicot root

#### EMBRYOLOGY

T.S. of anther

Total No. of topics	Local	Regional	National	Global
15	11	1	3	1

## NON-MAJOR ELECTIVE II

### HORTICULTURE

NME : II  
Course code: 18UBO4NME2

Hours : 2  
Credit : 2  
Max.Marks : 100  
Internal : 25  
External : 75

#### Objectives:

1. To study the importance of horticultural crops and their propagation methods
2. To understand the types of gardens and their establishment
3. To educate floriculture and fruit culture, greenhouse and nursery management

#### Unit I

Horticulture: Importance-and scope of Horticulture- Classification of horticultural crops fruits-vegetables crops- climate- soil- water- nutrition needs of horticultural crops.

#### Unit II

Plant propagation methods cutting- layering- grafting- budding- stock scion relationship- Use of plant regulators in horticulture.

#### Unit III

Garden designs- types of gardens- formal- informal- and kitchen garden- units of garden- hedge- border- Topiary arches- and lawn maintenance.

#### Unit IV

Floriculture- cultivation of commercial flower- rose and jasmines- Cultivation of important fruit trees- Mangoes -and Banana.

#### Unit V

Green house- Indoor gardening- Bonsai- flower arrangements- nursery management- and maintenance.

#### REFERENCE BOOKS:

1. Bose, T.K. and Mukherjee, D. (1972). *Gardening in India*. Oxford & IBH Publishing Co., Kolkatta.
2. Edmond, J.B., Musser, A.M. and Andrews, F.S. (1951). *Fundamentals of Horticulture*. McGraw-Hill Book Company, Inc., New York.
3. Jitendra Singh. (2014). *Basic Horticulture*. Kalyani Publishers, Chennai.
4. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil.
5. Lex Lauries and Victor, H.R. (1950). *Floriculture – Fundamental and Practices*. McGraw Hill Publishers, New York.
6. Naik, K.C. (1963). *South Indian Fruits and Their Culture*. Vardhachary & Co., Madras.
7. Randhawa, G.C. (1973). *Ornamental Horticulture in India*. Today & Tomorrow Publishers, New Delhi.
8. Sandhu, M.K. (1989). *Plant Propagation*. Wiley Eastern Ltd., New Delhi.

Total No. of topics	Local	Regional	National	Global
36	4	1	5	26

**SKILL BASED ELECTIVE – I**  
**GREENHOUSE TECHNOLOGY**

<b>SBE:</b>	<b>I</b>	<b>Hours</b>	<b>: 2</b>
<b>Course code:</b>	<b>18UBO4SBE1</b>	<b>Credit</b>	<b>: 2</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

1. To understand the basic details about organization and functioning of Greenhouses.
2. To familiarize with crop management in greenhouse condition.

**Unit I: Fundamentals of greenhouse technology**

Introduction - scope - classification of greenhouses - construction of greenhouse - heating unit - cooling unit - environmental control- (light and temperature).

**Unit II: Fertilizer application**

Root media for greenhouses - fertilizers : organic- and inorganic- #liquid fertilizers - application of fertilizers - nutrient deficiencies- and toxicities

**Unit III: Water in the greenhouses**

Irrigation system in green houses- drip irrigation- micro irrigation- water quality- water sanitation

**Unit IV: Plant protection in greenhouses**

Diseases of greenhouse plants (bacterial- fungal- nematodes- and viral diseases)- management of pest- and diseases - integrated pest management.

**Unit V: Applications of greenhouse technology**

Importance of greenhouse technology- net houses- poly houses- low cost greenhouses- micropropagation- and greenhouse planting of tissue culture transplants- advantages- and disadvantages of greenhouse technology.

**REFERENCE BOOKS:**

1. Prasad S, Kumar U. Green House Management for Horticultural Crops. Agrobios India, 2012.
2. Pant V, Nelson. Green House Operation and Management. Bali Publication, 1991.
3. Dubey RC. A text book of Biotechnology. S. Chand and Company, 2006.

Total No. of topics	Local	Regional	National	Global
35	5	7	0	23

## SEMESTER-V

### CORE COURSE V CELL AND MOLECULAR BIOLOGY

<b>Core course:</b>	<b>V</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UBO5CC5</b>	<b>Credit</b>	<b>: 5</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To study microscopy, cell organelles of Prokaryotic and Eukaryotic cells, chromosomes, cell divisions, DNA and RNA.
2. To understand gene regulation and chloroplast and mitochondria genome organization.

#### Unit I

Basic principles of microscopy- Differentiating features of Prokaryotic and Eukaryotic cells- Ultra structure plant cell- and functions of plasma membrane-Ultra structure of cell organelles- Plastids- Mitochondria- Golgi bodies- Endoplasmic reticulum- Lysosomes- Cell Inclusions.

#### Unit II

Nucleus: Nucleolus - Structure of euchromatin- and heterochromatin -Special types of chromosomes Lamp brush chromosomes- and polytene chromosomes- Cell cycle- Cell Division: Mitosis and meiosis.

#### Unit III

Nucleic acids- DNA and RNA- Differentiating features- Griffith Experiment- Structure- properties (C Value Paradox)- & replication of DNA- Hershey and Chase experiment- RNA- Structure- and functions of rRNA- mRNA- and tRNA.

#### Unit IV

Gene regulation in Prokaryotes (*Lac* operon concept)- and Eukaryotes- Initiation- elongation- and termination of Transcription- and Translation- Gene regulation in prokaryotes and eukaryotes- Differences.

#### Unit V

Chloroplast- and mitochondrial genome organization- Basic mechanism of signal transduction- Programmed Cell Death (PCD) Apoptosis.

#### REFERENCE BOOKS:

2. De Robertis, E.D.P. and De Robertis, E.M.F. Jr. (1980). Cell and Molecular Biology (7th Ed). Saunders College/Holt, Rinehart and Winson, Philadelphia.
3. Grierson, D. and Convey, S.N. (1989). *Plant Molecular Biology*. Blackie Publishers, New York.
4. Lea, P.J. and Leegood, R.C. (1999). *Plant Biochemistry and Molecular Biology*. John Wiley and Sons, London.
5. Old, R.W. and Primrose, S.B. (1994). *Principles of Gene Manipulation*. Blackwell Science, London.
6. Power, C.B. (1984). *Cell Biology*. Himalaya Publishing Co., Mumbai.
7. Sharma, N.S. (2005). *Molecular Cell Biology*. International Book distributors, Dehradun.

8. Verma, P.S. and Agarwal, V.K. (1986). *Cell Biology and Molecular Biology (Cytology)*. S. Chand and Company Ltd., New Delhi.

Total No. of topics	Local	Regional	National	Global
44	0	0	0	44

## CORE COURSE VI

### GENETICS, BIOSTATISTICS AND EVOLUTION

<b>Core course:</b>	<b>VI</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UBO5CC6</b>	<b>Credit</b>	<b>: 5</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To study Mendelian genetics, recombination of chromosomes, structure and function of genes and their various units
2. To educate on mutation
3. To impart knowledge on biostatistics and its applications biological experiments
4. To understand the mechanism of evolution and study of population genetics

#### Unit I

Genetics: Mendel's law- monohybrid and dihybrid ratio- back cross and test cross- Allelic interactions: Incomplete dominance- and co-dominance- complementary factor hypothesis- supplementary factor epistasis (Dominant and recessive)- Non-allelic interaction- Lethal factor- Multiple factor hypothesis.

#### Unit II

Recombination: Linkage- and crossing over in *Lathyrus odoratus*- eye colour in *Drosophila*- and colour blindness in man- Cytoplasmic inheritance- Sex determination in plants and *Drosophila*. Functional units of gene- cistron- recon- muton- codon- and operon concept (lac)- Mutation Definition- classification- types- mechanism (physical and chemical mutagens)- and application (role of mutation in evolution).

#### Unit III

Biostatistics: Definition- and scope- Sampling techniques: Sample- population- Random- and non random sampling techniques- Data:Types of data- Presentation of data- Graphical methods: Histogram- Bar- and Pie diagrams.

#### Unit IV

Measures of central tendency- Mean median and mode- Measures of dispersion: range- variance- Standard Deviation- and Standard Error- Chi Square analysis- Correlation- and its types: Probability Distribution- normal- binomial-and Poison distribution.

#### Unit V

Evolution: Evolutionary concepts- Theories of Lamarck- Charles Darwin- and the modern synthetic theories- Population genetics: gene pool- gene frequency-and Hardy Weinberg law- Factors affecting gene frequencies.

#### REFERENCE BOOKS:

##### GENETICS

1. Agarwal, V.K. (2000). *Simplified course in Genetics* (B.Sc., Zoology). S. Chand & Company Ltd., New Delhi.
2. Ahluwalia, K.B. (1990). *Genetics*. Wiley Eastern Ltd., Madras.

3. Gupta, P.K. (2000). *Genetics*. Rastogi Publishers, Meerut.
4. Jain, H.K. (1999). *Genetics-Principles, Concepts & Implications*. Oxford & IBH Publishing Co., (P) Ltd., New Delhi.
5. Lewin, B. (1990). *Genes IV*. Oxford University Press, Oxford.
6. Meyyan, R.P. (2000). *Genetics & Evolution*. Saras Publication, Nagercoil.
7. Pandey, B.P. (2012). *Cytology, Genetics and Molecular Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
8. Renganathan, T.K. and Shanmugavel, S. (1996). *Genetics & Genetic Engineering*. Commercial Offset Printers, Sivakasi.
9. Sandhya Mitra (1994). *Genetics - A Blue Print of Life*. Tata McGraw-Hill Education Private Ltd., New Delhi.
10. Sarin, C. (1994). *Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
11. Winter, P.C., Hickey, G.I. and Fletcher, H.L. (1999). *Instant Notes in Genetics*. Viva Books (P) Ltd., New Delhi, Mumbai, Chennai.

### **BIOSTATISTICS**

1. Olive, J.D. (1995). *Basic Statistics - A Primer for the Biomedical Sciences*. John Wiley and Sons, New Delhi.

### **EVOLUTION**

1. Savage, J.M. (1969). *Evolution* (2nd Ed.). Amerind Publishing (P) Ltd., New Delhi.
2. Shukla, R.S. and Chandel, P.S. (1996). *Cytogenetics, Evolution & Plant Breeding*. S. Chand & Company Ltd., New Delhi.
3. Sproule, A. (1998). *Charles Darwin Scientists who have changed the world*. Orient Longmans, Hyderabad.
4. Verma, P.S. and Agarwal, V.K. (1999). *Concepts of Evolution*. S. Chand & Company Ltd., New Delhi.

Total No. of topics	Local	Regional	National	Global
59	0	0	0	59

**CORE COURSE VII**  
**MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY**

<b>Core course:</b>	<b>VII</b>	<b>Hours</b>	<b>: 4</b>
<b>Course code:</b>	<b>18UBO5CC7</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

1. To study morphological features of vegetative, inflorescence, fruits and seed characters.
2. To impart knowledge on botanical nomenclature, classifications, merits and demerits of various systems of classifications.
3. To understand the systematics of the selected families of the flowering plants with their economic importance.
4. To have knowledge on the economically important plants with their systematic treatment.

**Unit I**

Morphology: phyllotaxy- types- floral description- Inflorescence: Types- racemose- cymose-mixed and special types- Fruit: types of fruit- simple- fleshy- dry dehiscent-and dry indehiscent-aggregate- and multiple fruits.

**Unit II**

Binomial nomenclature- ICBN rules- Systems of Classification- Bentham and Hooker (Linnaeus)- (Engler and Prantel)- Merits and demerits- Herbarium techniques.

**Unit III**

A detailed study of the following families with their economic importance: *Annonaceae*- *Capparidaceae*- *Tiliaceae*- *Rutaceae*- *Anacardiaceae*- *Leguminosae*- (*Papilionaceae*- *Cesalpiniaceae*- and *Mimosaceae*)- and *Cucurbitaceae*.

**Unit IV**

A detailed study of the following families with their economic importance: *Rubiaceae*- *Asteraceae*- *Apocynaceae*- *Asclepiadaceae*- *Solanaceae*- *Verbenaceae*- *Euphorbiaceae*- *Orchidaceae*- and *Poaceae*.

**Unit V**

Economic Botany: A brief study of the following economically important plants; Food: Cereals (*Oryza sativa*- *Eleusine coracana*)- Pulses: Black gram (*Phaseolus mungo*)- Edible: Gingelly oil (*Sesamum indicum*)- Root tubers: Tapioca (*Manihot esculenta*)- Sugar: Sugarcane (*Saccharum officinarum*)- Fibres: Textiles (*Gossypium*)- Others: *Crotalaria agave*- Medicinal Plants: *Ocimum*- *Phyllanthus*- *Solanum*- Forest Products- Timber Teak (*Tectona grandis*)- Jack (*Artocarpus heterophyllus*)- Tannins- Gums- Resins- Turpentine.

**REFERENCE BOOKS:**

**TAXONOMY**

1. Gurcharan Singh (1999). *Plant Systematics - Theory & Practice*. Oxford & IBH Publishing Co. (P) Ltd., New Delhi.

2. Jaques, H.E. (1999). *Plant Families-How to know them?*. Agro Botanical Publishers (India), Bikaner.
3. Mathews, K.M. (1987-90). *Flora of Tamilnadu Carnatic (1-4vols.)* Rapinat Herbarium, Trichy.
4. Naik, V.N. (1996). *Taxonomy of Angiosperms (9th Ed.)*. Tata McGraw-Hill Publishing Co., (P) Ltd., New Delhi.
5. Palaniyappan, S. (2000). *Angiospermgalin Vagaippadu (Taxonomy of Angiosperms)*. V.K. Publishing House, Chennai.
6. Pandey, B.P. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.
7. Sharma. O.P. (2007). *Plant Taxonomy*. Tata McGraw–Hill Publishing Co., New Delhi.
8. Sivarajan V.V. (1993). *Introduction to the Principles of Plant Taxonomy (2<sup>nd</sup> Edn.)*. N.K.P. Robson (Ed.). Oxford & IBH Publishing Co. (P) Ltd., New Delhi.
9. Subramaniyan, N.S. (1999). *Laboratory Manual of Plant Taxonomy (2<sup>nd</sup> Ed.)*. Tata McGraw-Hill Publishing Co., New Delhi.
10. Vashista, P.C. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.

### **ECONOMIC BOTANY**

1. Ashok Bendre and Ashok Kumar (1998-99). *Economic Botany*. Rastogi Publications, Meerut.
2. Govinda Praksh and Sharma, S.K. (1975). *Introductory Economic Botany*. Jai Prakash Nath, Meerut.
3. Pandey, B.P. (2000). *Economic Botany*. S. Chand & Company Ltd., New Delhi.
4. Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. (1989). *A Text Book of Economic Botany*. Wiley Eastern Ltd., Madras.
5. Sen, S. (1992). *Economic Botany*. New Central Book Agency, Calcutta.

Total No. of topics	Local	Regional	National	Global
59	38	0	0	21

## CORE PRACTICAL III

### CELL AND MOLECULAR BIOLOGY & GENETICS, BIostatISTICS AND EVOLUTION & MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Core course

(Practical): III

Course code: 18UBO5CP3

Hours : 6

Credit : 5

Max.Marks : 100

Internal : 40

External : 60

#### CELL AND MOLECULAR BIOLOGY

1. Observation of plant cells in Onion peeling and *Rheo* leaf
2. Non-living inclusions: Raphides, cystolith and Starch grains
3. Cell division: Mitosis and Meiosis Squash technique in onion Root tip and *Tradescantia/Rheo* flower bud respectively
4. Spotters: Ultra Structure of cell organelles

#### GENETICS, BIostatISTICS & EVOLUTION

1. Problems on simple monohybrid and dihybrid ratios. Simple problems on interaction on factors included in the theory.
2. Simple experiments to determine the mean median and mode Illustration of graphic representation of data using simple analysis.

#### MORPHOLOGY, TAXONOMY & ECONOMIC BOTANY

1. Dissection, observation, identification and sketching of floral parts of plants belonging to the families mentioned in the syllabus along with floral diagrams and floral formula.
2. Description of plants in technical terms with reference to the families in the syllabus
3. Economic plants covered in theory part in taxonomy and economic botany and their importance.

#### FIELD STUDY

Conduct field trip to study the families and acquire knowledge regarding plants.  
Submission of 20 herbarium sheets during autonomous practical examination

Total No. of topics	Local	Regional	National	Global
9	6	1	0	2

## MAJOR-BASED ELECTIVE - I

### MEDICAL BOTANY

<b>MBE:</b>	<b>I</b>	<b>Hours</b>	<b>: 4</b>
<b>Course code:</b>	<b>18UBO5MBE1</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To understand the importance of the medicinal plant wealth in India and the role of Medicinal plants in human health care.
2. To know the medicinally useful plants, Herbal medicine preparation for common diseases and adulterants.
3. To understand the importance of biofertilizers and biopesticides
4. To understand the techniques involved in the cultivation of edible mushrooms

**Unit I: Medical Botany:** Importance and relevance of herbal drugs in Indian Systems of Medicine- Pharmacognosy - aim- scope- and branches- Phytochemicals: reserve materials- secretory materials-and excretory materials.

#### Unit II

Cultivation- and marketing of Medicinal plants: *Aloe vera*- *Cassia senna*- *Catharanthus roseus*- *Gloriosa superba* - and *Withania somnifera*. Poisonous plants - action and treatments for different types of plant poisons- rejuvenating herbs- and medicinal uses of non-flowering plants

#### Unit III

Adulteration- and substitution of crude drugs - methods- types- and identification- botanical description- and active principles in the drugs of roots- rhizomes- woods- and bark- leaves- flowers- and seeds (two examples each/plant part).

#### Unit IV:

Traditional knowledge and utility of some medicinal plants in Tamilnadu: *Solanum trilobatum*- *Cardiospermum halicacabu*- *Vitex negund*- *Azadirachta indica*- *Gloriosa superba*- *Eclipta alb*- *Aristolochia indica*- and *Phyllanthus fraternus*.

#### Unit V:

Plants in day today life: *Ocimum sanctum*- *Centella asiatica*- *Cassia auriculata*- *Aloe vera*- Nutritive and medicinal value of some fruits (Guava- Sapota- Orange- Mango- Banana- Lemon- Pomegranate)- and vegetables Greens (*Moringa*- *Solanum nigrum* Cabbage).

## REFERENCE BOOKS:

1. Agarwal, O.P. (2014). *Organic Chemistry Natural Products, Vol. II*. Krishna Prakashan Media (P) Ltd., Meerut.
2. Alice, D., Muthusamy and Yesuraja, M. (1999). *Mushroom Culture*. Agricultural College, Research Institute Publications, Madurai.
3. Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1994). *Indigenous Drugs of India*. IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Marimuthu, T. (1991). *Oyster Mushroom*. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
5. Nair, N.C. and Henry, A.M. (1983). *Flora of Tamil Nadu, India*. Botanical Survey of India.
6. Nita Bhal (2000). *Handbook on Mushrooms Vol. I and II* (2nd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Pathak, V.N. and Yadav, N. (1998). *Mushroom Production and Processing Technology*. Agrobios, Jodhpur.
8. Somasundaram, S. (1997). *Medicinal Botany (Maruthuva Thavaraviyal)* (Tamil Medium Book). Elangovan Publishers, Tirunelveli.
9. Srivastava, A.K. (2006). *Medicinal Plants*. International Book distributors, Dehradun.
10. Subba Rao, N.S. (2000). *Soil Microbiology*. Oxford and IBH Publishing Co. Ltd., New Delhi.
11. Tripathi, D.P. 2005. *Mushroom Cultivation*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Varma, A. and Hock, B. (1995). *Mycorrhiza*. Springer-Verlag, Berlin.
13. Yaaco Vokan (1994). *Azospirillum/Plant Associations*. CRC Press, Boca Raton, FL.

Total No. of topics	Local	Regional	National	Global
53	9	13	29	2

**SKILL BASED ELECTIVE – II**  
**PLANT TISSUE CULTURE AND MOLECULAR TECHNIQUES**

<b>SBE:</b>	<b>II</b>	<b>Hours</b>	<b>: 2</b>
<b>Course code:</b>	<b>18UBO5SBE2</b>	<b>Credit</b>	<b>: 2</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**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**

Introduction Plant tissue culture- Definition and importance - Molecular Biology Definition- and importance - Laboratory organization - Laboratory design - Laboratory requirements (a) Instruments- (b) Glass wares- (c) Chemicals 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**

Sterilization techniques concepts- and performance - Glass wares - Cleaning and sterilization - Medium (a) Preparation - Murashige and Skoog- (b) Maintenance of pH- (c) Sterilization - Explant - Washing - Sterilization - Culture - Fumigation - Laminar air flow chamber(a) Cleaning- (b) UV exposure

**Unit III: Micropropagation**

Micropropagation Techniques - Micropropagation -Direct- and Indirect organogenesis- somatic embryogenesis - Synthetic seed - Hardening - Field visit to Commercial Plant Tissue Culture Laboratory

**Unit IV: Plant DNA Extraction and Quantification**

Plant DNA - Extraction - Separation - Agarose Gel Electrophoresis - Plant Protein: Extraction - Separation: SDS:PAGE

**Unit V : Genetic transformation techniques**

Indirect DNA delivery - Ti plasmid - Agrobacterium mediated transformation - Direct DNA delivery - Biolistics - Microinjection - Electroporation

**REFERENCES BOOKS :**

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. ParcticalManual 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., TissueCulture. Commonwealth Publishers, New Delhi, 2008.

7. Jwala Aggarwal and Shekhar K. Arora, Experiments in Plant Tissue Culture. Campus Book International, New Delhi, 2014.

Total No. of topics	Local	Regional	National	Global
52	0	0	0	52

**SKILL BASED ELECTIVE – III**  
**PLANT WEALTH FOR HUMAN LIFE**

<b>SBE:</b>	<b>III</b>	<b>Hours</b>	<b>: 2</b>
<b>Course code:</b>	<b>18UBO5SBE3</b>	<b>Credit</b>	<b>: 2</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**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 - decoration- Bouquet Preparation of garlands- and Strings- Regular- and festival decorations - Dry- and wet flower preparation- and cut flower for decoration.

**Unit II :**

Vegetables and Fruits - Pickle (Lime / Mango / Ginger) - Juice (Lemon / Sweet lime)- squash (Graph / Orange- Drying (Direct & treated) - Vegetable- pith and grain carving

**Unit III:**

Fibers - Baskets and pans - Ropes and chords - Brushes and brooms - Mats and Carpets

**Unit IV:**

Cosmetics and Medicines - Medicinal oils / Application - Hair oils- Preparation of Decoctions Syrups- Herbal Remedies - Ointments- Pain balms - Cosmetics- Face packs & Skin care

**Unit V :**

Phytowastes to wealth - Shells- and rinds (Useful and ornamental articles) - Waste/used papers and wood (recycling) - Leaves (cups and plates) - Phytojewellery (ear drops-studs- bangles / necklace)

**REFERENCES BOOKS:**

1. Pandey, B.P. Economic botany. S. Chand and Co. New Delhi, 2007.
2. Samba Murty, A.V.S., Subramanian, 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.

Total No. of topics	Local	Regional	National	Global
38	12	8	15	3

## SEMESTER-VI

### CORE COURSE VIII

### PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

<b>Core course:</b>	<b>VIII</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UBO6CC8</b>	<b>Credit</b>	<b>: 6</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To understand the metabolic activities of plants
2. To understand the role of enzymes in various metabolic activities of plants
3. To know the application of the laws of physics in biological phenomena

#### Unit I

**Plant Water relationship:** structure- and properties- and significance of water - osmotic- and non osmotic uptake of water- Ascent of sap cohesion theory- root pressure- transpiration- physiology of stomatal action- Translocation of solutes- and assimilates- Mass flow- Membrane permeability mineral uptake: Passive- and active- Role of major- and Minor elements- mineral deficiency symptoms.

#### Unit II

**Photosynthesis:** Absorption spectrum- Action spectrum- role of pigments- enhancement effect- Z scheme- photosystems I & II- Photophosphorylation- Carbon Assimilation: Calvin cycle- Hatch & Slack pathway- CAM pathway- photorespiration.

**Respiration:** Aerobic- and anaerobic- Glycolysis- Kreb's Cycle- and oxidative phosphorylation- energetics of respiration.

#### Unit III

Plant Growth regulatory substances: auxins- gibberellins- cytokinins- ethylene- and abscissic acid their chemical nature- physiological effects and function- Role of hormones in flowering senescence- and abscission- Photoperiodism- vernalization- and seed dormancy.

#### Unit IV

Biochemistry: Enzymes - Nature- and properties- Mechanism of enzyme action factors affecting Enzyme action- substrate concentration: inhibitors- cofactors- Structure- classification- and functions of carbohydrates- lipids- and Proteins- Secondary metabolites: alkaloids- flavonoids- terpenoids- and anthocyanins.

#### Unit V

Biophysics: physical forces- and chemical bonds- biological effect of ionising radiations- basic principles of spectroscopy- Laws of Thermodynamics- Enthalpy- buffers- and electrolytes- and their functions- Fractionation of biomolecules by paper chromatography- Centrifugation.

## REFERENCE BOOKS:

### PLANT PHYSIOLOGY

1. Dulsy Fatima, R.P. et. al., (1994). *Elements of Biochemistry*. Saras Publications, Nagercoil, Tamilnadu.
2. Jain, V.K. (1990). *Fundamentals of Plant Physiology*. S. Chand & Co., New Delhi.
3. Pandey, S.N. (1991). *Plant Physiology*. Vikas Publishing House (P) Ltd., New Delhi.
4. Salisbury, F.B. and Ross, C.W. (1999). *Plant Physiology*. CBS Publishers and Printers, New Delhi.

### BIOCHEMISTRY

1. Day, P.M. and Harborne, J.B. (2000). *Plant Biochemistry*. Harcourt Asia (P) Ltd., India & Academic Press, Singapore.
2. Srivastava, H.S. (1990). *Elements of Biochemistry*. Rastogi Publications, Meerut, India.
3. Wilson, K. and Walker, J. (1994). *Principles and Techniques of Practical Biochemistry* (4th Edition). Cambridge University Press, U.K.

### BIOPHYSICS

1. Annie and Arumugam, N. (2000). *Biochemistry & Biophysics*. Saras Publications, Nagercoil, Tamilnadu.
2. Narayanan, P. (2000). *Essentials of Biophysics*. New Age International Publishers (P) Ltd., New Delhi, Bangalore, Calcutta, Chennai, Guwahati, Hyderabad, Lucknow, Mumbai.

Total No. of topics	Local	Regional	National	Global
71	0	0	0	71

## CORE COURSE IX

### PLANT ECOLOGY AND PHYTOGEOGRAPHY

<b>Core course:</b>	<b>IX</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UBO6CC9</b>	<b>Credit</b>	<b>: 6</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To realize the values of plants and animals of the ecosystem
2. To know about the hazards of pollution and the importance of keeping his/her environment clean
3. To know in detail on various types of vegetation
4. To know about his/her environment and mould the students to become managers of various ecological systems

#### Unit I

General Ecology: Approaches to the study of Ecology- Autecology- Synecology- Plant environment- climatic- edaphic- and Biotic factors (interference on Plant habitat by animals: Grazing and browsing- by humans: deforestation- Agriculture).

#### Unit II

Ecosystem concept- components- abiotic- biotic- autotrophic producers- & heterotrophic consumers- biomass ecological pyramids- Productivity: primary- secondary- & gross- food chain -food web- & energy flow- pond ecosystem.

#### Unit III

Vegetation - Units of vegetation - formation- association- consociation- society - Development of vegetation: Migration - colonization- ecesis- Methods of study of vegetation (Quadrat & transect)- Plant succession - Hydrosere & xerosere- Ecological classification of Plants- Morphological- and anatomical features of plants- and their correlation to the habitat.

#### Unit IV

Pollution and its control- Air pollution- Radiation pollution- Noise pollution- Thermal pollution- Soil pollution: Industrial- agrochemicals insecticides- pesticides- fungicides- herbicides- Water pollution - Industrial effluents- Marine pollution and its consequence.

#### Unit V

Phytogeography-Approaches to Phytogeography - Climate of India- & its climatic zones- Botanical regions (provinces) of India - Vegetational types of Tamil Nadu- Evergreen-deciduous- scrub & Mangrove- Continuous and discontinuous distribution- Endemism- *In situ* - and *ex situ* conservation- Application of remote sensing in conservation.

#### REFERENCE BOOKS:

##### PLANT ECOLOGY & PHYTOGEOGRAPHY

1. Arumugam, N. (1994). *Concepts of Ecology* (Environmental Biology). Saras Publications, Nagercoil, Tamilnadu.
2. Chandrasekaran, P. (1996). *Chutru<sup>3</sup>ch choozh<sup>3</sup>al Maasupadu* (Environmental Pollution) T.K. Printers, Pudukkottai, Tamilnadu.

3. Kumar, H.D. (1992). *Modern Concepts of Ecology* (7th Edn.). Vikas Publishing Co., New Delhi.
4. Sharma, P.D. (2000). *Ecology & Environment*. Rastogi Publications, Meerut, India.
5. Vashishta, P.C. (1990). *Plant Ecology*. Vishal Publications, Delhi, Jalandhar.
6. Verma, P.S. and Agarwal, V.K. (1999). *Concept of Ecology* (Environmental Biology). S. Chand & Co., New Delhi.

### **PHYTOGEOGRAPHY**

1. Good, R. (1997). *The Geography of flowering Plants* (2<sup>nd</sup> Edn.). Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi.
2. Mani, M.S. (1974). *Ecology & Biogeography of India*. Dr. W. Junk Publishers, The Hague.

Total No. of topics	Local	Regional	National	Global
66	0	7	4	55

## CORE PRACTICAL IV

### PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS & PLANT ECOLOGY AND PHYTOGEOGRAPHY

Core Course

(Practical): IV

Course code: 18UBO6CP4

Hours : 6

Credit : 4

Max.Marks : 100

Internal : 40

External : 60

#### PLANT PHYSIOLOGY, BIOCHEMISTRY & BIOPHYSICS

##### For demonstration only

1. Enzyme activity using amylase activity.
2. Colorimeter: Operation and working principle
3. pH meter: Operation and working principle
4. Centrifuge: Operation and working principle

##### To be performed by each student

1. Colorimetric estimation of sugars
2. Gravimetric estimation of Starch
3. Estimation of protein by Lowry method
4. Determination of osmotic pressure of onion/Rheo leaf.
5. Effect of light intensity on transpiration using Ganong's potometer.
6. Determination of stomatal frequency- and estimation of transpiration rate.
7. Determination of absorption- and transpiration ratio in plants.
8. Measurement of respiration rate using germinating seeds- and flowerbuds with simple respiroscope.
9. Separation of plant pigments by paper chromatography.
10. Determination of photosynthetic rate in water plants under different CO<sub>2</sub> concentrations.
11. Measurement of oxygen evolution under different colours using Wilmott's bubbler.

#### PLANT ECOLOGY AND CONSERVATION

1. Study of morphological and anatomical features of hydrophytes and xerophytes.
2. Study of morphological features of epiphytes- parasites and halophytes.
3. Study of vegetation by the quadrat and line transect method.
4. Estimation of frequency density & Dominance.
5. Determination of soil & water pH.

Total No. of topics	Local	Regional	National	Global
20	13	3	2	2

## MAJOR-BASED ELECTIVE II

### PLANT BREEDING, HORTICULTURE AND LANDSCAPING

<b>MBE:</b>	<b>II</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UBO6MBE2</b>	<b>Credit</b>	<b>: 5</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. The various methods of plant breeding and plant propagation

#### PLANT BREEDING

##### Unit I

Methods of crop improvement: Introduction- acclimatization- selection methods: Mass- pure line and clonal- Hybridization techniques -interspecific- and Intergeneric hybridization- Heterosis.

##### Unit II

Back crossing- Mutation breeding- Polyploidy- and its application in plant breeding- Role of auto- and allopolyploid- breeding for crop improvement with reference to Paddy- Wheat- Sugarcane- and Groundnut.

#### HORTICULTURE

##### Unit III

Horticulture: scope- and importance- Horticultural crops: climate- soil- water- and nutritional needs- Plant propagation methods: cutting- layering- grafting- and budding- Plant growth regulators in horticulture.

##### Unit IV

Classification of horticultural crops: Pomology- Olericulture- Floriculture- Spices- and Plantation crops- Green house- Indoor gardening- Bonsai- Flower arrangements- Nursery management- and Maintenance.

##### Unit V

**Landscaping:** Principles- elements- and design- and layout - formal garden- Informal garden- Special types of gardens (bog garden- sunken garden- terrace- rock garden)- and specific areas.

## REFERENCE BOOKS:

1. Allard, R.W. (1960). *Principles of Plant Breeding*. John Wiley & Sons, New York.
2. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. (1999). *Floriculture and Landscaping*. Naya Prakash, Calcutta.
3. Chopra, V.L. (1989). *Plant Breeding*. Oxford IBH, New Delhi.
4. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publication, India.
5. Manibhushan Rao, K. (1991). *Text Book of Horticulture*. Macmillan Publications, New Delhi.
6. Roy Choudhry, N. and Mishra, H.P. (2001). *Text book on Floriculture and Landscaping*. Raja Infotech Enterprise, India.
7. Sandhu, M.K. (1989). *Plant Propagation*. Wiley Eastern Ltd., New Delhi.
8. Sharma, J.R. (1994). *Principles and Practice of Plant Breeding*. Tata McGraw Hill, New Delhi.

Total No. of topics	Local	Regional	National	Global
51	2	4	16	29

## MAJOR-BASED ELECTIVE III

### PLANT BIOTECHNOLOGY AND BIOINFORMATICS

<b>MBE:</b>	<b>III</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UBO6MBE3</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To comprehend the advances made in the field of plant biotechnology; and bioinformatics
2. To understand how mere jumbling of genes results in the creation of new organisms

#### Unit I

Biotechnology: definition- and scope- Tissue culture- sterilization methods- media preparation (MS basal medium)- use of different explants- and callus growth- differentiation- dedifferentiation- and dedifferentiation sub culturing- and hardening.

#### Unit II

Plasmids: general features- and types- plasmids as vectors pBR 322- Ti-plasmid- cosmids- phagemids- Lambda phage- transposons- site directed mutagenesis.

#### Unit III

Steps involved in genetic engineering: generation of desired foreign genes by restriction enzymes- and cDNA synthesis- joining DNA molecules- transfer of rDNA molecules into bacteria- and plants- Southern- and Western blotting- PCR technique- Role of *Agrobacterium* in plant genetic engineering.

#### Unit IV

Importance and application areas: biomass production- food (single cell proteins)- biofertilizers- Environmental Biotechnology: Waste treatment - solid (compost)- Liquid (industrial effluents)- sewage treatment (domestic sewage)- golden rice- GM crops plantibodies.

#### Unit V

Bioinformatics: History- scope and applications- Types of biological databases- Nucleic acid databases: Genbank- NCBI- EMBL- DDBJ- Primary protein databases: SWISSPROT- TrEMBL- Secondary protein databases - PROSITE- PROFILES- PRINTS- Pfam- Structural classification databases - SCOP- CATH- Literature databases -PubMed- Medline.

#### REFERENCE BOOKS:

1. Arthur, M.L. (2005). *Introduction to Bioinformatics* (Ed:2). Oxford University Press, New York.
2. Attwood, T.K. and Parrysmith, D.J. (2001). *Introduction to Bioinformatics*. Pearson Education, New Delhi.
3. Chatterji, A.K. (2011). *Introduction to Environmental Biotechnology*. Prentice Hall India Pvt., Ltd., New Delhi.

4. Dubey, R.C. (2013). A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi.
5. Gupta, P.K. (1994). *Elements of Biotechnology*. Restogi Publications, Meerut.
6. Ignacimuthu, S. (1997). *Plant Biotechnology*. Oxford & IBM Publishing Co., New Delhi.
7. Kalyan Kumar De. (1997). *Plant Tissue culture*. New central Book Agency, Calcutta.
8. Kumar, H.D. (1991). *A Textbook on Biotechnology*. East west press, New Delhi.
9. Parihar, P. (2014). A Textbook of Biotechnology. Argobios Publications, Jodhpur
10. Purohit, S.S. (2003). *Agricultural Biotechnology*. Agrobios Publications, Joshpur.
11. Trevan, M.D., Boffey, S., Goulding, K.H. and Stanbury, P. (1988). *Biotechnology -The Biological Principles*. Tata Mc Graw Hill Publishing Co., New Delhi.

Total No. of topics	Local	Regional	National	Global
59	0	0	0	59

## SEMESTER I/III

### ALLIED BOTANY- I MORPHOLOGY, TAXONOMY, ANATOMY AND EMBRYOLOGY

Allied course: 1/3	Hours : 4
Course code : 18UBO1AC1/18UBT3AC3	Credit : 4
	Max.Marks : 100
	Internal : 25
	External : 75

#### Objective:

- To learn about the external morphology, description and classification of higher plants
- To understand the internal morphology of higher plants and its morphogenesis.

#### UNIT I 12 hours

Morphology- Phyllotaxy-Inflorescence types (Raceme - Cyme - Mixed -and Special) - Terminology of floral parts- floral diagram- floral formula.

#### UNIT II 12 hours

Taxonomy - Classification - Natural (Bentham and Hooker's system) system, its merits -and demerits - Binomial nomenclature.

#### UNIT III 12 hours

Detailed study on salient features - description - distribution and - economic importance of the families- Annonaceae- Rutaceae- Fabaceae- Caesalpiniaceae- Rubiaceae- Apocyanaceae, Euphorbiaceae- and Poaceae.

#### UNIT IV 12 hours

Anatomy-Meristems - classification- and concepts-Primary structure of Root- Primary structure of Stem- Dicot -and monocot-.Simple -and complex tissue.

#### UNIT V 12 hours

Embryology: Structure - and development of Anther- Microsporogenesis- Male gametophyte development - Structure - types - and development of Ovule- Megasporogenesis - Female gametophyte development (Polygonum type)- Endosperm (Nuclear - Cellular -Helobial-and Ruminant) - Development of Embryo - Dicot (Capsella).

## Text Books

T.B.1. Pandey, B.P. Taxonomy of Angiosperms S. Chand and Co (p) Ltd. New Delhi, 2013.

T.B.2. Rendle, A.B. The classification of Flowering plants Vol. 1 and II, Vikas publishing house (P) Ltd. U.P., 1979.

T.B.3. Vashista, P.C. Taxonomy of Angiosperms, S. Chand and Co. New Delhi, Jullunder, 1997.

T.B.4. Panday, B.P. Plant Anatomy, S. Chand and Company Ltd, New Delhi, 2001.

T.B.5. Vasista,P.C. A Text Book of Plant Anatomy, S. Nagin& co., Jullunder and New Delhi, 1987.

T.B.6. Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms (4th Edn.) Vikas Publishing House (P) Ltd., & UBS Publishers Distributors, New Delhi, 2000.

T.B.7. Maheswari, P. Recent Advances in the Embryology of Angiosperms, International society of Plant Morphologists – Univof Delhi,1973.

T.B.8 B.P.PANDEY,College Botany Volume IIIS. Chand and Co (p) Ltd. New Delhi,2015

Total No. of topics	Local	Regional	National	Global
50	11	0	0	39

## SEMESTER II & IV

### ALLIED BOTANY- II THALLOPHYTES, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PLANT PHYSIOLOGY

Allied course: 4	Hours : 4
Course code : 18UBO2AC2/18UBT4AC4	Credit : 4
	Max.Marks : 100
	Internal : 25
	External : 75

#### UNIT I 15 hours

Thallophytes : Algae: - General characters - study of structure - and life histories of the following genera -*Oscillatoria-Volvox-Oedogonium-andPolysiphonia*

#### UNIT II 15 hours

Fungi: Study of structure - and reproduction of the following genera -*Albugo - and Pencillium-* Economic importance of fungi#.

#### UNIT III 15 hours

Bryophytes - Pteridophytes- and Gymnosperms, General characters of pteridophytes.- Bryophytes - Structure - and life cycle of *Lycopodium*. #General characters' of Gymnosperms - structure - and life cycle of *Cycas*#.

#### UNIT IV 15 hours

Plant physiology -Absorption of water -Ascent of sap -Transpiration - Specific role - and symptoms of mineral elements. Growth Hormones - Auxins, -Gibberellins - and cytokinins#.

#### UNIT V 15 hours

Photosynthesis -mechanism of photosynthesis -C3 - and C4 cycle - Factors affecting photosynthesis -Respiration - mechanism of respiration - Glycolysis- Kreb's cycle -#Factors affecting Respiration#.

#### Text Books

1. Gangulee, H.C & Kar A.K. College Botany Vol I and II, Books and Allied (Pvt.)Ltd., Calcutta, 1980.
2. Vashistha, B.R. Botany for Degree students, Vol I and II Chand & Co, New Delhi, 1995.
3. Sharma, O.P. Text book of Algae. Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1990.
4. Srivastava, N.N. Bryophyta. Pradeep Prakashnan, Meerut, India, 1996.
5. Sharma. O.P. Textbook of Pteridophyta, MacMillan India Ltd., New Delhi, Madras, 1990.

6. SundaraRajan. S Introduction to Pteridophyta, New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi. Madras 1994.
7. Vashista, P.C. Botany for Degree Students -Pteridophyta. S. Chand & Co., New Delhi, 1997.
8. Rasheed, A. An Introduction to Pteridophyta, Vikas Publishing Co., NewDelhi, 1999.
9. Chopra,G.W&Verma,Y. Gymnosperms, Pradeep Publications, Jalandhar,1988.
10. Vashista, P.C. Botany for Degree Students - Gymnosperms (2nd Edn.) S.Chand& Co., NewDelhi. 1996.
11. Sharma,O.P. Gymnosperms, PragatiPrakashan, Meerut, India, 1997.
12. Jain, V.K. Fundamentals of Plant Physiology, S.Chand& Co, New Delhi. 2000.
13. Pandey, S.N. 1991. Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.
- T.B.14. Verma, V. Text book of Plant Physiology, Ane Books India, New Delhi. 2007.

Total No. of topics	Local	Regional	National	Global
40	0	0	0	40

## SEMESTER IV

### ALLIED BOTANY PRACTICAL-1 MORPHOLOGY, TAXONOMY, ANATOMY AND EMBRYOLOGY

Allied course I (Practical):	Hours : 3
Course code : 18UBO2AP1/18UBT4AP2	Credit : 4
	Max.Marks : 100
	Internal : 40
	External : 60

#### Objective:

- To learn the description of external and internal morphology of plants.
- To identify the plant families and their description.
- To study the development of plant body.

#### Morphology:

1. Phyllotaxy types
2. Types of inflorescence - Raceme- Cyme -Mixed - and special
3. L.S. of Dicot flower-Hypogynous/ Epigenous
4. Mounting of floral parts
5. Construction of floral diagram and floral formula.

#### Taxonomy:

1. Detailed of study of the plants belonging to the families mentioned in theory.

#### Anatomy

1. Structure of Dicot stem
2. Structure of Monocot stem
3. Structure of Dicot root
4. Structure of Monocot root

#### Embryology

1. T.S. of anther -*Datura*
2. Structure of ovule
3. Isolation of Dicot embryo - *Tridax*

Total No. of topics	Local	Regional	National	Global
13	7	1	4	1

## SEMESTER I/III

### ALLIED BOTANY- I MORPHOLOGY, TAXONOMY, ANATOMY AND EMBRYOLOGY

Allied course: 1/3	Hours : 4
Course code : 18UBO1AC1/18UBT3AC3	Credit : 4
	Max.Marks : 100
	Internal : 25
	External : 75

#### Objective:

- To learn about the external morphology, description and classification of higher plants
- To understand the internal morphology of higher plants and its morphogenesis.

#### UNIT I

12 hours

Morphology - Phyllotaxy-Inflorescence types (Raceme - Cyme - Mixed -and Special) - Terminology of floral parts- floral diagram- floral formula- Fruits - Simple - fleshy - dry aggregate - and multiple fruits.

#### UNIT II

12 hours

Taxonomy - Classification -Natural (Bentham and Hooker's system) system, its merits - and demerits - Binomial nomenclature- ICBN Rules - Herbarium techniques.

#### UNIT III

12 hours

Detailed study on salient features - description - distribution and - economic importance of the families - Annonaceae - Rutaceae - Fabaceae - Caesalpiniaceae - Rubiaceae - Apocyanaceae Euphorbiaceae - and Poaceae.

#### UNIT IV

12 hours

Anatomy- Meristems - Concept -classification - and concepts - Primary structure of Root - Primary structure of Stem - Dicot - and monocot - Simple - and complex tissue.

#### UNIT V

12 hours

Embryology: Structure - and development of Anther - Microsporogenesis - Male gametophyte development - Structure - types - and development of Ovule - Megasporogenesis - Female gametophyte development (Polygonum type) - Endosperm (Nuclear - Cellular - Helobial -and Ruminant) - Development of Embryo - Dicot (Capsella).

## Text Books

T.B.1. Pandey, B.P. Taxonomy of Angiosperms S. Chand and Co (p) Ltd. New Delhi, 2013.

T.B.2. Rendle, A.B. The classification of Flowering plants Vol. 1 and II, Vikas publishing house (P) Ltd. U.P., 1979.

T.B.3. Vashista, P.C. Taxonomy of Angiosperms, S. Chand and Co. New Delhi, Jullunder, 1997.

T.B.4. Panday, B.P. Plant Anatomy, S. Chand and Company Ltd, New Delhi, 2001.

T.B.5. Vasista,P.C. A Text Book of Plant Anatomy, S. Nagin& co., Jullunder and New Delhi, 1987.

T.B.6. Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms (4th Edn.) Vikas Publishing House (P) Ltd., & UBS Publishers Distributors, New Delhi, 2000.

T.B.7. Maheswari, P. Recent Advances in the Embryology of Angiosperms, International society of Plant Morphologists – Univof Delhi,1973.

T.B.8 B.P.PANDEY,College Botany Volume IIIS. Chand and Co (p) Ltd. New Delhi,2015

Total No. of topics	Local	Regional	National	Global
58	11	0	0	47

## SEMESTER II & IV

### ALLIED BOTANY- II THALLOPHYTES, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PLANT PHYSIOLOGY

Allied course: 4	Hours : 4
Course code : 18UBO2AC2/18UBT4AC4	Credit : 4
	Max.Marks : 100
	Internal : 25
	External : 75

#### UNIT I 15 hours

Thallophytes : Algae: General characters - study of structure - and life histories of the following genera - *Oscillatoria* - *Volvox* - *Oedogonium* - and *Polysiphonia*

#### UNIT II 15 hours

Fungi: Study of structure - and reproduction of the following genera - *Albugo* - and *Pencilium* - Economic importance of fungi#.

#### UNIT III 15 hours

General characters of Bryophytes - Bryophytes - Pteridophytes - and Gymnosperms, General characters of pteridophytes. -Bryophytes - Structure - and life cycle of *Lycopodium* - General characters' of Gymnosperms - structure - and life cycle of *Cycas*.

#### UNIT IV 15 hours

Plant physiology - Absorption of water -Ascent of sap -Transpiration - Major and minor elements - Specific role - and symptoms of mineral elements. - Phytohormones - Auxins - Gibberellins - Ethylene - and cytokinins.

#### UNIT V 15 hours

Photosynthesis - Photosystems I & II - mechanism of photosynthesis - C3 - and C4 cycle - Factors affecting photosynthesis - Respiration - mechanism of respiration - Glycolysis - Kreb's cycle - Factors affecting Respiration.

#### Text Books

1. Gangulee, H.C & Kar A.K. College Botany Vol I and II, Books and Allied (Pvt.)Ltd., Calcutta, 1980.
2. Vashistha, B.R. Botany for Degree students, Vol I and II Chand & Co, New Delhi, 1995.
3. Sharma, O.P. Text book of Algae. Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1990.
4. Srivastava, N.N. Bryophyta. Pradeep Prakashan, Meerut, India, 1996.

5. Sharma. O.P. Textbook of Pteridophyta, MacMillan India Ltd., New Delhi, Madras, 1990.
6. SundaraRajan. S Introduction to Pteridophyta, New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi. Madras 1994.
7. Vashista, P.C. Botany for Degree Students –Pteridophyta. S. Chand & Co., New Delhi, 1997.
8. Rasheed, A. An Introduction to Pteridophyta, Vikas Publishing Co., NewDelhi, 1999.
9. Chopra,G.W&Verma,Y. Gymnosperms, Pradeep Publications, Jalandhar,1988.
10. Vashista, P.C. Botany for Degree Students - Gymnosperms (2nd Edn.) S.Chand& Co., NewDelhi. 1996.
11. Sharma,O.P. Gymnosperms, PragatiPrakashan, Meerut, India, 1997.
12. Jain, V.K. Fundamentals of Plant Physiology, S.Chand& Co, New Delhi. 2000.
13. Pandey, S.N. 1991. Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.
- T.B.14. Verma, V. Text book of Plant Physiology, Ane Books India, New Delhi. 2007.

Total No. of topics	Local	Regional	National	Global
45	0	0	0	45

## SEMESTER IV

### ALLIED BOTANY PRACTICAL-1 MORPHOLOGY, TAXONOMY, ANATOMY AND EMBRYOLOGY

Allied course I (Practical):	Hours : 3
Course code : 18UBO2AP1/18UBT4AP2	Credit : 4
	Max.Marks : 100
	Internal : 40
	External : 60

#### Objective:

- To learn the description of external and internal morphology of plants.
- To identify the plant families and their description.
- To study the development of plant body.

#### Morphology:

1. Phyllotaxy types
2. Venation types
3. Types of inflorescence - Raceme, Cyme, Mixed and special
4. L.S. of Dicot flower - Hypogynous/ Epigenous
5. Mounting of floral parts
6. Construction of floral diagram and floral formula.

#### Taxonomy:

1. Detailed study of the plants belonging to the families mentioned in theory.

#### Anatomy

1. Structure of Dicot stem
2. Structure of Monocot stem
3. Structure of Dicot root
4. Structure of Monocot root

#### Embryology

1. T.S. of anther - *Datura*
2. Structure of ovule
3. Isolation of Dicot embryo - *Tridax*

Total No. of topics	Local	Regional	National	Global
14	8	1	4	1