SEMESTER – I			
Core I	**Plant Diversity I (Algae, Bryophytes, Fungi and Lichens)**		
Course Code: 21UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

Objectives:

- To have comprehensive idea on primitive plants
- To understand the major groups of lower plants and their characteristics.
- To study the effective utilization of algae, fungi, lichen and bryophytes for the environment and human well being

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	know the general characteristics of algae, fungi, lichen and bryophytes	1	An
CO-2	ennumerate the importance of algae and bryophytes and their role in everyday life and environment.	7	Ev
CO-3	observe adaptive feature of the specified plant groups	3	An
CO-4	compare and contrast algae, fungi and bryophytes	2	Un
CO-5	identify algal, fungal and bryophytes samples	8	Re
CO-6	distinguish life cycle pattern in algae, fungi and bryophytes	7	Ap
CO-7	understand the criteria behind the classification of algae, fungi and bryophytes	1	Un
CO-8	apply the knowledge acquired for self employability	6	Ap

SEMESTER – I			
Core I	**Plant Diversity I (Algae, Bryophytes, Fungi and Lichens)**		
Course Code: 21UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

UNIT I: **Algae**: Introduction - Brief history of Algae, Classification of algae based on Fritsch (1945), Habitat. General characteristics of algae - Range of thallus organization, Methods of reproduction-vegetative, asexual and sexual, Life cycle patterns, Alternation of generation in algae. Algal cytology – cell wall, cytoplasm (algal pigments, reserve food materials), flagella and nucleus. Economic importance of algae: algae as food, SCP, fodder, green manure, role in N_2 fixation, medicine and biofuels. Ecological benefits of algae.

UNIT II: Habitat, thallus structure, reproduction and life cycle of *Oscillatoria, Volvox, Caulerpa, Vaucheria, Sargassum* and *Gracilaria*.

UNIT III: **Bryophytes:** General characteristics of Bryophytes. Classification of Bryophytes by Rothmaler (1951). Habitat, thallus structure, reproduction and life cycle of *Marchantia* and *Polytrichum.* Economic importance of Bryophytes - biological, ecological, medicinal and as potting material. Affinities between algae and bryophytes.

UNIT IV: **Fungi :** Classification of fungi based on Alexopoulus and Mims (1979), General characters. Habitat, somatic structure, asexual reproduction, sexual reproduction and life cycle of *Albugo, Aspergillus, Peziza,* and *Polyporous*. Role of fungi in medicine, industry, food and food products.

UNIT V: **Lichens:** Classification of lichen based on habit, habitat, anatomy, nature of partners, different views on lichen association, organization, process of lichenization. Vegetative propagules - isidia, soredia, cyphellae, cephalodia.Thallus structure and reproduction of *Collema, Parmelia* and *Usnea*. Economic and ecological significance of lichens.

Text Books:

1. Pandey S.N. and Trivedi. P.S. *A Text Book of Botany* Vol. I and II. New Delhi: VikasPublishing House Pvt. Ltd., 2006.
2. Sharma O.P. *Text Book of Algae.* New Delhi: Tata Mc. Graw-Hall Publications, 2006.
3. Johri, R.M., Smeh Lata and Kavitha Tyagi. 2011. *A Text Book of Fungi*, DominantPublishers and Distributors Pvt. Ltd., New Delhi
4. Singh V. Pandey P.C. and Jain D.K.. A *Text Book of Botany*. Meerut: RastogiPublication, 2002

Books for Reference:

1. Fritsch F.E. *The Structure and Reproduction of Algae*. London: Vol.I all II. CambridgeUniveristy Press, 1972.
2. Kamat N.D. *Topics in Algae*. Aurangabad: Sai Kraipa Prakasham, 1982.
3. Parihar N.S. *Bryophyta*. Allahabad: Central Book Depot Publications in Botany, 1967.
4. Robert Edward Lee. *Phycology*: Cambridge University Press, 2009.
5. Vashishta B.R, Sinha A.K. and Singh V.P. *Algae*. New Delhi: S. Chand and Co. Ltd.2007.
6. Vashishta B.R Sinha A.K. and Singh V.P. *Bryophyta*: New Delhi: S. Chand and Co.Ltd., 2006.
7. Ahmadjian V and Hale M.E. *The lichens.* London: Academic Press, 1973.
8. Alexpoulous C.J. Mims C.W. and Blackwell M. *Introductory Mycology.* New Delhi:Wiley Eastern Limited, 1988.
9. Dubey H.C. *An introduction of fungi.* New Delhi: Vikas Publishing House, 2005.
10. Pandey B.P. *Plant Pathology.* New Delhi: S.Chand and Co.Ltd, 2007.
11. Rangasamy G. *Diseases of Crop Plants in India Prenties.* New Delhi. Hall of India,1992.
12. Singh R.S. *Plant Diseases.* New Delhi: Oxford IBH, 1991.

Practicals: Hrs/Week: 2 hrs

- Micropreparation and evaluation of *Oscillatoria, Volvox*, Diatoms, *Vaucheria, Caulerpa,Sargassum, Dictyota, Acanthophora, Gracilaria*
- Micropreparation evaluation of *Riccia, Marchantia* and *Polytrichum*
- Micropreparation evaluation of *Albugo, Aspergillus*, *Peziza* and *Polyporous.*
- Micropreparation evaluation of *Usnea*and*Parmelia*
- Identification of microscopic and macroscopic algae
- Identification of Bryophytes
- Identification of microscopic and macroscopic fungi
- Field visit: No of days: 2 (Collection of seaweeds and bryophytes)
- Submission of specimen (algae/

bryophytes/ fungi/ lichen)Submission:

Record note book

SEMESTER – II			
Core II	**Anatomy, Embryology and Microtechniques**		
Course Code: 21UBOC21	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

Objectives:

- To understand the fundamental organization of tissues, developmental events of plants and related techniques
- To understand the developmental process from flower to fruit
- To gain knowledge on the histological architecture of plants
- Application of techniques in anatomical and embryological studies

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	classify meristems and explain the organization of root apex	2	Ev ,An
CO-2	distinguish meristematic and permanent tissues	8	An
CO-3	compare the secondary growth in dicot stem and root	3 , 7	An
CO-4	describe the cytological events associated with the flower development	1 ,3	Un , E
CO-5	explain the physiological changes during pollen pistil interaction.	1	Un
CO-6	understand fertilization and double fertilization.	2	Ev
CO-7	explain the development of seed and dispersal mechanism	2, 3	Un
CO-8	apply microtechniques to prepare anatomical sections and make permanent mounts	3	Un

SEMESTER – II			
Core II	**Anatomy, Embryology and Microtechniques**		
Course Code: 21UBOC21	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

UNIT I: Meristematic tissues: Classification based on position. Shoot apex (Tunica corpus theory) and root apex (Histogen theory). Permanent Tissues: Simple tissue -parenchyma (chlorenchyma, aerenchyma), collenchymas and sclerenchyma.Complex tissues – xylem and phloem.Organs: Primary structure of dicot and monocot root, stem and leaf.Nodal anatomy – Unilacunar (*Nerium*), Trilacunar (*Azadirachta*), Multilacunar (*Aralium*).

UNIT II: Secondary growth: Secondary growth in root and stem. Vascular cambium – structure (fusiform initial, ray initial) and function, seasonal activity – annual ring.Structure of wood, secondary medullary rays, heart wood and sap wood.Cork cambium – structure and function. Bark. Lenticels. Adaptive and Protective system: Epidermis, cuticle, stomata. General account of adaptations in xerophytes and hydrophytes.

UNIT III: Structural organization of flower: Structure of anther and pollen, structure andtype of ovules, types of embryo sacs, organization and ultra structure of mature embryo sac. Pollination and fertilization: Pollination mechanisms and adaptations.Pollen pistil interaction.Phenomenon of double fertilization.

UNIT IV: Embryo and endosperm: Dicot and monocot embryo. Endosperm - type, structure and functions. Embryo endosperm relationship.Seed-structure appendages anddispersal mechanisms.Apomixis and polyembryony: Definition, types and applications

UNIT V: Microtechnique: Preparation of permanent free hand sections.Microtomy: Fixation, dehydration, embedding, sectioning, staining (general staining and double staining) and mounting. Micrometry – definition, types and uses.

Books for Reference:

1. Bhojwani S.S. and Bhatnagar S.P. *The embryology of Angiosperms*. Uttar Pradesh: VikasPublishing house PVT. Ltd., 2007.
2. Dwivedi J.N and Singh R.B. *Essential of plant techniques*. Jodhpur: Chant printers, 1985.
3. Eames, A.J and L.H Mac Danniels. *An Introduction to Plant Anatomy*. New Delhi: TataMcGraw- Hill Publishing Company Ltd, 1972.
4. Fahn A. *Plant Anatomy*. United Kingdom, Pergamon Press.1990
5. Maheswari, P. *Introduction to embryology of angiosperm*. India: Tata Mc Graw Hillpublications and Co. 1971.
6. Pandey B.P. *Plant Anatomy*. India: S. Chand Co. 1978.
7. Ruth L.W. *Microtechniques*, New York: Mc millaian Company, 1971.
8. Singh V Pandey P.C and Jain D.K. 1987. Meerut: *Anatomy of Seed Plants*. Rastogi,Publication,

Practicals Hrs/ hr: 2

- Observation of tissues - parenchyma, collenchyma and sclerenchyma.
- To measure the dimensions of the given tissue types using stage micrometer and ocularmicrometer
- Sectioning of stem - monocot (*Dracaena*), dicot (*Polyalthea* and *Boerhaavia*)
- Sectioning of root – Dicot (*Azadirachta*), Monocot (*Crinum*)
- Nodal anatomy: Taking series of transverse sections in the nodal region and identify thetypes of nodal anatomy
- Study of the types of stomata from the epidermal peeling of *Hybiscus/ Cucurbita/* grass
- Adaptive antomy: Xerophytic – (*Nerium* leaf), hydrophytes (*Hydrilla* stem)
- Structure of young and mature anther (permanent slide)
- Types of ovule: Anatropus (permament slide), orthotropus, circinotropus, amphitropus,campylotropus (models)
- Dissection of embryo from developing seeds

SEMESTER – II			
Skill Enhancement Course - II Professional English for Botany – II			
Course Code: 21UBOPE2	**Hrs / Week: 2**	**Hrs / Sem: 30**	**Credits: 2**

Objectives:

- To enhance the lexical, grammatical, sociolinguistic and communicative competence in an increasingly complex, interdependent world.
- To develop intellectual flexibility, creativity and critical thinking skills of students by offering adequate practice in professional context.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	recognise the words used in life science and improve their competence in using the language	1	An
CO-2	Comprehend unfamiliar texts and describe biological processes	7	Ev
CO-3	Apply critical and theoretical approaches to the reading and analysis of various texts in life science	3	An
CO-4	Analyse critically, negotiate and present without committing errors and develop entrepreneurship skills	2	Un
CO-5	Recognize the technical words used life science laboratory settings	8	Re
CO-6	learn language use in formal/professional world	7	Ap
CO-7	Write simple sentences without spelling or grammatical error	7	Ap
CO-8	Improve English proficiency with good vocabulary	7	Ap

SEMESTER – II			
Skill Enhancement Course - II Professional English for Botany – II			
Course Code:21UBOPE2	**Hrs / Week: 2**	**Hrs / Sem: 30**	**Credits: 2**

UNIT I: Communication

Listening: Listening to audio text and answering questions: Primary Tissues in plants
Pair Work: Pairwise reading of a conversation script (e.g. difference between plant cell and animal cell) prepared by each pair of their choice. (The script can be based on any topic in plant science)
Reading: Comprehension passage- JanakiAmmal, the Indian Botanist
Writing: Developing a story with pictures: Story of seed
Vocabulary: Unit oriented

UNIT II: Description

Listening: Listening to Process Description - Mitosis
Role play: Deforestation
Reading Passages on Environment conservation
Process Description - Compare & Contrast Algae and Fungi
Vocabulary: Unit oriented

UNIT III: Negotiation Strategies

Listening to the interviews of James Watson, Stephen Hawking, SasiTharoor Small group discussion - Green Revolution, impacts, limits, and the path ahead
Reading: Passage reading - Pseudoscience, the paranormal, and science education
Writing: Developing essay from the passage -Healthy diet.
Vocabulary: Unit oriented

UNIT IV: Presentation Skills

Listening : Listening to lectures and notes taking-
(https://www.youtube.com/watch?v=Dh9ptiJj7TE)
Speaking: Organized speech – Frustrations of people in Pandemic situation. (informative)
Reading: Comprehensive passage - Embryogenesis and answering questions.
Writing: Descriptive writing- Interpretation-Animals for ever (Gerald Durrell's)
Vocabulary: Unit oriented

UNIT V: Critical Thinking Skills

Listening: Listening for information - Introduction to enzymes
Speaking: Preparation of Power Point presentation –Small group discussion on errors in Power Point presentation: History of Botany
Reading: Note making –Professional Competence and Professional Ethics
Writing: Summary writing – Drug designing.

Text Book:

1. Tamil Nadu State Council for Higher Education (TANSCHE).*Professional English forLife Sciences - I.*

Books for Reference:

1. Verma P.S. and Agarwal. V.K. *Cell biology, Genetics, Molecular Biology, Evolution andEcology*. New Delhi, S. Chand and Co., 2007.
2. Bhojwani S.S and Bhatnagar S.P. *The embryology of Angiosperms*. New Delhi: VikasPublishing house PVT. Ltd., 2007.
3. Dubey, R.C. 2006. *Text Book of Biotechnlogy*, fourth edition. New Delhi. S. Chand and CoLtd., 2006.

SEMESTER – III			
Core III Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany)			
Course Code: 21UBOC31	**Hrs / Week:4**	**Hrs / Semester: 60**	**Credits:4**

Objectives:

- To investigate and illustrate the key characteristics of fossil and living pteridophytes and gymnosperms through micropreparation and microscopic observation
- To provide firsthand experience in plant collection, identification preservation and data collection for future studies.
- To impart knowledge on the ecology, economic importance, phylogenic importance of pteridophytes and to infer the evolution of seed habit from pteridophytes.

Course Outcomes:

CO.No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	summarize the general characters of pteridophytes and gymnosperms and outline the classification of these groups of plants	1,2	Cr
CO-2	specify the criteria of classification and assign the taxonomic hierarchical rank to the taxa	2,3	Re
CO-3	explore the ecological and economic significance of pteridophytes and gymnosperms	1,4	Ev
CO-4	highlight the phenomenon of heterospory in pteridophytes and infer its significance in origin of seed habit	2,4	Un
CO-5	examine microscopically the key characteristics of (morphological, anatomical and ecological) pteridophytes and gymnosperms and make sketches of the same.	4,7	An
CO-6	record the geological time scale and relate the geological era with evolution of plants	7,8	Un
CO-7	identify the types of fossils and discuss the fossilization process and substantiate the importance of fossils evidences in organic evolution.	2,4	Un
CO-8	analyze and justify the idea of evolution of seed plants from pteridophytes	7	Ev

SEMESTER – III			
Core III Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany)			
Course Code: 21UBOC31	**Hrs / Week:4**	**Hrs / Semester: 60**	**Credits:4**

UNIT I: General Characters of pteridophytes (upto genus level). Classification of pteridophytes: Pteridophyte Phylogeny Group (PPG) by Erics (2016) (upto order level). Stelar Evolution. Heterospory and seed habit. Economic importance: food, fodder, medicine, ecological indicators, ornamental and biofertilizer

UNIT II: Distribution, external structure, internal structure, reproduction, types of gametophyte and life cycle of *Lycopodium* and *Selaginella* (Developmental details not required).

UNIT III: Distribution, external structure, internal structure, reproduction, types of gametophyte and life cycle of *Adiantum* and *Marsilea* (Developmental details not required)

UNIT IV: General characters of gymnosperms, outline the classification of gymnospermsby Chamberlain (1934). Distribution, external structure, internal structure, reproduction and life cycle of *Pinus* and *Gnetum.* (Developmental details not required)

UNIT V: Economic importance of gymnosperms: food, fodder, ornamentals and industrial uses. Fossils: introduction, process of fossilization, theories of fossilization, types of fossils, techniques to study fossils. Geological time scale. Fossil pteridophyte: *Rhynia,* Fossil gymnosperm: *Lyginopteris* constructed plant parts.

Text Book:

1. Pandey S.N., Trivedi P.S. and Misra S.P. *A text Book of Botany Vol. II.*New Delhi:Vikas Publishing House Pvt. Ltd., 2006.

Books for Reference:

1. Rashid A. *An introduction to Pteridophyta*. New Delhi: Vani Educational Books. Vikas Publishing House Pvt. Ltd., 1985.
2. Vashishta P.C., Sinha A.K. and Anil Kumar, *Botany for degree students – pteridophyte.*New Delhi.S. Chand & Co., 2007.
3. Vashishta P.C., Sinha A.K. and Anil Kumar, *Botany for degree students - Gymnosperms.*New Delhi.S. Chand & Co., 2007.
4. Chamberlain C.J., *Gymnosperms* – Structure and evolution. New Delhi: CBS Publishers & Distributors, 1986.

5. Shukla A.C. and Misra S.P. *Essentials of Paleobotany*. New Delhi: Vikas PublishingHouse Pvt. Ltd., 1982.

Practicals:
Hrs/Weel: 2

Pteridophytes

- *Lycopodium* - Habit, section – T.S. of stemPermanent slide: L.S. of cone
- *Selaginella* - Habit, section – T.S of rhizophore, stem and L.S. of cone
- *Adiantum* - Habit, section – T.S. of rachisPermanent slide: L.S. of sporophyll
- *Marsilea*- Habit, section – T.S. of rhizome, petiole and sporocarpPermanent slides: sporocarp at different plane

Gymnosperms:

- *Pinus* - Twig, dwarf shoot, section- T.S. of young stem and needle
  Permanent slides: T.S. of old stem, L.S. of young and mature male, female cone, seedentire
- *Gnetum* - Twig, section – T.S. of stem and leaf, wood showing anomalous secondarythickening
  Permanent slides: L.S. of male and female inflorescence, seed entire

Fossils :

- *Rhynia* (Stem)
- *Lyginopteris*- Constructed plant parts

Field Study

Submission: Record note book

Laboratory manual for reference:

Srivastava H. N. *Practical Botany Volume I.* Jalandhar: Pradeep Publications, 1987

SEMESTER - III			
Allied III	**Plant Diversity**		
Course Code: 21UBOA31	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits:3**

Objectives:

- To observe and record the key morphological and anatomical structures using compound microscope and make sketches of the same.
- To provide field experience in plant collection, identification, preservation and generation of herbarium database.
- To explain lifecycle pattern, economic importance and the role of diversified group of plants in ecosystem function.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
1.	consider the criteria of classification and outline the system of classification (algae, fungi, bryophytes, pteridophytes and gymnosperms) as proposed by different taxonomist	1, 2	An
2.	work out micropreparation techniques to study the specimen and to reveal the histological architecture using compound light microscope	1, 2	Cr
3.	illustrate the key features of these plants and explain their characters to distinguish different plant groups	1, 6	Ap
4.	explore and express the ecosystem services and economic benefits of these groups of plants	6	Ap
5.	assign the taxonomic ranks to indicate its systematic position and evaluate the evolution of plant species	1, 2	Un
6.	trace the origin and evolution of steles, foliage and seed from seedless plants	1, 2	Re
7.	infer phylogenetic relation between plant groups and comment pteridophytes are pioneer in the evolution of seed habit	1, 2	An
8.	discuss the life cycle pattern of different group of plants	1, 2	Un

SEMESTER - III			
Allied III	**Plant Diversity**		
Course Code: 21UBOA31	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits:3**

UNIT I: **Algae**: General characteristics. Classification of algae by F. E. Fritsch (1954).Economic importance of algae. Occurrence, morphology and anatomical structures, mode of reproduction and life cycle of *Caulerpa* and *Gracilaria.*

UNIT II: **Fungi:**General characteristics. Classification of fungi by Alexopoulos and Mims (1979). Economic importance of fungi. Occurrence, morphology and anatomical structures, mode of reproduction and life cycle of *Agaricus*

UNIT III: Bryophytes: General characteristics. Classification of bryophytes by Rothmaler(1951). Economic importance of bryophytes. Occurrence, morphology and anatomical structures, mode of reproduction and life cycle of *Polytrichum*.

UNIT IV: Pteriodophytes: General characteristics. Classification of pteridophytes by Smith (1955). Economic importance of pteridophytes. Morphological, anatomical structure and mode of reproduction of *Marsilea.*

UNIT V: Gymnosperms: General characteristics, classification of Gymnosperms by K.R. Sporne (1965). Economic importance of gymnosperms. Morphological, anatomical structure, reproduction and life cycle of *Pinus.*

Text book

1. Pandi S.N., Trivedi P.S. and Misra S.P. *A text Book of Botany*. Vol. I and II. New Delhi: Vikas Publishing House Pvt. Ltd., 2006.

Books for Reference:

1. Fritsch F.E. *The structure and reproduction of algae*. Vol. I & II. London: Cambridge University Press, 1972.
2. Alexopoulos and Mims. *Introductory mycology*. Hyderabad: Wiley Eastern Ltd., 1983.
3. Rashid, A. *An introduction to Bryophyta*. Chennai: Vikas Publishing House Pvt. Ltd., 1999.
4. Vashishta, P.C., Sinha A.K. and Anil Kumar. *Botany for degree students*. New Delhi: S. Chand & Co., 2008.

Practicals: 2Hrs/Week

- **Algae:**

  Caulerpa – T.S. of rhizome

  Gracilaria – T.S. of thallus with cystocarp

- **Fungi :**

  Agaricus –

  T.S. of Pileus

  Permanent

  slide –

  Aspergillus

- **Bryophytes:**

  Polytrichum - T.S. of stem, T.S. of capsule

  Funaria - T.S. of stem and leaf

- **Pteridophytes:**

  Marsilea – Habit, section - T.S. of petiole, T.S. of rhizome and T.S. of sporocarp

  Dicranopteris – Habit, section - T.S. of rhizome,

  petiole and pinnulePermanent slide: *Marsilea*

  sporocarp at different planes

- **Gymnosperms:**

  Pinus - Twig, dwarf shoot, section- T.S. of young stem

  and needle Permanent slides: T.S. of old stem,

  L.S. of young and mature male,female cone,

  seed entire

  Gnetum - Twig, section of T.S. of stem and leaf, wood

  showing anomaloussecondary thickening

  Permanent slides: L.S. of male and female inflorescence, seed entire

Laboratory manual for Reference:

Srivastava, H. N. *Practical Botany.* Volume I. Jalandhar: Pradeep Publications, 1987.

SEMESTER - IV			
Allied IV	**Angiosperm Taxonomy and Plant Physiology**		
Course Code: 21UBOA41	**Hrs / Week : 4**	**Hrs / Semester: 60**	**Credits:3**

Objectives:

- To understand the natural system of classification of plants and acknowledge the scientific contribution of plant taxonomist.
- To furnish first hand learning experience in plant collection and describe the diagnostic features of plant in technical terms with the aim of identifying the taxa.
- To elucidate the physiological metabolism associated with the life of the plants.

Course Outcomes:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	study the morphological variation of vegetative part of angiosperms in relation to environmental condition	1	Un
CO-2	characterize the morphological features and architecture of floral components and categorize the types of inflorescences	2	Ev
CO-3	layout and recall the natural systems of classification of angiosperms as proposed by Bentham and Hooker	2	Re
CO-4	describe the dissected components of flowers and make sketches of that.	2	An
CO-5	understand the physical process associated with water absorption, transport and transpiration	2 ,3	Un
CO-6	analyze light enhance photochemical reaction, synthesis of ATP and NADPH and fixation of carbon dioxide into organic compound	2.,3	Un
CO-7	pronounce the role of growth hormones in plant function	2	An
CO-8	design and conduct scientific experiments to record the data	4, 8	Cr

SEMESTER - IV			
Allied IV	**Angiosperm Taxonomy and Plant Physiology**		
Course Code: 21UBOA41	**Hrs / Week : 4**	**Hrs / Semester: 60**	**Credits:3**

UNIT I: Modification of plant parts: root, stem, leaf. Types of inflorescence, parts of a flower and types of fruits.

UNIT II: Concept of classification, natural system - Bentham and Hooker. Vegetative, floral characters and economic importance of Annonaceae, Rutaceae and Caesalpiniaceae.

UNIT III: Vegetative, floral characters and economic importance of Rubiaceae, Asclepiadaceae, Euphorbiaceae and Poaceae.

UNIT IV: **Plant - Water Relations:** Importance of water to plant life. Physical properties of water**,** diffusion, osmosis, imbibition, plasmolysis and water potential. **Absorption and transport of water:** Soil water, mechanism of water absorption, ascent of sap – path and mechanism. **Theories of ascent of sap:** Vital force theory, root pressure theory and Dixon cohesion theory. **Theory of translocation**: Munch hypothesis. **Transpiration**: types, mechanism of stomatal movement, significance

UNIT V: Photosynthesis: Electromagnetic spectrum, photosynthetic apparatus, pigment systems, red drop and Emerson enhancement effect. **Photochemical reaction:** cyclic and non-cyclic photophosphorylation. **CO_2 fixation:** C_3 cycle. Factors affecting photosynthesis. **Growth:** definition, growth phases. **Plant growth promoting hormones:** occurrence, physiological effects and practical applications of auxin, gibberellin and cytokinin.

Text books:

1. Pandey B.P. *Taxonomy of Angiosperms*. New Delhi: S. Chand & Company Ltd., 2005.
2. Jain V.K. *Fundamentals of Plant Physiology*. New Delhi: S. Chand & Company Ltd., 2004.

Books for Reference:

1. Shukla P. and Misra S.P. *An introduction to Taxonomy of angiosperms*. New Delhi: Vikas Pub. House Ltd., 1997.
2. Vashista P.C. *Taxonomy of Angiosperms*. New Delhi: S. Chand & Co., 1985.

3. Pandey B.P. *Economic Botany*. S. New Delhi: Chand & Co., 2000.
4. Salisbury F.B. and Ross C.W. 2007. *Plant physiology.* Singapore: Thompson. Asia. Pvt.Ltd., 2007.

Practicals: 2 Hrs/week

- Dissections and drawing of the floral parts of typical genus belonging to the familiesprescribed in the syllabus (Floral diagram and floral formula are expected).

  Anonaceae - *Anonasquamosa*
  Rutaceae - *Murraya koenigii*
  Caesalpiniaceae - *Caesalpinia pulcherima*
  Rubiaceae - *Ixora coccinea*
  Asclepiadaceae - *Calotropis gigantea*
  Euphorbiaceae - *Euphorbia cyathophora*
  Poaceae - *Chloris barbata*
- Identification of families.
- Identification of the economically important plant products prescribed in the syllabus.
- Determination of water potential by gravimetric method
- Effect of temperature on membrane permeability
- Estimation of starch by colorimetric method.
- Estimation of chlorophyll by spectroscopic method.
- Submission of record notebook

Laboratory Manual for Reference:

1. Ashok Bendre and Ashok Kumar. *Text Book of Practical Botany II*. Meerut: RastogiPublications, 1976.
2. Gamble J.S. *Flora of Presidency of Madras, Volume I to III,* London: Adlard and Son.,Ltd., 1997.
3. Henry A.N., Chitra, V. and Balakrishnan, N.P. *Flora of Tamil Nadu, India, Volume III.*
   Coimbatore: Botanical Survey of India, Southern circle, 1989.

4. Henry N., Kumari, G.R. and Chitra, V. *Flora of Tamil Nadu, India, Volume II*. BotanicalSurvey of India, 1987.
5. Mathew K.M. *The flora of Tamil Nadu, Carnatic. Volume I to III.* Rapinet herbarium,
   Tiruchirapalli: St. Joseph's College, 1981 to 1984.
6. Francis H Witham, David F Blaydes and Robert N Devlin.
   Experiments in PlantPhysiology. New Delhi: Vanmostr and Rainhold Company, 1970.

SEMESTER IV			
Skill Based Elective	**Weed Science**		
Course Code: 21UBOS42	**Hrs/week: 2**	**Hrs/semester: 30**	**Credits: 2**

Objectives

- To provide knowledge on ecology of weeds and its dynamic interaction with human activities
- To evaluate herbicides and its long time impact to environment and non-targeted organism
- To identify and survey weeds distribution and apply various weed management techniques

Course Outcomes:

CO.No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	characterize and classify weeds	1	An
CO-2	recall the harmful and beneficial effects of weeds	7	Ev
CO-3	comment on method of propagation, dispersal mechanism and its perpetuation in its ecological niches	7	Un
CO-4	recognize competition between crop and weed in terms of light, space, moisture and nutrition	4,7	An
CO-5	investigate allelopathic effects between crops in their rhizosphere	1	Un
CO-6	strategies weed control methods	7	Un
CO-7	reveal the mechanism action of herbicides	5	Re
CO-8	understand the importance of herbicides and correlate its long time impact to the environment and non targeted organisms	8	Ap

SEMESTER IV			
Skill Based Elective	**Weed Science**		
Course Code: 21UBOS42	**Hrs/week: 2**	**Hrs/semester: 30**	**Credits: 2**

UNIT I: Weeds**:** Definition, characteristics and classification of weeds. Harmful and beneficial effects of weeds. Biology and ecology of weeds.

UNIT II: Propagation and persistence**:** Propagation, dispersal and persistence of weeds.

UNIT III: Crop - weed competition**:** Crop - weed competition for light, space, moisture and nutrients. Critical period of crop - weed competition. Allopathic effects of weeds on crops.

UNIT IV: Weed management**:** Principles, prevention, eradication and control of weed. Mechanical, cultural, chemical and biological methods of weed control.

UNIT V: Herbicide**:** Definition. Objectives and scope of herbicide application. Formulation. Mechanism of action of herbicides. Toxic symptoms of herbicide in weeds and crops. Effects of herbicide on the environment.

Text Books

1. Grafts A. S. and Robbins W. W. *Weed Control*. New Delhi: Tata-McGraw-Hill, Publishing Co. Ltd., 1973.
2. Zimdahl R. L. *Fundamentals of Weed Science*. U.S.A: Academic Press, 1983.

Books for Reference:

1. Aldrich R.J. *Weed - crop ecology- principles in Weed Management*. Massachusetts, U. S. A.: Breton Publishers, 1984.
2. Fryer J.D. and Makepeace. *Weed Control Handbook Vol. II*. London: Blackwell Scientific Publication, 1978.
3. Hance R.J. and Holy K. *Weed Control Handbook*. Oxford: Blackwell Scientific Publication, 1990.
4. Narwal S. S. *Allelopathy in Crop Production*. Jodhpur: Scientific Publishers, 1994.
5. Gupta O. P. *Scientific Weed Management*. New Delhi: Today & Tomorrow's Printers & Publishers, second revised & enlarged edition, 1984.
6. Gupta O. P. and Lamba P. S. *Modern Weed Science*. New Delhi: Today and Tomorrow's Printers and Publishers, 1978.
7. Rao V. S. *Principles of Weed Science*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd., third edition, 1988.
8. Subramanian S., Mohamed Ali A. and Joya Kumar R. *All about Weed Control*. New Delhi: Kalyani Publishers, 1997.

SEMESTER VI			
Core X - Marine Botany			
Code: 15UBOC62	**Hrs/week: 6**	**Hrs/semester: 90**	**Credits: 5**

Objectives:

- To know about the marine biodiversity and its importance
- To generate self-employment by training the students in commercial cultivation of sea-weeds and mass cultivation of micro-algae.

Unit I : Marine environment- classification, physical and chemical properties of sea water, characteristics and adaptations of pelagic (planktonic), benthic (littoral and deep sea) organisms.

Unit II : Marine phytoplankton- collection, preservation and importance of phytoplankton, productivity- measurement, factors affecting primary production. Role of marine bacteria in the economy of sea.

Unit III : Laboratory culture of marine micro algae. Commercial cultivation of seaweeds - general methods- *Gracilaria* and *Porphyra.* Economic importance of marine algae- in food and agriculture. Phycocolloids - agar – agar, algin, alginate, carrageenan -commercial production, properties and uses, diatomite, antibiotics and vitamins.

Unit IV : Estuarine ecology – characteristics, types. Adaptations and importance of mangroves, mangroves of Tamil Nadu. Salt marshes. Coastal sand dune vegetation and their importance.

Unit V : Marine pollution– pollution due to heavy metals, radioactive wastes, oil, thermal, algal blooms - sources and control measures – oil degrading bacteria – GMO and Pollution abatement. .Conservation of coastal ecosystem with special reference to coral reef and mangroves.

Text Books:

1. Bilgrami, K.S. and L.C. Saha, 2004. Textbook of Algae. CBS publishers & Distributors, New Delhi.

2. Tait, 1978. Elements of marine ecology. Butterworth & Co. (Publishers) Ltd. London

Books for Reference:

1. Boaden P.J.S. and R. Seed 1985. An Introduction to coastal ecology. Thomas Press Limited, New Delhi.
2. Chapman, V.J. and Chapman, 1980. Seaweeds and their uses – Chapman and Hall, London.
3. Dawes, C.J. 1981. Marine Botany. John Wiley & Sons, New york.
4. Lobban, C.S. and M. J. Wynne. 1981. The biology of Seaweeds. Blackwell Scientific publications. Oxford, London.
5. Newell and Newell.1977. Marine Plankton a practical guide. Hutchinson and Co. Ltd.
6. Sinha, P. C. 1998. Marine pollution, Anmol publications Pvt. Ltd. New Delhi.
7. Sverdrup H.U. 1972. The Oceans – Modern Asia Edition.
8. Venkataraman, G.S. 1969. The cultivation of algae, IARI.

Practical

Hrs/week: 2

1. Determination of acidity in water samples.
2. Determination of alkalinity in water samples.
3. Estimation of dissolved oxygen content in sea water samples.
4. Estimation of phosphate in seawater samples.
5. Phytoplanktons-Collection and identification
6. Seaweeds- *Ulva, Sargassum, Hypnea* and *Gracilaria*
7. Study of sand dune, salt marsh and mangrove vegetation in their natural habitat, submission of photographs and field report for internal evaluation.

SEMESTER IV			
NME II	**Food Technology**		
Course Code: 21UBON41	**Hrs/week:2**	**Hrs/Semester:30**	**Credit: 2**

Objectives:

- To provide cognizant on the chemistry of food components, microbial interaction with food product and apply scientific methods of food preservation to restrict microbial growth.
- To develop skill in food processing techniques and apply it to their professional accomplishment.
- To encourage collaborative learning and develop skill to introduce novelty in quality improvement and enhancing marketing values.

Course Outcomes:

CO. No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	discuss basic principles of food preservation methods.	6,8	Un
CO-2	identify and explain nutrients in foods and the specific functions in maintaining health.	6,8	Re
CO-3	commends on causes and deterioration mechanisms of foods and methods to control food spoilage.	6,8	An
CO-4	manufacture a range of simple nutritious and novel food products	6,8	Ap
CO-5	modify recipe for specific purposes such as nutrient enhancement, quality improvement and ingredient substitution.	4	Ap
CO-6	understand the compositional and technological improvement in dairy and bakery industries	6,8	Un
CO-7	learn nutritious values of food and employ technologies in production and preservation	6,8	Ap
CO-8	apply preservation principles in product design	6	Ap

SEMESTER IV			
NME II	**Food Technology**		
Course Code: 21UBON41	**Hrs/week:2**	**Hrs/Semester:30**	**Credit: 2**

UNIT I: Technology of Vegetables**:** Nutritive value of vegetable, storage of vegetable, factors affecting storage life, spoilage of vegetables. Methods of preservation: refrigeration, freezing, canning, drying and dehydration, and chemical preservatives. Preparation - pickles (lemon, mango), soups (mixed vegetables, tomato).

UNIT II: Bakery Technology**:** Ingredients & processes for breads, cakes. Equipments used, product quality characteristics, faults and corrective measures. Different types of icings.

UNIT III: Dairy Technology**:** Milk and dairy products, Pasteurization, sterilization, HTST and UHT processes. Preparation of butter, ghee, ice-cream, paneer.

UNIT IV: Technology of Fruits**: C**omposition and nutritive values of fruits. Spoilage of fruits. Preparation of jam - mixed fruits jam. Fruit juices pineapple and grapes.Squash – lemon. Sauce- tomato.

UNIT V: Technology of millets: Types of millets, nutrient content of millets, health benefits of millets, ways to incorporate millet into diet. Processing - hand pound method and machine method. Preparation of millet bread, millet roti, porridge and laddu.

Text Book:

1. Raina U. Kashyap S. Narula V. Thomas S. Suvira S. and Chopra S. *Basic Food Preparation-A complete Manual*. Hyderabad: Orient Longman Pvt. Ltd., third edition, 2007.

Books for Reference:

1. Dubey S.C. *Basic Baking*. New Delhi: Chanakya Mudrak Pvt. Ltd., fifth edition, 2007.

2. Frazier W.C. and West Holf D.C. *Food Microbiology*. New Delhi: Tata McGraw Hillpublishing Co Ltd., 1995.
3. Kulshrestha S.K. *Food preservation.* New Delhi: Vikas publishing House. 1994.
4. Srivastava R. P. *Preservation of fruits and vegetable products***.** Dehra Dun: Bishen SinghMahendra Pal Singh, 1982.
5. Srivastava R. P. and Kumar S. *Fruit and Vegetable Preservation: Principles andPractices.* Lucknow: International Book Distributing Co., 2002.
6. Swaminathan M. *Handbook of Food Science and Experimental foods*. Banglore: TheBanglore printing and publishing Co. Ltd., 1992.

SEMESTER V			
Core VII	**Biotechnology (Common Core)**		
Code: 18UBCC51	**Hrs/Week:4**	**Hrs/Sem: 60**	**Credits: 3**

Vision:

- To gain knowledge and develop skill in the field of about the importance of biotechnology in different fields
- To create graduates who endeavor for the welfare of mankind.
- Create opportunities for multi-disciplinary education, training and research in biotechnology

Mission:

- Impart quality education for lifelong professional growth and opportunity in a wide range of Careers.
- To create awareness towards socio-ethical implications of potentials of biotechnology
- To provide a platform for biotechnology education, training and research at the interface of multiple disciplines

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	describe different cloning vehicles and learn the different type of vectors	1	Kn, Un
CO-2	gain knowledge about techniques of biotechnology.	2	Un
CO-3	summarise the different techniques in animal biotechnology	2	Un, An
CO-4	compare the various techniques in plant and animal biotechnology	4	Cr
CO-5	enumerate cell culture, organ culture and stem cell culture and point out implications in health care	6	Kn, An
CO-6	distinguishes methods of alleviating environmental pollution and understand the synthesis of industrial products	5	An
CO-7	relate biotechnology and its benefits to mankind	6	Ap, Ev
CO-8	design, conduct experiments, analyze and interpret data for investigating problems in biotechnology and allied fields	7,8	Ap

SEMESTER V			
Core VII	**Biotechnology (Common Core)**		
Code: 18UBCC51	**Hrs/Week:4**	**Hrs/Sem: 60**	**Credits: 3**

Unit I Cloning Vectors

Introduction – Scope and importance of biotechnology – Gene cloning techniques - cloning vehicles – bacterial plasmid vectors – pBR322 and Ti plasmid – bacteriophage vectors – lambda – M13 – Plant viral vector – CaMV- Gemini virus and tobamovirus – animal viral vector – SV40- Role of restriction and modification enzymes

Unit II Gene Cloning and Screening

Gene cloning – methods of introduction of cloned genes into host cells – transformation – liposome mediated transfer – electroporation – particle bombardment gun – viral vector method – DNA library – PCR – hybridization technique – blotting techniques – Southern, Northern and Western.

Unit –III Cell, Tissue and Organ culture

Culture media – cell culture techniques – monolayer culture and immobilized culture of cell lines –callus culture – suspension culture and anther culture – techniques and applications of human embryonic stem cell culture – plant embryo culture- invitro pollination – organ culture – techniques – tissue engineering of artificial skin and cartilage.

Unit – IV Environmental and Bioprocess technology

Biotechnological methods for sewage and waste water treatment – bioremediation – degradation of xenobiotic (hydrocarbons and pesticides) – role of genetically engineered microbes – biomining – bioleaching – industrial production of penicillin and ethanol – Biodiesel – Biofertilizer – mass cultivation and application of Azola

Unit –V Health care biotechnology

DNA probes and diagnosis of genetic disorders – DNA fingerprinting technique – gene therapy and treatment of genetic diseases – vaccines – recombinant DNA vaccines and viral vaccines – edible vaccines- Bt cotton – Golden rice- Human Genome Project – types – methods of sequencing – potential benefits of mankind

Text Books

Dubey R.C, S *A text book of Biotechnology* .Chand and Comp.Ltd, New Delhi, 2004.
Kumaresan, V., Biotechnology . - Saras Publication , Nagercoil - 2010

Books for Reference

1. Clark and J. Pazdernik. 2009. *Biotechnology*, Elsevier Academic Press, California, USA.
2. Dubey, R.C. 2006. *Text Book of Biotechnlogy*, 4th edition, S. Chand and Co Ltd, New Delhi.
3. Ramadass, P. 2009. *Animal Biotechnology – Recent Concepts and Development*. MJP Publishers, Chennai
4. Rema, L.P. 2009. *Applied Biotechnology*, MJP Publishers, Chennai.

5. Shailendra Singh, 2007. *Applied Biotechnology*, 1st edition, Campus Books InternationalNew Delhi.
6. Singh, B.D. 2005. *Biotechnology, Revised edition*, Kalyani Publishers, Chennai.

Practicals 18UBCCR5
Hours/Week :2 Credits : 1

1. Isolation of Blue Green Algae
2. Preparation of synthetic seed
3. Estimation of dissolved oxygen and BOD
4. DNA Estimation by Spectrophotometric method
5. Preparation of plant and animal tissue culture media
6. Preparation of SDS – PAGE (Gel mould only)
7. Isolation of protoplast
8. Estimation of protein by column chromatography
9. Demonstration : Electrophoresis – full techniqueBlotting technique
   PCR – DNA
   Amplification
   Mushroom
   cultivation /
   Vermiculture
10. Models and Charts pertaining to theory

Book for Reference:

1. Aneja,K.R., *Experiments in Microbiology, Plant Pathology and Tissue Culture*, WishwaPrakashan, (A Division of Wiley Eastern Ltd), New Delhi.

SEMESTER V			
Core VIII	**Microbiology**		
Code: 18UBOC52	**Hrs/week: 5**	**Hrs/semester: 75**	**Credits: 4**

Vision:

- To provide information on various techniques to culture different microbial strains and recent advances in the field of microbiology

Mission:

- To know the characteristic features of microbes including their mode of nutrition
- To make the students aware of symptoms and preventive measures of common human diseases.
- To exploit the potentialities of microorganisms in food and industries.

Course Outcome

CO.No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	realise the history and scope of microbiology	3	Un
CO-2	understand the structure and growth characteristics of microorganism that enabling the learner to identify and classify microorganisms by themselves	4	Cr
CO-3	use various microbiological techniques to isolate, characterize and identify bacterial and viral pathogens of plants.	6	An
CO-4	provide a thorough knowledge about the microbes causing human diseases , their symptoms and preventive measures	4	Ap
CO-5	understand the role of microorganisms in biotechnology, fermentation, medicine and other industries for human well being	4	Ap
CO-6	discuss the role of microorganism in food, milk and water	4	An
CO-7	identify and control food borne disease and food spoilage	4	An
CO-8	test the quality of milk and enumerate microorganisms found in milk and soil	6	Ev

SEMESTER V			
Core VIII	**Microbiology**		
Code: 18UBOC52	**Hrs/week: 5**	**Hrs/semester: 75**	**Credits: 4**

Unit I:

Brief history and scope of microbiology. Morphology and ultra structure of Bacteria. Reproduction – binary fission, conjugation, transduction and transformation. Nutrition types - chemosynthetic, photosynthetic, saprophytic, parasitic and symbiotic.

Unit II

Culture of microorganisms – sterilization (dry, heat, moist heat and filtration), media for micro organisms (NA, Czapek-Dox and PDA), Methods of culturing bacteria – broth culture, agar plate and agar slant culture, pure culture, batch culture and continuous culture. Growth – phases of growth.

Unit III

Virus – general characteristics, structure and multiplication of TMV and T_4 phage. Microbes and human diseases –typhoid, cholera, tuberculosis and influenza

Unit IV

Fermentation technology- fermentors- stirred tank, tower and air lift. Commercial production of vinegar, citric acid, penicillin and vitamin B_{12}.

Unit V

Food microbiology – types of food spoilage and methods of food preservation. Microorganisms as food -single cell protein –bacteria, fungi and yeast.
Milk microbiology - bacterial flora in milk, types of contamination and pasteurization of milk.
Water microbiology – testing potability of water and methods of purification of potable water.

Text Book

1. Dubey, R.C. and D.K. Maheswari, 2003. A textbook of Microbiology. S. Chand company Ltd. New Delhi.

Books for Reference:

1. Adams, M.R. and M.O. Moss, 2005. Food Microbiology. New Age International publishers.
2. Kalaichelvan, P.T. 2005. Microbiology. Biotechnology - Lab Manual – MJP Publishers, Chennai.
3. Patel, A.H. 2004. Industrial Microbiology. Mac Milan India Ltd., New Delhi.
4. Pelzar, M.H., E.C.S Chan and N.R. Krieg. 2005. Microbiology. Tata MC. Graw Hill Pub. Co. Ltd., New Delhi.
5. Purohit, S.S. 1988. Microbiology. Agro Botanical publishers India.

Practical

Hrs/ week: 2

- Sterilization (dry, heat, moist heat and filtration)
- Preparation of media- NA, PDA
- Demonstration of plating and serial dilution technique
- Pure culture technique – streak plate method
- Staining of Bacteria (Gram's staining)
- Analysis of milk – dye reduction test

Spotters

- Ultra structure of bacterial cell, T_4 phage, TMV and HIV-EM
- Colony counter
- Fermentors- stirred tank, tower and air lift,
- Agar slant/ stab/plate
- Milk samples
- Spoiled food

Submission: Record note book

Book for Reference: Lakshmanan M, Kunthala Jeyaraman, Jeyaraman and Gnanam, 1971.Laboratory experiments in microbiology and molecular biology, Higginbothams Pvt. Ltd.

SEMESTER - II			
Core III	**Fungi, Lichens and Plant pathology**		
Code:18UBOC21	**Hrs / Week: 4**	**Hrs / Sem : 60**	**Credits: 4**

Vision:

Imbibe knowledge on uniqueness of Fungi and Lichens

Mission:

To study the life cycle patterns of fungi and lichen.

To learn about the plant diseases and their impact on crops

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	characterize and identify the diversity of fungal and lichen world and their adaptations	1	Un
CO-2	Identify fungal specimens microscopically	2	Ap
CO-3	Identify major groups of fungi and lichens based on morphology and anatomy	2	Ap
CO-4	understand and explain the ecological roles and trophic modes of major Fungal and Lichen groups	5	Ap
CO-5	evaluate the importance of Fungi and Lichens , their role in everyday life and environment	7	Ev
CO-6	understand the various plant diseases and their impact on agriculture	7	Un
CO-7	identify symptoms and diagnose different plant diseases and methods to control.	6	Ap
CO-8	identify pathogenecity with their specific symptoms	4	Ev

SEMESTER - II			
Core III	**Fungi, Lichens and Plant pathology**		
Code:18UBOC21	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 4**

Unit I : Classification of fungi based on Alexopoulus and Mims (1979), General characters.
Occurrence, somatic structure, asexual reproduction, sexual reproduction and life cycle of *Albugo* and *Aspergillus*.

Unit II : *Peziza* - Occurrence, somatic structure, asexual reproduction, sexual reproduction and life cycle.
Puccinia - Occurrence, primary host, alternative host and life cycle.
Role of fungi in medicine, industry, agriculture, food and food products.

Unit III : Lichens- Classification, association, morphology of thallus- crustose, foliose, fruiticose, reproduction and economic importance.
Usnea- Structure and reproduction.

Unit IV : Study of the following diseases with reference to causal organism, symptoms, dissemination and control measures: tikka disease of groundnut, red rot of sugarcane and blast disease of paddy.

Unit V : Study of the following diseases with reference to causal organism, symptoms, dissemination and control measures: canker disease of citrus, angular leaf spot of cotton and bunchy top of banana.

Text Books:

1. Johri, R.M., Smeh Lata, Kavitha Tyagi. 2011. A Text Book of Fungi, Dominant Publishers and Distributors Pvt. Ltd., New Delhi
2. Pandey, S.N. and P.S Trivedi 2006. A Text Book of Botany Vol. I Vikas Publishing House Pvt. Ltd., New Delhi & I.
3. Singh, V., P.C. Pandey and D.K.Jain. 2002. A Text Book of Botany, Rastogi Publication, Meerut.

Books for Reference:

1. Ahmadjian, V and M.E. Hale.1973. The lichens, Academic Press, London.
2. Alexpoulous, C.J., C.W. Mims, and M. Blackwell. 1988. Introductory Mycology, Wiley Eastern Limited, New Delhi
3. Dubey, H.C.2005. An introduction of fungi. Vikas Publishing House, New Delhi.
4. Pandey, B.P. 2007. Plant Pathology S.Chand and Co.Ltd New Delhi.
5. Rangasamy, G. 1992. Diseases of Crop Plants in India Prenties Hall of India, New Delhi.
6. Singh, R.S. 1991. Plant Diseases. Oxford IBH, New Delhi

SEMESTER - II			
Core IV	**Anatomy and Embryology**		
Code:18UBOC21	**Hrs / Week: 4**	**Hrs / Sem: 60**	**Credits: 4**

Vision:

To understand the fundamental organization of tissues and developmental events of plants

Mission:

To understand the developmental process from flower to fruit

To gain knowledge on the histological architecture of plants

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	classify meristems and explain the organization of root apex	2	Ev ,An
CO-2	distinguish meristematic and permanent tissues	8	An
CO-3	compare the secondary growth in dicot stem and root(normal and anomalous)	3 , 7	An
CO-4	describe the structure of a microsporangium and pollengrains and	1 ,3	Un , E
CO-5	Explain the structure and development of male gametophyte.	1	Un
CO-6	explain the structure and development of megasporangium	2 , 3	Ev
CO-7	understand fertilization and double fertilization.	2	Un
CO-8	differentiate dicot embryo from monocot embryo.	2 ,3	An

SEMESTER - II			
Core IV	**Anatomy and Embryology**		
Code:18UBOC21	**Hrs / Week: 4**	**Hrs / Sem : 60**	**Credits: 4**

Unit I : Tissues-definition and types. Meristems -classification based on position. Shoot apex (Tunica – corpus theory). Root apex (Histogen theory). Permanent tissues-simple -parenchyma, collenchyma,and sclerenchyma; Complex- xylem and phloem.

Unit II : Normal secondary thickening in dicot stem (*Polyalthia*) and root (*Azadirachta*). Anomalous secondary thickening in dicot stem (*Boerhaavia)* and monocot stem (*Dracena*)

Unit III : Anther – structure, anther wall, tapetum. Microsporogenesis. Pollen grain structure and pollen wall development. Pollinium. Development of male gametophyte

Unit IV : Structure of orthotropous ovule. Ovule-types. Megasporogenesis
Structure and development of female gametophyte (Polygonum type). Double fertilization, and post fertilization changes.

Unit V : Endosperm-types (nuclear, cellular and helobial -each one example) and haustorial behavior of endosperm. Dicot embryo-*Capsella* type, Monocot embryo *Luzula* type.

Text Books:

1. Pandey, B.P. 1995. Embryology of Angiosperms S. Chand and Company Ltd. Ram Nagar, New Delhi.
2. Pandey, B.P. 2005. Plant Anatomy S. Chand and Company Ltd. Ram Nagar, New Delhi.

Books for Reference :

1. Bhojwani SS and S.P Bhatnagar. 2007. The embryology of Angiosperms. Vikas Publishing house PVT. Ltd.,
2. Eames, A.J. and L.H. Mac Danniels. 1972. An Introduction to Plant Anatomy, Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
3. Maheswari, P. 1971. Introduction to embryology of angiosperm. Tata Mc Graw Hill publications and Co.
4. Singh, V., P.C. Pandey and D.K. Jain. 1987. Anatomy of Seed Plants, Rastogi Publication, Meerut.

SEMESTER IV			
Core VI	**Taxonomy of Angiosperms**		
Code: 18UBOC41	**Hrs/week: 4**	**Hrs/Semester: 60**	**Credit: 4**

Unit I : Taxonomy- definition and scope. Contribution of Mathew and Santappa. Botanical nomenclature - vernacular names, binomial, ICBN – principles of the code, principles of priority, type concept and author citation.

Unit II : Systems of classification- natural - Bentham and Hooker and phylogenetic – Engler and Prantl's system, Angiosperm Phylogeny Group (IV)- characteristics, merits and demerits.BSI. Herbarium techniques – botanical collection, pressing, preservation and role.

Unit III: Vegetative, floral characters and economic importance of: Annonaceae, Rutaceae, Caesalpiniaceae, Myrtaceae, Cucurbitaceae.

Unit IV: Vegetative, floral characters and economic importance of: Rubiaceae, Sapotaceae, Apocynaceae, Asclepiadaceae and Acanthaceae.

Unit V: Vegetative, floral characters and economic importance of: Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Arecaceae and Poaceae,.

Text Books

1. Pandey, B.P. 2005. Taxonomy of Angiosperms. S.Chand & Company LTD., New Delhi.
2. Shukla P. and S.P. Misra. 1997. An introduction to Taxonomy of angiosperms, Vikas Pub. House Ltd., New Delhi.
3. Vashista, P.C. 1985. Taxonomy of Angiosperms. Vikas Publications, New Delhi.

Books for Reference:

1. Gurcharan Singh, 2004. *Plant Systematics.* Oxford & IBH Publishing Co. PVT. Ltd., New Delhi.
2. Naik, V.N. 1984. *Taxonomy of Angiosperms*, R. Chand & Co, New Delhi.
3. Rendle, 1979. *The classification of flowering plants vol. II & I.* Vikas Publishing House Pvt. Ltd. Sahibabad, U.P.
4. Sharma, O.P. 1996. *Plant Taxonomy*. Tata MC Graw – Hill publishing Company Limited, New Delhi.
5. Singh, V. and Jain, 1997. *Taxonomy of Angiosperms*.Rastogi publications, New York.

Practical

Hrs/ week: 2

- Dissect out and display the floral parts of the typical members of the families prescribed in the syllabus.
- Survey of locally available plant species belonging to the families prescribed in the syllabus and preparation of digital herbarium
- Taxonomic field trip under supervision and submission of 2 herbarium sheets and 10 photographs. Field notebook to be submitted for external evaluation.
- Study of various modifications and record of economically important products from the members of the families prescribed in the syllabus.

Submission: Record note book/ Herbarium / Field note book

Books for Reference:

- Ashok Bendre and Ashok Kumar. *Text Book of Practical Botany II*. Rastogi Publications, Meerut.
- Gamble J.S. 1997. *Flora of Presidency of madras, Volume I to III*, Adlard and Son., Ltd., London
- Henry A N , Chitra V and Balakrishnan, NP, 1989. *Flora of Tamil Nadu, India, Volume III.* Botanical Survey of India, Southern circle Coimbatore.
- Henry AN, Kumari GR and Chitra V 1987. *Flora of Tamil Nadu, India, Volume II.* Botanical Survey of India.
- Mathew K M, 1981 to 1984. *The flora of Tamil Nadu, Carnatic. Volume I to III.* Rapinet herbarium, St. Joseph's College, Tiruchirapalli.

SEMESTER V			
Core Integral II	**Pharmacognosy**		
Code:18UBOI52	**Hrs/week:4**	**Hrs/semester: 60**	**Credit: 4**

Vision:

- To provide knowledge on significance of medicinal plants and their medicinal potency.

Mission

- To understand the characterization , production and standardization of crude drugs
- To deal with methods for sustainable production of crude drugs and their therapeutic value.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	define and identify the more valuable medicinal plants based on their pharmaceutically active compounds	3	Ap
CO-2	formulate medicinal product and apply the knowledge for proper storage and distribution	8	Ap
CO-3	assess and evaluate the purity of herbal medicine.	7	Ev
CO-4	elaborate the cultural practices of important medicinal plants.	6	Re
CO-5	assess the trade opportunities of medicinal plants.	6	Ap
CO-6	define, classify and explain the importance of herbal medicine.	6	Re
CO-7	identify the crude drugs by morphological, organoleptic and histological characters.	6	Un
CO-8	know and expain the important phytoconstituents of therapeutic value.	6	Un

SEMESTER V			
Core Integral II	**Pharmacognosy**		
Code:18UBOI52	**Hrs/week:4**	**Hrs/semester: 60**	**Credit: 4**

Unit I : Definition, scope and applications of herbal medicine. Classification (morphological. therapeutic, chemical. taxonomical and chemotaxonomic classifications) and identification of drugs

Unit II : Drug adulteration. Methods of drug evaluation (morphological, micoroscopic, physical, chemical and biological).

Unit III : Botanical name, family, useful part, chemical constituents, adulterants anduses of the following drug.

Glycosides – Senna, Aloe,
Digitalis, Liquorice Terpenoids
– Coriander, Fennel, Lemon,
CinnamomAlkaloids – Datura,
Opium, Vinca, Pepper
Lipids - Castor, Neem, Sesame oil.

Unit IV Methods of collection, process and storage of medicinal plants; purification of raw drugs; factors causing drug contamination, methods of storage of drugs

Unit V Extraction methods and medicinal uses of *Eucalyptus*, Castor and Lemongrass oil. Conservation of medicinal plants – *in-situ* and *ex-situ* methods

Text book:

Roseline. A. 2011. *Pharmacognosy*, MJP Publishers, Chennai.

Books for Reference

1. Anonymous. 1978. *The Ayurvedic Formulary of India.* Govt. of India, New Delhi
2. Anonymous. 1989. *Formulary of Siddha Medicine.* The Indian Medical Practitioners'Co-operative Pharmacy and Stores Ltd., Chennai
3. Anonymous. 1999. *The Ayurvedic Pharmacopoeia of India. Vol. I (1 & 2).* Ministry ofHealth and Family Welfare, Govt. India, New Delhi.
4. Chauhan, M.G. and A.P.G. Pillai. 2005. Microscopic Profile of Powdered Drugs Used inIndian Systems of Medicine. *Institute of Ayurvedic Medicinal Plant Sciences*, Jamnagar.
5. Daljithsimha, K. 1974. *Unani Dravyaguna Darshana*. Ayurvedic and Tibbi Academy,Lucknow
6. Kumar, N.C. 1993. *An Introduction to Medicinal Botany and Pharmacognosy*. EmkayPublications, Delhi.

7. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. 2004. *A Text book of Pharmacognosy*.Nirali Prakashan, Pune.
8. Murugesh, N. 2002 *A Concise Text Book of Pharmacognosy*. Sathya Publishers, Madurai.

Semester VI			
Core X	**Plant Physiology**		
Code: 18UBOC61	**Hrs/week: 5**	**Hrs/ Semester: 75**	**Credit : 4**

Vision:

- To provide knowledge on orderly metabolic activities in plant to sustain life

Mission:

- To understand the plant functions such as transpiration, photosynthesis and respiration.
- To recognize the intermediary metabolism of plants.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the water relation and root structure and functions that influence the transfer of inorganic nutrients from the soil into the plants	2,3	Un
CO-2	assess the symptom specific nutritional deficiencies and discuss the need of fertilisers for crop improvement	2	An,Ap
CO-3	analyse the mechanism of their assimilation of inorganic molecules into organic molecular components.	3	Un
CO-4	analyse light enhanced photochemical reactions that culminates in the synthesis of ATP and NADPH and fixation of carbon dioxide into organic compounds	3	Un
CO-5	describe respiration with its associated carbon metabolism and releasing of energy stored in chemical bonds in a controlled manner for cellular use	3	Re,Cr
CO-6	investigate plant's functions and adaptations under altered environmental conditions	2	Cr
CO-7	comment on the hormone controlled and light mediated morphogenetic events in plants	2	An
CO-8	design and conduct scientific experiments and analyse the data critically	4,8	Cr

Semester VI			
Core X	**Plant Physiology**		
Code: 18UBOC61	**Hrs/week: 5**	**Hrs/ Semester: 75**	**Credit : 4**

Unit I : **Plant - Water Relations:** Importance of water to plant life. **Physical properties of water:** Imbibition, Diffusion, Osmosis, Plasmolysis and Water potential. **Absorption and transport of water:** active and passive absorption, ascent of sap – path and mechanism (Dixon's cohesion theory). **Transpiration:** types, mechanism of stomatal movement (starch- sugar interconversion theory and proton transport and hormonal regulation theory), factors affecting transpiration, importance of transpiration

Unit II : **Solute relations: Mineral nutrition** – role of essential macro elements in plant nutrition, deficiency and toxicity symptoms. **Translocation of organic solutes:** mechanism of phloem transport, source-sink relationship, factors affecting translocation. **Nitrogen metabolism:** Nitrogen fixation: symbiotic fixation - importance of nitrate reductase and its regulations - ammonia assimilation.

Unit III : **Photosynthesis:** photosynthetic apparatus, pigment systems, red drop and Emerson enhancement effect. **Photochemical reaction:** cyclic and non cyclic photophosphorylation. **CO_2 fixation:** C_3 and C_4 cycles. Factors affecting photosynthesis.

Unit IV : **Respiration:** Respiratory substrates, **types of respiration:** aerobic – glycolysis, Krebs cycle, ETC and oxidative phosphorylation. **Anaerobic respiration:** lactic acid fermentation, alcohol fermentation. Pentose Phosphate Pathway (PPP).Factors affecting respiration.

Unit V : **Growth:** definition, phases of growth- factors affecting growth. **Plant growth regulators:** occurrence, physiological effects and practical applications of auxin, gibberellin and cytokinin. **Physioloy of flowering:**Photoperiodism and vernalization. **Seed dormancy:** causes and methods of seed dormancy, physiology of seed germination.

Text Book:

1. Jain, V.K. 2004. *Fundamentals of Plant Physiology*. S. Chand & Company Ltd. NewDelhi.

Books for Reference:

1. Noggle, G. R. and G. J. Fritz, 2008. *Introductory Plant Physiology*. Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Pandey, K.K. and B.K. Sinha, 2005. *Plant Physiology*. Vikas publications, New Delhi.
3. Salisbury, F.B. and C.W. Ross 2007. *Plant physiology*. Thompson. Asia. Pvt. Ltd. Singapore.

Practical Hrs per Week: 2

- Imbibition by direct weight method
- Determination of water potential by Chardakov's method
- Determination of differential transpiration of leaf surface using cobalt chloride method
- Estimation of magenisum in plant tissue
- Determination of effect of light intensity on photosynthesis
- Rate of photosynthesis in different concentration of bi-carbonate (bubble count method)
- Extraction and separation of chloroplast pigments by ascending paper chromatography
- Demonstration of aerobic respiration by Retort's method
- Demonstration on fermentation
- Determination of growth curve by leaf area method
- Estimation of auxin

Submission: Record note book

Books for Reference: Francis H Witham, David F Blaydes and Robert N Devlin, 1970.
Experiments in Plant Physiology.VanmostrandRainhold Company, New Delhi

SEMESTER VI			
Core XI	**Marine Botany**		
Code:18UBOC62	**Hrs/week: 5**	**Hrs/semester: 75**	**Credits: 4**

Vision:

- To give elaborate account on marine environment and its role in controlling the Earth's climate.

Mission:

- To understand the different types of marine habitats and the adaptation of life there in.
- To understand the role of marine products and their socio economic and environmental significance

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	analyze how marine organism adapt to their dynamic environment	5	Un
CO-2	understand the marine environment and classify them	7	Un
CO-3	able to signify the characteristic feature of sandy shore and sand dunes and their economic importance	1	An
CO-4	achieve practical skills in processing, preserving and culturing marine plants	6	Ev
CO-5	evaluate the uses of marine resources and realize the role of marine plants in the economy of the ocean	5	Ap
CO-6	able to signify the characteristic feature of coral reefs and their role in biodiversity conservation	1	An
CO-7	able to identify and understand the role of mangroves in coastal protection and their adaptation to its hostile environment	5	Ap
CO-8	explain the ecological relationship between organisms and their environment	2	An

SEMESTER VI			
Core XI	**Marine Botany**		
Code: 18UBOC62	**Hrs/week: 5**	**Hrs/semester: 75**	**Credits: 4**

Unit I : Marine environment- classification, physical and chemical properties of sea water, characteristics and adaptations of pelagic (planktonic), benthic (littoral and deep sea) organisms.

Unit II : Introduction to marine plants - Phytoplankton – sea weeds and sea grasses - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit III : Coastal vegetation – sandy shore and sand dunes - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit IV : Coastal shore vegetation – salt marshes and mangroves - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit V : Laboratory culture of marine algae, commercial cultivation of seaweeds – general methods – *Gracilaria* and *Porphyra*. Economic importance of marine algae – in food and agriculture. Phycocolloids – agar agar, algin, alginate, carrageenan – commercial production, properties and uses, diatomite, antibiotics and vitamins. Conservation of coastal ecosystem with special reference to coral reef and mangroves.

Text Books:

1. Bilgrami, K.S. and L.C. Saha, 2004. *Textbook of Algae.* CBS publishers & Distributors, New Delhi.
2. Tait, 1978. *Elements of marine ecology*. Butterworth & Co. (Publishers) Ltd. London.

Books for Reference:

1. Boaden P.J.S. and R. Seed 1985. *An Introduction to coastal ecology.* Thomas Press Limited, New Delhi.
2. Chapman, V.J. and Chapman, 1980. *Seaweeds and their uses* – Chapman and Hall, London.
3. Dawes, C.J. 1981. *Marine Botany*. John Wiley & Sons, New york.
4. Lobban, C.S. and M. J. Wynne. 1981. *The biology of Seaweeds*. Blackwell Scientific publications. Oxford, London.
5. Newell and Newell.1977. *Marine Plankton a practical guide.* Hutchinson and Co. Ltd.
6. Sinha, P. C. 1998. *Marine pollution*, Anmol publications Pvt. Ltd. New Delhi.
7. Sverdrup H.U. 1972. *The Oceans* – Modern Asia Edition.
8. Venkataraman, G.S. 1969. *The cultivation of algae*, IARI.

Practical Hrs per week: 2

- Phytoplanktons - Collection and identification
- Culture of micro algae
- Seaweeds- *Ulva, Sargassum, Hypnea* and *Gracilaria*
- Study of sand dune, salt marsh and mangrove vegetation in their natural habitat,
- Submission of photographs and field report for internal evaluation.

Books for Reference:

Murugesan A.G. and Rajakumari 2005. *Environmental Science and Biotechnology andBiotechnology, Theory and Techniques,* MJP Publishers.

Semester VI			
Core XII	**Ecology and Phytogeography**		
Code;18UBOC63	**hrs/week:4**	**Hrs/semester: 60**	**Credit : 4**

Vision:

- To learn about the interconnectedness of life with the environment

Mission:

- To understand the structure and function of ecosystem
- To analyze the different types of vegetation and their distribution pattern.

Course Outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	reveal the range of plant diversity in terms of structure, function and their environmental relationships.	5	Un
CO-2	describe the climatic and edaphic factors and ecological succession	5	Un
CO-3	categorize the plants based on adaptation	3	An
CO-4	address the global environment crisis and the strategies applicable for environmental problem mitigation	7	Ev
CO-5	learn the global level environmental summit organized that focused for sustainable future	7	Cr
CO-6	know the importance of remote sensing in finding the current status of global health	7	Cr
CO-7	recognize the causes of environmental problems	7	Un
CO-8	discuss ecological issues and concept	5	Re

Semester VI			
Core XII	**Ecology and Phytogeography**		
Code:18UBOC63	**hrs/week:4**	**Hrs/semester: 60**	**Credit : 4**

Unit I : Introduction. Ecological factors: Climatic factor – light, temperature, wind, precipitation and humidity. Biotic factors – Interaction between plants and animals, interaction between plants growing in a community and interaction between plants and microorganisms. Edaphic factors – soil temperature, soil nutrients and soil organisms.

Unit II : Plant adaptations – morphological, anatomical and physiological adaptations of hydrophytes, xerophytes and halophytes.

Unit III : Plat communities – Characteristic features, methods of analysis- quadrats and transect methods, units of vegetation.

Unit IV : Plant succession - types, causes, processes. Hydrosere and xerosers. Climax and its concepts.

Unit V : Geographical regions of India. Vegetational types of Tamil Nadu. Structure and distribution of evergrren and deciduous forests, mangroves, scrub jungle and grassland, Endemism.

Text Books:

1. Sharma, P.D1999.*Elements of ecology*. Rastogi Publications, Shivaji Road, Meerut.
2. Shukla, R.S. and Chandal, S.S 1991. *Plant Ecology*. S, Chandal and Co. New Delhi

Books for Reference:

1. Asthana and Meera Asthana, 2001. *Environmental problems and solutions*. S.Chand and Co. Ltd., New Delhi.
2. Balasubramanian,D; C.F.a. Bryee, K.Dharmalingam, J.Green and K. Jeyaraman, 2005. *Concepts in Biotechnology*. Universities Press.
3. Dash, M.C.2001.*Fundamentals of ecology*. Tata McGraw Hill publishing Co. Ltd., New Delhi.
4. Murugesan, A.G.and Rajakumari , 2005. *Environmental Science and Biotechnology, theory and Techniques.* M.J.P. Publishers, chennai.
5. Trivedi P.R, P.L Sharma and KN Sundarshan 1994. *Natural environment and Constitution of India*, Efficient offset printers, New Delhi.
6. Tyller Miller G., 2004. *Environment Science* Thompson Brooks/Cole. Singapore.
7. Varshney C.K 1989. *Water pollution and management*, S.P. Printers, Noida.

Practical Hrs per week: 2

- Determination of soil pH (at least 3 types of soil)
- Determination of soil texture.
- Determination of soil moisture.
- Determination of soil bulk density.
- Determination of soil porosity.
- Determination of soil organic matter content.
- Estimation of dissolved O_2 in water samples.
- Estimation of BOD in water samples.
- Estimation of COD in water samples.
- Adaptation of plants- hydrophytes, xerophytes and halophytes,

Submission - Record Note Book

Books for Reference : Murugesan A.G. and Rajakumari 2005.Environmental Science andBiotechnology and Biotechnology, Theory and Techniques, MJP Publishers