



Semester	Part	Course	Title	Instru. Hours/Week	Credit	Exam Hours	Marks		Total
							Int.	Extn.	
I	I	Language Course – I (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – I (ELC)		6	3	3	25	75	100
	III	Core Course – I (CC)	Bacteria, Viruses, Algae, Fungi and Lichens	5	5	3	25	75	100
		Core Practical – I (CP)	Bacteria, Virus, Algae, and Fungi Andlichens & Plant Pathology and Plant Protection (P)	3	-	***	-	-	-
		First Allied Course – I (AC)		5	4	3	25	75	100
		First Allied Course – II (AP)		3	-	***	-	-	-
	IV	Value Education	Value Education	2	2	3	25	75	100
<b>Total</b>				<b>30</b>	<b>17</b>				<b>500</b>
II	I	Language Course – II (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – II (ELC)		6	3	3	25	75	100
	III	Core Course – II (CC)	Plant Pathology and Plant Protection	5	5	3	25	75	100
		Core Practical – I (CP)	Bacteria, Viruses, Algae, Fungi and Lichens & Plant Pathology and Plant Protection (P)	3	4	3	40	60	100
		First Allied Course – II (AP)		2	2	3	40	60	100
		First Allied Course – III (AC)		5	4	3	25	75	100
	IV	Environmental Studies	Environmental Studies	3	2	3	25	75	100
<b>Total</b>				<b>30</b>	<b>23</b>				<b>700</b>
III	I	Language Course – III (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – III (ELC)		6	3	3	25	75	100
	III	Core Course – III (CC)	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	6	5	3	25	75	100
		Core Practical – II (CP)	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany & Anatomy and Embryology	3	-	***	-	-	-
		Second Allied Course – I (AC)		5	4	3	25	75	100
		Second Allied Course – II (AP)		2	-	***	-	-	-
	IV	Non-Major Elective I – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Biofertilizers and Biopesticides	2	2	3	25	75	100
<b>Total</b>				<b>30</b>	<b>17</b>				<b>500</b>

IV	I	Language Course –IV (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100	
	II	English Language Course – IV (ELC)		6	3	3	25	75	100	
	III	Core Course – IV (CC)	Anatomy and Embryology		5	5	3	25	75	100
		Core Practical – II (CP)	Bryophytes, Pteridophytes, Gymnosperms and Paleobotany & Anatomy and Embryology (P)		3	4	3	40	60	100
		Second Allied Course – II (AP)	Practical		2	2	3	40	60	100
		Second Allied Course – III (AC)			4	4	3	25	75	100
	IV	Non Major Elective II – for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Horticulture		2	2	3	25	75	100
	Skill Based Elective - I	Skill Based Elective - I		2	2	3	25	75	100	
<b>Total</b>				<b>30</b>	<b>25</b>				<b>800</b>	
V	III	Core Course – V (CC)	Cell and Molecular Biology		5	5	3	25	75	100
		Core Course – VI (CC)	Genetics, Biostatistics and Evolution		5	5	3	25	75	100
		Core Course – VII (CC)	Morphology, Taxonomy and Economic Botany		4	4	3	25	75	100
		Core Practical – III (CP)	Cell and Molecular Biology & Genetics, Biostatistics and Evolution & Morphology, Taxonomy of Angiosperms and Economic Botany (P)		6	5	3	40	60	100
		Major Based Elective – I	Medical and Applied Botany		4	4	3	25	75	100
	IV	Skill Based Elective – II	Skill Based Elective - II		2	2	3	25	75	100
		Skill Based Elective – III	Skill Based Elective – III		2	2	3	25	75	100
	Soft Skills Development			2	2	3	25	75	100	
<b>Total</b>				<b>30</b>	<b>29</b>				<b>800</b>	
VI	III	Core Course – VIII (CC)	Plant Physiology, Biochemistry and Biophysics		6	6	3	25	75	100
		Core Course – IX (CC)	Plant Ecology and Conservation		6	6	3	25	75	100
		Core Practical – IV (CP)	Plant Physiology, Biochemistry and Biophysics & Plant Ecology and Conservation (P)		6	6	3	40	60	100
		Major–Based Elective II	Plant Breeding, Horticulture and Landscaping		6	5	3	25	75	100
		Major–Based Elective III	Plant Biotechnology and Bioinformatics		5	4	3	25	75	100
	V	Extension Activities	Extension Activities		-	1	-	-	-	-
		Gender Studies	Gender Studies		1	1	3	25	75	100
<b>Total</b>				<b>30</b>	<b>29</b>				<b>600</b>	
<b>Grand 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]

\* for those who studied Tamil upto +2 (Regular Stream)

\*\* Syllabus for other Languages should be on par with Tamil at Degree level

# those who studied Tamil upto 10<sup>th</sup> or +2, but opt for other languages in degree level under Part I should study special Tamil in Part IV

\*\*\* Examination at the end of the next semester.

**Note :**

- 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.
- 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]

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## CORE COURSE I

### BACTERIA, VIRUSES, ALGAE, FUNGI AND LICHENS

#### 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 – Discovery, 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); techniques in sterilization, bacterial culture and staining (simple and differential); Economic importance.

#### Unit II Viruses

Viruses – Discovery, general structure, Symptoms of virus infection in plants; transmission of plant viruses; genome organization, replication of plant virus (tobacco mosaic virus); techniques in plant viruses – purification; structure and multiplication of bacteriophages; structure and multiplication of viroids. Economic importance.

#### Unit III Algae

General characteristics of various divisions; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae (F. E. Fritsch); Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Diatoms*, *Ectocarpus*, *Dictyota*, *Polysiphonia*. Economic importance of algae.

#### Unit IV Fungi

General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification (Alexopolous); True Fungi – General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Economic importance.

## **Unit V      Lichens**

Symbiotic Associations – Lichens: General account, occurrence, thallus organization, classification, structure, physiology, reproduction, and role in environmental pollution and uses; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

### **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* (2<sup>nd</sup> 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* (10<sup>th</sup> 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.

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## CORE PRACTICAL I

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

Tools and equipments used in microbiology: Spirit lamp, Inoculation loop, Hotair 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 *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *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 tease mounts.

*Puccinia*: 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: Study of growth forms of lichens (crustose, foliose and fruticose)

Mycorrhiza: ectomycorrhiza and endomycorrhiza (Photographs)

#### Field visit

1. Make suitable micropreparations and identify the diseases mentioned theory with due emphasis on symptoms and causative organisms.
2. A detailed study of diseased specimens included in the theory.
3. Identification of various plant protection appliances mentioned in the syllabus and their working mechanism.

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## **CORE COURSE II**

### **PLANT PATHOLOGY AND PLANT PROTECTION**

#### **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: History, losses due to pathogens, 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, Biological control agents and their role in plant disease control

#### **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.

Research in Plant Pathology- Contribution of Indian Plant Pathologists: Rangasami, G Mahadevan, A., Bilgrami, K. S., and Mehrotra, R. S.), Contribution of Research institutes – IARI (Indian Agricultural Research Institute), ICRISAT (International Crop Research Institute for Semi-Arid Tropics)

#### **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: Objectives, Traditional and modern methods of soil sterilization. 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: For diseases – 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, tin-bands 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

#### **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.

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## CORE COURSE III

### BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

#### 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 – Liverworts (Stotler et al., 2009), hornworts (Renzaglia et al., 2009), and Mosses (Goffinet et al., 2009); Morphology, Structure, Reproduction and life history of the following genera: *Riccia*, *Marchantia*, *Anthoceros* and *Polytrichum*.

#### Unit II

**Pteridophytes**– General characteristics and classification by Smith; Morphology, Structure, Reproduction and life-history of the following genera: *Psilotum*, *Lycopodium*, *Selaginella* and *Equisetum*.

#### Unit III

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

#### Unit IV

**Gymnosperms**– General characteristics and classification of Gymnosperms by Sporne; Morphology, structure, mode of reproduction and life-history 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*, *Calamites* & *Williamsonia*.

#### Books:

#### BRYOPHYTES

1. Chopra, R.N. and Kumara, P.K. (1988). *Biology of Bryophytes*. Wiley Eastern Ltd., New Delhi.
2. Jeyaraman, (1978). *Indiyavin liverwortugal* (In Tamil). Tamil Nadu Textbook society, Madras.
3. Palaniyappan, S. (1988). *Bryophyta* ( In Tamil). T.K. Publishing House, Chennai.

4. Prem, P. (1981). *Bryophytes: Morphology, Growth and differentiation*. Atma Ram and Sons, New Delhi.
5. Rashid, A. (1998). *An Introduction to Bryophyta*. Vikas Publishing House (P) Ltd., New Delhi.
6. Smith, G.M. (1955). *Cryptogamic Botany Vol. II Bryophytes and Pteridophytes* (2<sup>nd</sup> edn.). Tata McGraw Hill Publishing Co., New Delhi.
7. Srivastava, N.N., (1996). *Bryophyta*. Pradeep Prakashan, Meerut.
8. Vashista, B.R. (1983). *Botany for Degree Students – Bryophyta*. S. Chand and Company Ltd., New Delhi.

### **PTERIDOPHYTES**

1. Rashid, 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. Smith, G.M. (1955). *Cryptogamic Botany Vol. IIBryophytes and Pteridophytes* (2<sup>nd</sup> Edn.). Tata McGraw-Hill Publishing Co., New Delhi.
4. Sporne, K.R. (1970). *The Morphology of Pteridophytes* (The Structure of Ferns and Allied Plants). Hutchinson University Library, London.
5. Sundara Rajan, S. (1994). *Introduction to Pteridophyta*. New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi.
6. Vashista, P.C. (1997). *Botany for Degree StudentsPteridophyta*. 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. Coulter, J.M. and Chamberlain, C.J. (1964). *Morphology of Gymnosperms*. Central Book Depot, Allahabad.
3. Sharma, O.P. (1997). *Gymnosperms*. Pragati Prakashan, Meerut.
4. Sporne, K.R. (1971). *The Morphology of Gymnosperms* (The Structure and Evolution of Primitive seed Plants). Hutchinson University Library, London.
5. Srivastava, H.N. (1998). *Gymnosperms*. Pradeep Publications, Jalandhar.
6. Vashishta, P.C. (1996). *Botany for Degree Students-Gymnosperms* (2<sup>nd</sup> Edn.). S. Chand and Company Ltd., New Delhi.

### **PALEOBOTANY**

1. Delavoryas, T. (1962). *Morphology and Evolution of Fossil Plants*. Holt, Rinehart and Winston, New York.
2. Scott, D.H. (1962). *Studies in Fossil Botany* (Vol.I and Vol.II). Hafner Publishing Co., New York.
3. Seward, A.C. (1959). *Plant Life Through the Ages*. Hafner Publishing Co., New York.
4. Shukla, A.C. and Misra, S.P. (1975). *Essentials of Paleobotany*. Vikas Publishing House (P) Ltd., New Delhi.
5. Stewart, W.N. (1983). *Paleobotany and the Evolution of Plants*. Cambridge University Press, Cambridge, London.
6. 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.

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## CORE PRACTICAL II

### BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY &ANATOMY AND EMBRYOLOGY

**Practical for Core Course IV:** A study of both vegetative and reproductive structures (wherever available) of Genera included in the theory.

**Practical for Core Course VI:** A study of the morphology and anatomy of both vegetative and reproductive parts of the living genera and fossil forms of the following Genera.

#### 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, Megasporephyll – 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*

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## NON-MAJOR ELECTIVE I

### BIOFERTILIZERS AND BIOPESTICIDES

#### 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 biofertilizers, Rhizobium-legume Symbiotic association – mass cultivation and carrier materials.

#### Unit II

Cultural method of *Azospirillum*, *Azotobacter*, *Azolla* and *Anabaena*, carrier materials.

#### Unit III

Mycorrhiza – VAM association, types, isolation and inoculum production.

#### Unit IV

Pesticides – Introduction – Biological Magnification concept. Biopesticides – Viral origin, fungal origin.

#### Unit V

Biopesticides – Bacterial origin, *Bacillus thuringiensis* mechanism of action and application. Advantages of biopesticides and commercialization.

#### 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.

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## CORE COURSE IV

### ANATOMY AND EMBRYOLOGY

#### 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, definition, differentiation, redifferentiation and dedifferentiation. Classification of 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, Ontogeny and Phylogeny; Phloem – Components, Ontogeny and Phylogeny. Laticifer types.

#### Unit III

Primary structure of root, stem and leaf in dicots and monocots. Normal Secondary growth in stem and root-annual rings – heart Wood, sapwood. Periderm formation.

Anomalous secondary growth in dicot stems: *Nyctanthes* and *Boerhaavia* and monocot stem-*Dracaena*. Nodal anatomy – uni and trilacunar types.

#### Unit IV

Embryology – Structure and development of anther. Microsporogenesis; Microgametogenesis; Ultrastructure of pollen wall – structure, development and types of ovules, megasporogenesis, Megagametogenesis (*Polygonum* type of embryo sac development), Fertilization.

#### Unit V

Endosperm – Nuclear, cellular and helobial and Ruminant types. Development of embryo – dicot and Monocot. Basic concepts of apomixis, apospory, Polyembryony and Parthenogenesis

## **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* (2<sup>nd</sup> Edition). Wiley Eastern Ltd., New Delhi.
4. Fahn, A. (1997). *Plant Anatomy*. Pergamon Press, Oxford.
5. Foster, A.S. (1960). *Practical Plant Anatomy*. 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* (4<sup>th</sup> 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.

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## NON-MAJOR ELECTIVE II

### HORTICULTURE

#### 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, green house 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, popiary arches and lawn maintenance.

#### Unit IV

Floriculture, cultivation of commercial flowers – rose and jasmines. Cultivation of important fruit trees – Mangoes and Banana.

#### Unit V

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

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

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## CORE COURSEV

### CELL AND MOLECULAR BIOLOGY

#### Objectives:

To enable the students

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 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).

#### Books:

1. De Robertis, E.D.P. and De Robertis, E.M.F. Jr. (1980). Cell and Molecular Biology (7<sup>th</sup> Ed). Saunders College/Holt, Rinehart and Winson, Philadelphia.



2. Grierson, D. and Convey, S.N. (1989). *Plant Molecular Biology*. Blackie Publishers, New York.
3. Lea, P.J. and Leegood, R.C. (1999). *Plant Biochemistry and Molecular Biology*. John Wiley and Sons, London.
4. Old, R.W. and Primrose, S.B. (1994). *Principles of Gene Manipulation*. Blackwell Science, London.
5. Power, C.B. (1984). *Cell Biology*. Himalaya Publishing Co., Mumbai.
6. Sharma, N.S. (2005). *Molecular Cell Biology*. International Book distributors, Dehradun.
7. Verma, P.S. and Agarwal, V.K. (1986). *Cell Biology and Molecular Biology (Cytology)*. S. Chand and Company Ltd., New Delhi.

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## CORE COURSEVI

### GENETICS, BIOSTATISTICS AND EVOLUTION

#### 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 laws, monohybrid, dihybrid, back cross and test cross. Allelic interactions: Incomplete dominance and co-dominance – complementary factor hypothesis, epistasis (Dominant and recessive), Non-allelic interaction – Lethal factor, Multiple factor hypothesis

#### Unit II

Recombination – Linkage & 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 – 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 Poisson 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.

### BOOKS:

#### GENETICS

1. Adrin, M.S.R.B., Owen, R.D. and Edger, R.S. (1979). *General Genetics*. In: Mendelism. Eurasia Publishing House (P) Ltd., New Delhi.
2. Agarwal, V.K. (2000). *Simplified course in Genetics* (B.Sc., Zoology). S. Chand & Company Ltd., New Delhi.
3. Ahluwalia, K.B. (1990). *Genetics*. Wiley Eastern Ltd., Madras.
4. Chandrasekaran, S.N. and Parathasarathy, S.V. (1965). *Cytogenetics and Plant Breeding*. P. Varadhachari & Co., Madras.
5. Daniel Sundararaj, D. and Thulsidas, G. (1972). *Introduction to Cytogenetics & Plant Breeding* (3<sup>rd</sup> Ed.). Popular Book Depot, Madras.
6. Gardner, E.J. and Snusted, D.P. (1984). *Principles of Genetics* (7<sup>th</sup> edition). John Wiley & Sons, New York.
7. Gupta, P.K. (2000). *Genetics*. Rastogi Publishers, Meerut.
8. Herskowitz, I.H. (1977). *Principles of Genetics* (2<sup>nd</sup> Ed.). MacMillan Publishing Co. Inc., New York.
9. Hexter, W. and Yost, H.T. Jr. (1977). *The Science of Genetics*. Prentice Hall of India (P) Ltd., New Delhi.
10. Jain, H.K. (1999). *Genetics-Principles, Concepts & Implications*. Oxford & IBH Publishing Co., (P) Ltd., New Delhi.
11. Lewin, B. (1990). *GenesIV*. Oxford University Press, Oxford.
12. Meyyan, R.P. (2000). *Genetics & Evolution*. Saras Publication, Nagercoil.
13. Palaniyappan, S. (1987). *Marabiyal* (Genetics - In Tamil). V.K. Publishing House, Madras.
14. Pandey, B.P. (2012). *Cytology, Genetics and Molecular Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
15. Renganathan, T.K. and Shanmugavel, S. (1996). *Genetics & Genetic Engineering*. Commercial Offset Printers, Sivakasi.
16. Sandhya Mitra (1994). *Genetics - A Blue Print of Life*. Tata McGraw-Hill Education Private Ltd., New Delhi.
17. Sarin, C. (1994). *Genetics*. Tata McGraw-Hill Education Private Ltd., New Delhi.
18. Singleton, R. (1963). *Elementary Genetics*. D. Van Nostrand Co., Ltd. Inc., New York.
19. Sinha, U. and Sinha, S. (1989). *Cytogenetics, Plant Breeding & Evolution*. Vikas Publishing House, New Delhi.
20. Sinnott, E.W., Dunn, L.C. and Dobshansky, J. (1958). *Principles of Genetics* (5<sup>th</sup> Edition) McGraw Hill Publishing Co., New York.
21. Strickberger, M.W. (1976). *Genetics* (2<sup>nd</sup> Ed.). MacMillan Publishing Co. Inc., New York.

22. Watson, J.D. (1977). *Molecular Biology of the Gene*. W.A. Benjamin Inc., California.
23. Winchester, A.M. (1958). *Genetics* (3<sup>rd</sup> Ed.). Oxford & IBH Publishing House, Calcutta.
24. 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. Nageswara Rao, G. (1983). *Statistics for Agricultural Science*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Olive, J.D. (1995). *Basic Statistics - A Primer for the Biomedical Sciences*. John Wiley and Sons, New Delhi.

### **EVOLUTION**

1. Gottlieb, LD. and Jain, S.K. (1988). *Plant Evolutionary Biology*. Chapman & Hall, London.
2. Savage, J.M. (1969). *Evolution* (2<sup>nd</sup> Ed.). Amerind Publishing (P) Ltd., New Delhi.
3. Shukla, R.S. and Chandel, P.S. (1996). *Cytogenetics, Evolution & Plant Breeding*. S. Chand & Company Ltd., New Delhi.
4. Sproule, A. (1998). *Charles Darwin Scientists who have changed the world*. Orient Longmans, Hyderabad.
5. Verma, P.S. and Agarwal, V.K. (1999). *Concepts of Evolution*. S. Chand & Company Ltd., New Delhi.

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## CORE COURSE VII

### MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

#### Objectives:

To enable the students

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: vegetative, floral and fruit parts – Inflorescence – Types – racemose, cymose, mixed and special types. Fruit - simple, fleshy, dry dehiscent and dry indehiscent, aggregate and multiple fruits.

#### Unit II

Binomial nomenclature – ICBN rules – taxonomic types. Systems of Classification – Bentham and Hooker classification – 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.

## **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. Jefferey, C. (1968). *An Introduction to Plant Taxonomy*. J.A. Churchill, London.
4. Lawrence, G.H.M. (1953). *Taxonomy of Vascular Plants*. Oxford & IBH Publishers, New Delhi.
5. Lawrence, G.H.M. (1955). *An Introduction to Plant Taxonomy*. The Central Book Depot, Allahabad.
6. Mathews, K.M. (1987-90). *Flora of Tamilnadu Carnatic (1-4vols.)* Rapinat Herbarium, Trichy.
7. Mathur, R.C. (1970). *Systematic Botany (Angiosperms)*. Agra Book Stores, Lucknow.
8. Mitra, J.N. (1964). *An Introduction to Systematic Botany & Ecology*. The World Press (P) Ltd., Calcutta.
9. Naik, V.N. (1996). *Taxonomy of Angiosperms (9<sup>th</sup> Ed.)*. Tata McGraw-Hill Publishing Co., (P) Ltd., New Delhi.
10. Narayanaswamy, R.V. and Rao, K.N. (1976). *Outlines of Botany*. S. Viswanathan Printers & Publishers, Chennai.
11. Palaniyappan, S. (2000). *Angiospermgalin Vagaippadu (Taxonomy of Angiosperms)*. V.K. Publishing House, Chennai.
12. Pandey, B.P. (1997). *Taxonomy of Angiosperms*. S. Chand & Company Pvt. Ltd., New Delhi.
13. Porter, C.L. (1967). *Taxonomy of flowering Plants*. Eurasia Publishing House, New Delhi.
14. Ramaswami, S.N., Lakshminarayana, S. and Venkateswaralu, V. (1976). *Taxonomy (Systematic Botany) for Degree Course*. Maruthi Book Depot, Guntur, Hyderabad.
15. Sharma, O.P. (2007). *Plant Taxonomy*. Tata McGraw-Hill Publishing Co., New Delhi.
16. Singh, V. and Singh, D.K. (1983). *Taxonomy of Angiosperms*. Rastogi Publications, Meerut.
17. 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.
18. Subramanian, N.S. (1999). *Laboratory Manual of Plant Taxonomy (2<sup>nd</sup> Ed.)*. Tata McGraw-Hill Publishing Co., New Delhi.
19. 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. Gupta, S.K. and Kaushik, M.P. (1973). *An Introduction to Economic Botany*. K. Nath & Co., Meerut.
4. Hill, A.W. (1952). *Economic Botany*. Tata McGraw-Hill Publishing Co., New Delhi.
5. Pandey, B.P. (2000). *Economic Botany*. S. Chand & Company Ltd., New Delhi.
6. Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. (1989). *A Text Book of Economic Botany*. Wiley Eastern Ltd., Madras.
7. Sen, S. (1992). *Economic Botany*. New Central Book Agency, Calcutta.
8. Verma, V. (1974). *A Text Book of Economic Botany*. Emkay Publications, New Delhi.

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## **CORE PRACTICAL III**

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

#### **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 tips and *Tradescantia/Rheo* flower bud respectively
4. Isolation of cell organelles through differential centrifugation
5. Photographs: Ultra Structure of cell organelles

#### **GENETICS, BIOSTATISTICS & EVOLUTION**

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

#### **MORPHOLOGY, TAXONOMY & ECONOMIC BOTANY**

Training in 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.

Description of plants in technical terms.

Field study flora.

Submission of 25 Herbarium specimens.

Economic plants covered in theory part in taxonomy and economic botany and their importance.

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**MAJOR-BASED ELECTIVE I**  
**MEDICAL AND APPLIED BOTANY**

**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**

**Biofertilizer Technology:** biofertilizers – types and importance. Mass cultivation of *Azospirillum*, *Azolla* and *Anabaena*. Rhizobium-legume symbiotic association – mass cultivation and carrier materials. Mycorrhiza – types and importance.  
Biopesticides – importance; bacterial (*Bacillus thuringiensis*); Viral (NPV); Fungal (*Trichoderma*).

**Unit V**

**Mushroom Technology:** types and identification of edible and poisonous mushrooms; nutritive value; cultivation of button (*Agaricus bisporus*) and

oyster mushroom (*Pleurotus sajorcaju*); harvest and storage methods; mushroom research centres in India.

**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., Badhuvar, R.L. and Gosh, G. (1965). *Poisonous Plants of India*. CSIR Publications, New Delhi.
4. 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.
5. Gamble, J. S. and Fisher, C.E.C. (1915-1938). *Flora of the Presidency of Madras*. Adlard & Son Ltd., London.
6. Marimuthu, T. (1991). *Oyster Mushroom*. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
7. Mathew, K.M. (1988). *Flora of the Tamilnadu Carnatic*. Rapinat Herbarium, Tiruchirappalli.
8. Nair, N.C. and Henry, A.M. (1983). *Flora of Tamil Nadu, India*. Botanical Survey of India.
9. Nita Bhal (2000). *Handbook on Mushrooms Vol. I and II* (2nd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
10. Pathak, V.N. and Yadav, N. (1998). *Mushroom Production and Processing Technology*. Agrobios, Jodhpur.
11. Somasundaram, S. (1997). *Medicinal Botany (Maruthuva Thavaraviyal)* (Tamil Medium Book). Elangovan Publishers, Tirunelveli.
12. Srivastava, A.K. (2006). *Medicinal Plants*. International Book distributors, Dehradun.
13. Subba Rao, N.S. (2000). *Soil Microbiology*. Oxford and IBH Publishing Co. Ltd., New Delhi.
14. Tripathi, D.P. 2005. *Mushroom Cultivation*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
15. Varma, A. and Hock, B. (1995). *Mycorrhiza*. Springer-Verlag, Berlin.
16. Yaaco Vokan (1994). *Azospirillum/Plant Associations*. CRC Press, Boca Raton, FL.

**Note:** No Practical for this paper.

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## CORE COURSE VIII

### PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

#### Objectives:

To enable the students

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, 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 abscisic 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 and entropy-electron transfer processes-a) Definition of pH -its determination; b) Buffers and electrolytes and their functions. c) Fractionation of biomolecules by paper chromatography, d)Centrifugation.

## **BOOKS:**

### **PLANT PHYSIOLOGY**

1. Devlin, R.M. (1969). *Plant Physiology*. Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
2. Dulsy Fatima, R.P. et. al., (1994). *Elements of Biochemistry*. Saras Publications, Nagercoil, Tamilnadu.
3. Jain, V.K. (1990). *Fundamentals of Plant Physiology*. S. Chand & Co., New Delhi.
4. Noggle, R. and Fritz (1989). *Introductory Plant Physiology*. Prentice Hall of India.
5. Pandey, S.N. (1991). *Plant Physiology*. Vikas Publishing House (P) Ltd., New Delhi.
6. Periyasamy, K. (1978). *Cell Iyakka Viyal* (Cell Physiology). Tamilnadu text Book Society, Chennai.
7. Salisbury, F.B. and Ross, C.W. (1999). *Plant Physiology*. CBS Publishers and Printers, New Delhi.
8. Saraswathy and Rangamannar (1973). *Thaavara Valarchithai Martram* (Metabolism & Biosynthesis). Tamilnadu Text Book society, Chennai.

### **BIOCHEMISTRY**

1. Day, P.M. and Harborne, J.B. (2000). *Plant Biochemistry*. Harcourt Asia (P) Ltd., India & Academic Press, Singapore.
2. Jain, J.L. (1998). *Fundamentals of Biochemistry*. S. Chand & Co., New Delhi.
3. Jayaraman, J. (1981). *Laboratory Manual of Biochemistry*. Wiley Eastern Ltd., New Delhi.
4. Lehninger, A.L. (1984). *Biochemistry* (2<sup>nd</sup> Edition). Kalyani Publishers, Ludhiana, New Delhi.
5. Plummer, D.T. (1988). *An Introduction to Practical Biochemistry* (3<sup>rd</sup> Edn.). Tata McGraw Hill Publishing Co., Ltd., New Delhi.
6. Srivastava, H.S. (1990). *Elements of Biochemistry*. Rastogi Publications, Meerut, India.
7. Stryer, L. (1989). *Biochemistrty*. W.H. Freeman & Co., New York, San Francisco.
8. Wilson, K. and Walker, J. (1994). *Principles and Techniques of Practical Biochemistry* (4<sup>th</sup> Edition). Cambridge University Press, U.K.

### **BIOPHYSICS**

1. Annie and Arumugam, N. (2000). *Biochemistry & Biophysics*. Saras Publications, Nagercoil, Tamilnadu.
2. Casey, E.J. (1969). *Biophysics-Concepts and Mechanisms*. Van Nostrand Reinhold Co., & Affiliated East West Press (P) Ltd., New Delhi.
3. Narayanan, P. (2000). *Essentials of Biophysics*. New Age International Publishers (P) Ltd., New Delhi, Bangalore, Calcutta, Chennai, Guwahati, Hyderabad, Lucknow, Mumbai.
4. Salil Bose, S. (1982). *Elementary Biophysics*. Vijaya Printers, Madurai.

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## **CORE COURSE IX**

### **PLANT ECOLOGY AND CONSERVATION**

#### **Objectives:**

To enable the students

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), Allelopathy.

#### **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.

#### **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.

## **BOOKS:**

### **PLANT ECOLOGY & PHYTOGEOGRAPHY**

1. Agrawal, K.C. (1987). *Environmental Biology*. Agro Botanical Publisher, India.
2. Arumugam, N. (1994). *Concepts of Ecology* (Environmental Biology). Saras Publications, Nagercoil, Tamilnadu.
3. Chandrasekaran, P. (1996). Chutruch choozhal Maasupadu (Environmental Pollution) T.K. Printers, Pudukkottai, Tamilnadu.
4. Kumar, H.D. (1992). *Modern Concepts of Ecology* (7<sup>th</sup> Edn.). Vikas Publishing Co., New Delhi.
5. Odum, E.P. (1971). *Fundamentals of Ecology* (2<sup>nd</sup> Edn.). Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Sharma, P.D. (2000). *Ecology & Environment*. Rastogi Publications, Meerut, India.
7. Sundaram, R. (1972). Thaavara Chuyach Choozhnilai yiyal. Tamilnadu Text Book Society.
8. Vashishta, P.C. (1990). *Plant Ecology*. Vishal Publications, Delhi, Jalandhar.
9. Verma, P.S. and Agarwal, V.K. (1999). *Concept of Ecology* (Environmental Biology). S. Chand & Co., New Delhi.

### **PHYTOGEOGRAPHY**

1. Cain, S.A. (1944). *Foudations of Plant Geography*. Harper & Brothers, N.Y.
2. Good, R. (1997). *The Geography of flowering Plants* (2<sup>nd</sup> Edn.). Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi.
3. Mani, M.S. (1974). *Ecology & Biogeography of India*. Dr. W. Junk Publishers, The Haque.

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## **CORE PRACTICAL IV**

### **PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS & PLANT ECOLOGY AND CONSERVATION**

#### **PLANT PHYSIOLOGY, BIOCHEMISTRY & BIOPHYSICS**

##### **For demonstration only**

1. Enzyme activity using amylase.
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. Determination of osmotic pressure of onion/Rheo leaf.
4. Effect of light intensity on transpiration using Ganong's potometer.
5. Determination of stomatal frequency and estimation of transpiration rate.
6. Determination of absorption and transpiration ratio in plants.
7. Measurement of respiration rate using germinating seeds and flowerbuds with simple respiroscope.
8. Separation of plant pigments by paper chromatography.
9. Determination of photosynthetic rate in water plants under different CO<sub>2</sub> concentrations.
10. 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.
6. The light and dark bottle experiment for primary productivity study in the aquatic ecosystem.

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## **MAJOR-BASED ELECTIVE II**

### **PLANT BREEDING, HORTICULTURE AND LANDSCAPING**

#### **Objectives:**

This course introduces

1. the various methods of plant breeding and plant propagation
2. teaches students the art of growing plants for a pre-defined purpose and pleasure and facilitates students to become an entrepreneur

#### **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.



**BOOKS:**

1. Allard, R.W. (1960). *Principles of Plant Breeding*. John Wiley & Sons, NewYork.
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. Jenson, N.F. (1988). *Plant Breeding Methodology*. Wiley Inercience Publication, NewYork.
5. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publication, India.
6. Manibhushan Rao, K. (1991). *Text Book of Horticulture*. Macmillan Publications, New Delhi.
7. Mukherjee, D. (1972). *Gardening in India*. Oxford & IBH Publishing Co., Kolkatta, Mumbai, New Delhi.
8. Roy Choudhry, N. and Mishra, H.P. (2001). *Text book on Floriculture and Landscaping*. Raja Infotech Enterprise, India.
9. Sandhu, M.K. (1989). *Plant Propagation*. Wiley Eastern Ltd., New Delhi.
10. Sharma, J.R. (1994). *Principles and Practice of Plant Breeding*. Tata McGraw Hill, New Delhi.

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## MAJOR-BASED ELECTIVEIII

### PLANT BIOTECHNOLOGY AND BIOINFORMATICS

#### 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 types; materials and callus growth; differentiation; subculturing 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); bio-fertilizers. Environmental Biotechnology: Waste treatment – solid (compost), Liquid (industrial effluents), sewage treatment (domestic sewage).

#### 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.

#### 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.

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