# ST. XAVIER'S COLLEGE (AUTONOMOUS)
# Palayamkottai - 627 002

**(Recognized as "College with Potential for Excellence" by UGC)**
**(Re-accredited with "A$^{++}$" Grade with a CGPA of 3.66)**

**SYLLABUS**

**B.Sc. BOTANY**
**(w.e.f 2021 - 22)**

**Programme: B.Sc. Botany**
**Programme Code: UBO**

## Program Specific Outcomes

Upon graduation, Botany majors should have a thorough knowledge and comprehension of the core concepts in the discipline of Plant Biology. These include the fact that:

1. Plants are *like* other organisms in regard to: basic metabolism, sexual reproduction, clonal reproduction, hormonally regulated development, ability to respond to the environment, diversity and evolution.
2. Plants are *unique* organisms in: their varied life histories - especially a sporic one with alternation of generations; their role as primary producers in food webs, serving as the interface organisms between the organic and inorganic worlds *via*mineral assimilation and photosynthesis; and the oxygenation of the atmosphere.
3. Plants serve as an important source of products: food, fiber, flavorings, feed, fuel, pharmaceuticals, etc.

Upon graduation, Botany majors should have mastered a set of fundamental skills which would be useful to function effectively as professionals and to their continued development and learning within the field of Plant Biology. These skills include the following:

1. 1. *Field and Laboratory Research Skills:* Botany majors should be competent observers and experimentalists, whether such research takes place in the field or in the laboratory.
2. *Critical Thinking Skills:* Botany majors should be able to engage in the following aspects of critical thinking: (i) differentiate between fact and opinion,(ii) develop inferential skills, (iii) recognize logical fallacies and faulty reasoning, and (iv) make decisions and judgments by drawing logical conclusions using sound quantitative or statistically-based reasoning. Critical thinking does not exclude imaginative and speculative thinking as it applies to science in general and botany specifically. To the extent that critical thinking skills are discipline- specific, students should understand that science and its methodology is a way of knowing.
3. *Problem-Solving Skills:* Botany majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information.
4. *Communications Skills:* Botany graduates will be required to demonstrate competence in communication, both written and oral.
5. Computer *Skills:* Botany graduates should be competent users of computer software including, but not limited to, word processing, spreadsheet, graphing, and web-search programs. Such skills are also imperative for organizing their required portfolios.
6. *Information-Seeking Skills*: For success in college and for lifelong learning, graduates must be able to: recognize when information is needed; to identify appropriate types of information; and to locate, evaluate, and use information

effectively, ethically, and legally.

7. *Cooperation/Social Responsibility Skills:* Graduates ought to understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills. *Self-Assessment Skills:* Graduates should be able to demonstrate progress in the development of their ability to make a realistic appraisal of growth in all three domains of learning (cognitive, conative, and affective). They should be able to identify, evaluate and explain major, if not pivotal, influences in their development as a botanist.

Upon graduation, Botany majors should demonstrate significant value-added progress in developing the following values:

1. *Appreciation* of the *diversity* of cultures and intellectual points of view.
2. *Understanding* of *ethical issues* and responsibilities such as the environmental costs of excessive consumerism, impacts of technology upon society, etc.
3. *Commitment* to the development of cultural perspectives that do not disparage others solely on the basis of an individual's or group's ethnicity, gender, religion, sexual orientation, marital status, age or disability.
4. *Appreciation* that Botany follows the *Liberal Arts* tradition which is based upon the notion that, in a world of ideas, a person is not free or liberated from the bonds of ignorance if s/he makes decisions based upon closed-minded habits, prejudices, or unconscious emotions that preclude critical thinking. Additionally, graduates will need to demonstrate growth in their social obligation to communicate with the public on scientific and technical issues.
5. *Appreciation* of the *aesthetic* attributes of nature, whether their studies are primarily in the field where entire ecosystems or biomes are investigated or in the laboratory where the microscope and biochemical techniques are used as tools for observing nature.

*All students who are exposed to Botany courses* should understand and appreciate, in addition to the core knowledge of Plant Biology, the nature of science, how science is applied to everyday problems, and significant botanical achievements.

**B.SC. BOTANY COURSE PATTERN**
WITH EFFECT FROM JUNE 2021

| Sem | Part | Status | Subject code | Papers | Hrs | Crdt |
|---|---|---|---|---|---|---|
| I | I | Lang | 21UGT11 | General Tamil– I | 6 | 3 |
| | | | 21UGH11 | Hindi – I | | |
| | | | 21UGF11 | French – I | | |
| | II | Lang | 21UGE11 | General English - I | 6 | 3 |
| | III | Core 1 | 21UBOT11 | Plant Diversity - I | 4 | 4 |
| | III | Core –P1 | 21UBOP12 | Practical - Plant Diversity I | 2 | 1 |
| | III | Allied -1 | 21UCHA11 | Chemistry- I | 4 | 4 |
| | III | Allied -P1 | 21UCHAP12 | Practical -Chemistry- I | 2 | 1 |
| | IV | NME-1 | 21UNM11 | Food & Nutrition | 2 | 2 |
| | IV | SBE -1 | 21USB11 | Integrated Personality Development | 2 | 2 |
| | IV | VE | 21UVE11 | Religion I/ Ethics | 2 | 2 |
| **Sub Total** | | | | | **30** | **22** |
| II | I | Lang | 211UGT21 | General Tamil– II | 6 | 3 |
| | | | 21GH21 | Hindi – II | | |
| | | | 21UGF21 | French – II | | |
| | II | Lang | 21UGE21 | General English - II | 6 | 3 |
| | III | Core -2 | 21UBOT21 | Plant Diversity II | 4 | 4 |
| | III | Core -P2 | 21UBOP22 | Practical - Plant Diversity II | 2 | 1 |
| | III | Allied -2 | 21UCHA21 | Chemistry- II | 4 | 4 |
| | III | Allied -P1 | 21UCHAP22 | Practical - Chemistry- II | 2 | 1 |
| | IV | NME - 2 | 21UNM21 | Gardening and Landscaping | 2 | 2 |
| | IV | SBE - 2 | 21USB21 | Life Issues and Coping Skill Development | 2 | 2 |
| | IV | PE | 21UPE21 | Professional English for Life Sciences (TANSCHE) | 2 | 2 |
| | | | | | | |
| **Sub Total** | | | | | **30** | **22** |
| III | I | Lang | 21UGT31 | General Tamil– III | 6 | 3 |
| | | | 21UGH31 | Hindi – III | | |
| | | | 21UGF31 | French – III | | |
| | II | Lang | 21UGE31 | General English - III | 6 | 3 |
| | III | Core - 3 | 21UBOT31 | Anatomy & Embryology | 4 | 4 |
| | III | Core - P3 | 21UBOP32 | Practical - Anatomy & Embryology | 2 | 1 |
| | III | Allied-3 | 21UZOA31 | Zoology- I | 4 | 4 |
| | III | Allied P1 | 21UZOAP32 | Practical - Zoology -I | 2 | 1 |
| | IV | SBE - 4 | 21USB31 | Human Rights and Social Analysis | 2 | 2 |
| | IV | SBE 5 | 21USB32 | Herbal Botany (Major students only) | 2 | 2 |
| | IV | EVS | 21UES31 | Environmental Studies | 2 | 2 |
| | | | | **Sub Total** | **30** | **22** |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **IV** | I | Lang | 21UGT41 | General Tamil– IV | **6** | **3** |
| | | | 21UGH41 | Hindi – IV | | |
| | | | 21UGF41 | French – IV | | |
| | II | Lang | 21UGE41 | General English - IV | 6 | 3 |
| | III | Core - 4 | 21UBOT41 | Taxonomy of Angiosperms | 4 | 4 |
| | III | Core – P4 | 21UBOP42 | Practical - Taxonomy of Angiosperms | 2 | 1 |
| | III | Allied-4 | 21UZOA41 | Zoology -II | 4 | 4 |
| | III | Allied – P1 | 21UZOAP42 | Zoology Practical -II | 2 | 1 |
| | III | Elective 1 | 21UBOTE41 | Plant Breeding / Floriculture | 4 | 4 |
| | IV | SBE - 6 | 21USB42 | Ecotourism | 2 | 2 |
| | **Sub Total** | | | | **30** | **22** |
| **V** | III | Core - 5 | 21UBOT51 | Biochemistry & Biophysics | 4 | 4 |
| | III | Core - 6 | 21UBOT52 | Cell Biology, Genetics & Evolution | 5 | 4 |
| | III | Core - 7 | 21UBOT53 | Ecology | 4 | 4 |
| | III | Core - 8 | 21UBOT54 | Microbiology & Plant Pathology | 4 | 4 |
| | III | Core -P5 | 21UBOP55 | Practical - Biochemistry & Biophysics | 2 | 1 |
| | III | Core - P6 | 21UBOP56 | Practical - Cell Biology, Genetics & Evolution | 2 | 1 |
| | III | Core -P7 | 21UBOP57 | Practical - Ecology | 2 | 1 |
| | III | Core -P8 | 21UBOP58 | Practical - Microbiology & Plant Pathology | 2 | 1 |
| | III | Elective -2 | 21UBOTE59 | Biological Techniques/Forestry | 5 | 5 |
| | **Sub Total** | | | | **30** | **25** |
| **VI** | III | Core - 9 | 21UBOT61 | Plant Physiology | 5 | 5 |
| | III | Core - 10 | 21UBOT62 | Molecular Biology and Genetic Engineering | 5 | 5 |
| | III | Core -11 | 21UBOT63 | Plant Biotechnology | 5 | 5 |
| | III | Core -P9 | 21UBOP64 | Practical - Plant Physiology | 3 | 2 |
| | III | Core -P10 | 21UBOP65 | Practical - Molecular Biology, Genetic engineering(2) & Plant Biotechnology(3) | 5 | 2 |
| | III | Elective- 3 | 21UBOTE66 | Biostatistics & Bio Informatics/ Agricultural Botany | 7 | 7 |
| **Sub Total** | | | | | **30** | **26** |
| **STAND** | | | | | -- | 1 |
| **Grand Total** | | | | | **180** | **140** |

| Extra Credits, Certificate and Diploma Courses | | | | | |
|---|---|---|---|---|---|
| I | ECC 1 | 21UBOTECC1 | Entrepreneurship Botany | 30 | 2 |
| II | ECC2 | 21UBOTECC2 | Introduction to Microscopy | 30 | 2 |
| III | ECC3 | 21UBOTECC3 | Mushroom Technology | 30 | 2 |
| IV | ECC4 | 21UBOTECC4 | Renewable Energy Resources | 30 | 2 |
| V | ECC5 | 21UBOTECC5 | Botany for Competitive examinations | 30 | 2 |
| VI | ECC6 | 21UBOTECC6 | Project | 30 | 2 |
| | Certificate Course | | Food Technology | | |
| | Diploma Course | | Bioinformatics | | |

**PLANT DIVERSITY - I**
**(ALGAE, FUNGI, LICHENS & BRYOPHYTES)**
**(SUB. CODE: 21UBOT11)**

| SEMESTER - I | CORE - 1 | HOURS - 4 | CREDITS – 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- List out the diversity of lower group of plants. (K1)
- Describe the difference between the various classes of algae. (K2)
- Explain the morphological and anatomical characters of algae, fungi and bryophytes.(K3)
- Apply the knowledge to identify the different species of algae, fungi and bryophytes.(K4)
- Classify the economic importance of lower group of plants.(K5)
- Understand the evolution of lower group of plants (K2)

**(Developmental studies not included)**

**UNIT: I**

**Algae:** General characters of the algae - Outline classification of algae according to Fritsch. Detailed study of the following types: (occurrence, structure of thallus and cell, reproduction and life cycle)

Chlorophyceae:*Chlorella, Volvox. Caulerpa.*

**UNIT: II**

Phaeophyceae: *Dictyota*
Rhodophyceae: *Gracilaria*
Cyanophyceae: *Nostoc*
Economi cimportance of algae.

**UNIT: III**

**Fungi:** General characters of the fungi. Outline classification proposed by Alexopoulous and Mims (1979). Detailed study of the following fungi (occurrence, structure, reproduction and life cycle).Zygomycetes*: Pilobolus.*

**UNIT: IV**

Ascomycetes: *Peziza*
Basidiomycetes: *Polyporus*
Economic importance of fungi.
Lichens: *Usnea*- morphology, anatomy and reproduction. Economic importance of lichens.

**UNIT: V**

General characters of the bryophytes. Outline classification by Rothmaler (1951).Detailed study of the following types –*Marchantia* and *Funaria.*Economic importance of Bryophytes.

**TEXT BOOK**

1. **Pandey, S. N. & P.S. P. Trivedi. 1994 :** Text Book of Botany, Vikas Publishing House Pvt. Ltd., Delhi.

**REFERENCES**

1. **Dube, H. C. 2005.** Introduction to Fungi. Vikas publishing House, New Delhi.
2. **Gangulee, Das and Kar. 1959.** College Botany Vol II, Central Book Depot, Allahabad.
3. **Singh, Pandey and Jain. 2000.** A Text Book of Botany, Rastogi Publications
4. **Vashishta, B. R.2002.**The Algae, S. Chand & Co., New Delhi.
5. **Vashishta, B. R.2002.**The Fungi, S. Chand & Co., New Delhi.
6. **Vashishta, B. R.2003.** The Bryophytes, S. Chand & Co., New Delhi.
7. **Alexopoulus, C.J., Mims, C. W., Blackwell, M. 1988.** Introductory Mycology, Wiley Eastern Ltd., New Delhi.
8. **Parihar, N. S. 1967.**Bryophyta, Central Book Depot, Allahabad.
9. **Fritsch, F. E. 1972.**The Structure and Reproduction of Algae. Vol I& II. Cambridge University Press, London.
10. **Vashsita, B. R., Sinha, A.K. and Singh, V. P. 2007.**Algae. S. Chand & Co., New Delhi.
11. **Vashsita, B. R., Sinha, A.K. and Singh, V. P. 2007.** Fungi. S. Chand & Co., New Delhi.
12. **Vashsita, B. R., Sinha, A.K. and Singh, V. P. 2007.**Bryophytes.S. Chand & Co., New Delhi.

**PRACTICAL - I**
**PLANT DIVERSITY – I**
**(21UBOP12)**
**(ALGAE, FUNGI, LICHENS & BRYOPHYTES) –PRACTICALS**

| SEMESTER - I | HOURS - 2 | CREDIT - 1 |
|---|---|---|

**Study of the following types:**

Algae : *Nostoc, Chlorella, Volvox, Caulerpa, Dictyota, Gracilaria.*
Fungi : Pilobolus, *Peziza, Albugo, Polyporus*
Lichens : *Usnea.*
Bryophytes : *Funaria* or *Polytrichum, Marchantia.*

**Field Visit to three different sites –Submission of field report (10 marks)*

## ALLIED CHEMISTRY-I (FOR BOT AND ZOO)
## (SUBJECT CODE:21UCHA11)

| Semester: I | Allied: A1 | Credits : 4 | Hours/W :4 |
|---|---|---|---|

**Objectives:**

- To know the structure and properties of compounds
- To understand the concepts of redox system and types of reactions
- To identify the intermolecular forces in different molecules.
- To Study the chemistry of carbon and nitrogen compounds
- To Know the synthesis of important aminoacids.

**Outcome: Students Can**

- Identify bonding and structure of organic and inorganic compounds
- Familiar with the acid-base concepts and their applications
- Understand the role of hydrogen bonding and other molecular forces through different applications
- Get the knowledge of different functionalities and their properties
- Assimilate the importance of protiens and aminoacids in biological systems.

**Unit I: Chemical Bonding** **12 hrs**

**Self Study:** Atomic number, mass number, isotopes, electronic configuration of atoms and ions.

Valency and valence electrons - Electronic theory of valency -Electrovalency-conditions favouring electrovalency-illustration -Electrovalent compounds and their properties - covalency- conditions favouring covalency-illustration- Covalent compounds and their properties- coordinate covalency-conditions favouring formation of the bond-illustration- Transition from lectrovalency to covalency- polarisation and polarizability-Fajan's rules-statement and illustration- Atomic orbitals-Definition-charge cloud interpretation-shapes of s,p and d orbitals- Overlapping of atomic orbitals-conditions for overlap-types(s-s, s-p,and p-p) with illustrations-sigma and pi overlaps- hybridisation $sp^3$ in $CH_4$, $sp^2$ in $BF_3$ and sp in $BeCl_2$. Geometry of $H_2O$ and $NH_3$ molecules-VSEPR theory.

**Unit II: Redox systems and analytical chemistry-I** **12 hrs**

**Self Study:** oxidation, reduction, acids and bases.

Redox systems- Redox reactions in terms of electron transfer - Oxidation number-Definition-Rules for assigning oxidation number- Calculation of oxidation number- Redox processes in terms of oxidation number- Advantages and disadvantages of the concept- Acids and bases-Arrhenius concept –illustration- Lowry-Bronsted concept-conjugate acid and conjugate base - Types of reactions relevant to qualitative analysis - Displacement reaction – Decomposition - Double decomposition- Hydrolysis- redox reaction- Complex formation- Interfering anions and their elimination- Group reagents and analytical group classification- Explanation and application of the following principles in qualitatiive analysis- Solubility and solubility product- Common ion effect- pH- Buffer

**UNIT III: Intermolecular forces and properties of liquids 12 hrs**

**Self Study:** pure covalent bonds with examples, electro negativity, conductors, insulators, boiling point, melting point

Polar and non-polar molecules - Dipole-dipole (Debye) forces, dipole-induced dipole (Keesom) forces, Induced dipole-Induced dipole (London) forces. Repulsive forces - Resultant intermolecular energies- Hydrogen bonding-Nature of hydrogen bonding-conditions favouring hydrogen bonding- Types of hydrogen bonding-illustrations-impact of hydrogen bonding on melting points, boiling points and solubilities. Electrolysis - What is electrolysis-strong and weal electrolytes - Mechanism of electrolysis - Electrical units-coulomb,Amphere, Ohm and Volt- Faradays laws of electrolysis and their importance - Conductance of electrolyte – Conductance- Specific conductance and molar conductance-Units - of equivalent conductance with concentrations

**UNIT IV: Aldehydes, Ketones, Acids and Amides 12 hrs**

**Self Study**: aliphatic compounds, aromatic compounds, Functional group of aldehydes, ketones and amides

Aliphatic aldehydes and ketones-Nomenclature-General reactions- Formaldehyde- a comparison with other aldehydes of the series - Aromatic aldehydes-Reactions of benzaldehyde-benzaldehyde compared with acetaldehyde - Aromatic ketones-Aceton, acetophenone and benzophenone-distiction- Aliphatic saturated monocarboxylic acids-Nomenclature, general reactions-comparison of formic acid with other acids of the series. Aromatic saturated monocarboxylic acids-distinction between benzoic acid and acetic acid - Aliphatic amides-nomenclature, general reactions - Aromatic amides – Distiction between benzaldehyde and acetamide.

**UNIT V: Amines, Amino acids and Proteins 12 hrs**

**Self Study:** Functionalities of amino acids and amines, Functionalities of proteins (nitrogen containing compounds)

Aliphatic monoamines - Nomenclature and classification - General reactions- Aniline-Reactions of aniline- Distinction between aniline and ethylamine- Amino acids-classification-zwitter ions-isoelectric point-preparation and properties of glycine and alanine- Proteins-introduction-peptides and polypeptides-partial hydrolysis and terminal residue analysis in the determination of structure of peptides.

NOTE : Course materials will be supplied to the students**.**

**ALLIED CHEMISTRY PRACTICAL-I (FOR BOT AND ZOO)**
**INORGANIC QUALITATIVE ANALYSIS**
**(Subject code:21UCHAP12)**

| Semester : I | Allied : AP1 | Credit :1 | Hours/w :2 |
|---|---|---|---|

Qualitative anlysis of a simple salt containing one anion and one cation

**Anions** :Carbonate, Borate, Fluoride, Oxalate and Phosphate
**Cations** : Lead, Bismuth, Copper, Cadmium, Cobalt, Nickel, Manganese, Zinc, Barium, Strontium and Ammonium

Note: Laboratory manual will be supplied.

**FOOD & NUTRITION**
**(21UNM11)**

| SEMESTER - I | NME HOURS - 2 | CREDITS - 2 |
|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Identify the nutritious food crops in daily life.(K1)
- Describe the different types of nutritional rich foods and their importance. (K3)
- Differentiate the various groups of vegetables, fruits and their nutritional status. (K2)
- Apply the nutritional knowledge and identify the quality food crops for overcoming the nutritional deficiency. (K4)
- Modify the food habits based on the information given by the ICMR. (K5)
- Calculate the BMI, BMR and maintain the good health. (K6)

**UNIT: I**

Introduction to nutrition- food as a source of nutrients and energy, Functions of food – Adequate, Optimum and good nutrition – Malnutrition – Food intake and energy expenditure – energy unit of food – energy content of different foods.

**UNIT: II**

Basal metabolic rate – body mass index, maintenance of ideal body weight, Lifestyle related diseases – overweight and obesity – diabetes – blood pressure – cardiovascular diseases.

**UNIT: III**

Carbohydrates – functions, food sources – storage in body – Proteins – sources – essential and non-essential amino acids – functions – protein deficiency.

**UNIT: IV**

Fats and Oils – composition – saturated and unsaturated fatty acids – functions of fats – vitamins – types, functions, deficiency diseases – Minerals – macro and micronutrients – functions – sources and bioavailability of calcium – iron – sodium and potassium.

**UNIT: V**

Food sanitation and hygiene – Diets – different types of diet – diabetic diet – low carbohydrate and high fibre diet – anorexia and bulimia – Importance of traditional foods for healthy diet.

**TEXT BOOK**

**1. Swaminathan M, 2000.** Handbook of Food and Nutrition Vol I and II CFTRI, Mysore

## PLANT DIVERSITY - II
## (PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)
## (SUB. CODE: 21UBOT21)

| SEMESTER – II | CORE - 2 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Identify the non-flowering vascular plants in their environment (K1)
- Summarize the characteristics feature of Pteridophytes & Gymnosperms (K2)
- Differentiate non-seeded plants with seeded plants (K2)
- Determine the richness of Pteridophytes and Gymnosperms in India (K3)
- Understand the evolutionary history and relationship among various group of plants (K2)
- Classify the plants based on their morphological and anatomical features (K4)
- Justify the economic importance of plants in sustainable developemnt of human beings (K4)

### Pteridophytes (Developmental studies not included)

**UNIT: I**

General characters and life cycle pattern of homosporous and heterosporous Pteridophytes. Heterospory and seed habit. Classification of pteridophytes according to K. R. Sporne. Economic importance of Pteridophytes: Edible, Medicinal, Ornamental, Biofertilizers, Phytoremediators and other uses.

**UNIT: II**

Detailed study (Ecology, distribution, morphology, anatomy and life cycle) of the following genera: *Lycopodium, Equisetum, Pteris, Selaginella* and *Marsilea*.

### Gymnosperms (Developmental studies not included)

**UNIT: III**

General characters and life cycle pattern of Gymnosperms. Classification according to K.R.Sporne. Economic importance of Gymnosperms: Timber, Edible, Ornamental, Medicinal, Gums / Resins, other uses.

**UNIT: IV**

Detailed study (Morphology, Anatomy, Ecology, Distribution and Life cycle) of the following genera: *Cycas, Pinus* and *Gnetum.*

### Paleobotany

**UNIT: V**

Definition and importance of Paleobotany. Geological time table. Fossilization process and types of fossils. Detailed study of the following genera: *Rhynia, Lepidodendron* and *Lyginopteris.* Contribution by BirbalSahni. Indian fossils: *Cyatheasiwalika* and *Glossopteris* sp.

**TEXTBOOK**


1. 1. **Sambamurty, A. V. S. S.2005.**Textbook of Bryophytes Pteridophytes Gymnosperms and Paleobotany. I K International,New Delhi.
2. **Pandey S.N., S.PMisra and P.S.Trivedi. 2005.** A text book of Botany Vol. II. Vikas Publishing House, Pvt. Ltd. New Delhi.


**REFERENCES**


1. **Bhatnagar S. P. and AlokMoitra.1996.** Gymnosperms. New Age International Ltd., Publishers, New Delhi.
2. **Pandey, B. P**. 1978. Pteridophyta. S. Chand & Company Ltd., New Delhi.
3. **Rashid, A.1990.** An introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd., New Delhi.
4. **Srivastava, H. N.1990.** Fundamentals of Pteridophytes. Pradeep Publications, Jalandhar.
5. **Vashista, P. C.1997.**Pteridophyta. S. Chand and Company Ltd., New Delhi
6. **Vashista, P. C.1991.** Gymnosperms. S. Chand and Company Ltd., New Delhi.
7. **Sporne, K. R.** The Morphology of Pteridophytes, Hutchinson & Co, London.
8. **Sporne, K. R.** The Morphology of Gymnosperms, Hutchinson & Co, London.
9. **Bera, S.*et al.*, 2014.** First megafossil evidence of Cyatheaceous tree fern from the Indian Cenozoic. *J. Earth Syst. Sci.***123**: 1433-38.
10. **Surange, K. R.1966.**Indian Fossil Pteridophytes. Botanical Monograph, No. 4, Council of Scientific & Industrial Research, New Delhi.

**PRACTICAL -II**
**PLANT DIVERSITY - II**
**(21UBOP22)**
**PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY**

| SEMESTER - II | HOURS - 2 | CREDIT - 1 |
|---|---|---|

1. Morphological and anatomical studies on vegetative and reproductive parts of:
   i. **Pteridophytes:** *Lycopodium, Equisetum, Pteris, Selaginella, Marsilea.*
   ii. **Gymnosperms:** *Cycas, Pinus, Gnetum*
   ***iii.*** **Paleobotany:** *Rhynia, Lepidodendron, Lyginopteris.*
2. **Field visit** to nearby evergreen forests to study the ecology and distribution of Pteridophytes and Gymnosperms.
3. **Herbarium visit** to observe the common/rare, endangered Pteridophytes and Gymnosperms of South India.– Submission of field report (10 marks).

## ALLIED CHEMISTRY-II (FOR BOT AND ZOO)
## (SUBJECT CODE:21UCHA21)

| Semester: II | Allied: A2 | Credits : 4 | Hours/W :4 |
|---|---|---|---|

**Objectives:**

- **To understand and correctly use thermodynamic terminology.**
- To describe the composition and properties of colloidal dispersions and surface phenomena
- To distinguish between monosaccharides, disaccharides, and polysaccharides
- To study the special arrangement of atoms in a molecule and know how role of hetero atoms in organic compounds
- To understand the basic concepts of quantitative analysis

**Outcome: Students Can**

- **Explain fundamental thermodynamic properties**
- List and explain several technological applications of colloids
- Summarize the roles carbohydrates, alkaloids and terpenoids play in biological systems.
- Figure out how many stereoisomers a compound has, and synthesis of a few heterocyclic molecules.
- Prepare and standard solutions and standardize an unknown solution.

**Unit-I : Thermodynamics** **12 hrs**

**Self study:** ideal gas, ideal gas equation, homogeneous reactions and heterogeneous reactions, heat.

Introduction - Basic terminology and functional concepts- System, boundary and surrounding- Types of systems: open, closed and isolated- Properties of a system: extensive and intensive - State of a system and state variables (or state functions)

Thermodynamic equilibrium - Process and types: Isothermal, adiabatic, isochoric, isobaric, cyclic, reversible, and irreversible- comparison between isothermal and adiabatic processes, reversible and irreversible processes - Internal energy as a state function- components of internal energy- Work: Thermodynamic concept-types of work - Heat : Thermodynamic concept- Heat and work as path functions - First law of thermodynamics- Statement of the law of conservation of energy- Mathematical expression of the law- Application of the law- Heat capacity, specific heat capacity and molar heat capacity of asystem- Relation between molar hear capacities of gases- Enthalpy and enthalpy change- Enthalpy as a state function- Relation between $\Delta H$ and $\Delta E$- Enthalpies of reaction, formation and combustion-Definition and illustration- standard state- Calculation of enthalpy change using Hess law- Bond enthalpies and bond dissociation enthalpies-Definition and illustration using $CH_4$ as example (Numerical problems not expected)- Spontaneous (natural) process- Entropy-it's meaning of disorder- Gibb's free energy-its meaning as available energy- Criteria for spontaneity

**UNIT : II Surface chemistry and Colloidal Chemistry 12 hrs**

**Self study:** Adsorbent, adsorbate, molecular interactions.

Adsorption chemistry-introduction-definition-distinction from adsorption- Adsorption and adsorbate-definition and explanation- Chromatography-introduction- Adsorption chromatography-column chromatography, TLC- Partition chromatography-ascending chromatography- $R_f$ value and its significance- Ion exchange chromatography-gas liquid chromatography (GLC), high - Types of colloidal systems- Classification of colloids-Lyophilic and lyophobic sols-a comparison- Stability of colloids-origin of charge-electrical double layer-salvation- Electrical properties-electrophoresis and electro-osmosis- Gels-gelation-classificatio-properties of gels-hydration, swelling or inhibition, syneresis and thixotropy- Emulsions-types of emulsion-identification of emulsion-dilution test, dye test, spreading test, viscosity and electrical conductivity-de-emulsification- Application of colloid in food, medicine, industry, purification of water, artificial rain, blue colour of the sky and cleaning action of soap.

**UNIT : III Carbohydrates, Alkaloids and Terpenoids 12 hrs**

**Self study:** Examples for food contains carbohydrates

Introduction- Monosaccharide- Reaction of glucose- Open chain structure and ring structure of glucose (elucidation not expected)- Epimers, mutarotation- Interconversion of glucose into fructose and vice versa- Disaccharides- Reactions and structure of sucrose (elucidation nor expected)- Structure of maltose and lactose (elucidation not expcted)- Polysaccharide- Starch- amylase and amyl pectin-type of glycosidic linkage- Reaction of starch-action of heat-, hydrolysis and with iodine- Alkaloids- Definition, classification, (based on structure) occurrence and extraction- General methods of identification-functional nature of oxygen-functional nature of nitrogen-unsaturation-exhaustive methylation-Structure of conine- Terpenoids- Introduction, classification of terpenoids-Isoprene rule-Structure of citral (synthesis not included)

**UNIT : IV Stereoisomerism and Heterocyclic compounds 12 hrs**

**Self study:** Isomers, cyclic compounds, practice to draw the structure of simple molecules like $H_2O$, $NH_3$ etc.

Optical isomerism- Plane polarized light - Optical activity - Asymmetric carbon-chirality - Elements of symmetry-plane of symmetry- axis of symmetry-centre of symmetry-dissymmetric- Van't Hoff-le Bel theory- Optical isomerism of tartaric acid- Racemization - Resolution of racemic-mixture-biochemical method, chemical method and chromatographic method- Geometrical isomerism- Cause for geometrical isomerism- Illustration of compounds containing C-C double bond - Heterocyclic compounds- Pyrrole- Introduction-aromatic character- Basic and acidic character of pyrrole- Pyridine- Electronic interpretation of electron-rich centers- Reaction of pyridine- Quinoline- Skaraup synthesis - Reactions of quinoline

**UNIT : V Analytical Chemistry-II 12 hrs**

**Self study:** Solvent, solute, solution, saturated solution, unsaturated solution, equivalent weight.

Methods of expressing concentration of solution- Normality- Molarity- Molality- Mole fraction- Equivalent weight of acids, bases, oxidizing agent and reducing agent- Standard solution- Primary standard- Secondary standard-Preparation of standard solution-Principles underlying the following types of titration-Acid-base titration-theory of indicator-Permanganimetry-Dichrometry-Iodometry and Iodimetry-EDTA

Note: Course materials will be supplied to the students.

**ALLIED CHEMSITRY PRACTICAL-II (FOR BOT AND ZOO)**
**INORGANIC VOLUMETRIC ESTIMATIONS**
**(Subject Code : 21UCHAP21)**

| **Semester : II** | **Allied AP2** | **Credit : 1** | **Hours/W : 2** |
|---|---|---|---|

| **S.NO** | **Estimation** | **Link** | **Standard** |
|---|---|---|---|
| 1 | Strong acid | Weak base/ Strong base | Strong acid |
| 2 | Strong acid | Strong base | Weak acid |
| 3 | Strong base | Strong acid | Weak base |
| 4 | Oxalic acid | Potassium permanganate | Oxalic acid |
| 5 | Ferrous sulphate | Potassium permanganate | Ferrous ammonium sulphate |
| 6 | Potassium dichromate | Ferrous sulphate | Potassium dichromate |
| 7 | Ferrous ammonium sulphate | Potassium dichromate | Ferrous sulphate |
| 8 | Potassium permanganate | Sodium thiosulphate | Potassium dichromate |
| 9 | Magnesium sulphate | EDTA | Zinc sulphate |
| 10 | Zinc sulphate | EDTA | Magnesium sulphate |

Note: Laboratory manual is supplied.

## GARDENING AND LANDSCAPING
## (SUB. CODE 21UNM 21)

| SEMESTER - II | NME- 2 | HOURS - 2 | CREDITS – 2 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the list of gardens present in our country (K1)
- Summarize the principles of gardening and landscaping (K2)
- Demonstrate the facilities and requirements needed to establish a garden (K3)
- Categorize the various components of a garden (K4)
- Evaluate the difficulties associated with cultivation of garden plants (K5)
- Establish his/her own kitchen or ornamental garden (K6)

**UNIT: I**

Ornamental garden, Importance of garden making- Principles of designing a garden. Choice of plants for a garden.

**UNIT: II**

Garden components – Lawn – trees, shrubs and shrubberies – climbers and creepers – flower beds and borders

**UNIT: III**

Ornamental hedges – Edges and edgings – drives, roads, walks and paths – Rockery and water garden– Carpet beds

**UNIT: IV**

Topiary –Trophies. Indoor gardening Propagation methods of garden Plants- Preparation of soil and its composition, manuring, watering and maintenance,

**UNIT: V**

Basic principles of landscape design – components of landscape design – plant materials and structural materials. Landscaping of residential, public areas, schools and colleges.

**REFERENCES**


1. **Kumar, N.1989.**Introduction to Horticulture.Rajalakshmi publications.Nagercoil.
2. **Edmond J.B., Senn T.L., Andrews F.S&Halfacre R.G. 1977.**Fundamentals of Horticulture. Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. **ManibhusanRao, K. 1991.** Text book of Horticulture, Mac millan India, New Delhi
4. **Sheela V. L. 2011.** Horticulture, MJP publishers, Chennai.

**PROFESSIONAL ENGLISH FOR LIFE SCIENCES**
**(Sub Code:21UPE21)**

| SEMESTER - II | SBE- 2 | HOURS - 2 | CREDITS – 2 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recognize their own ability to improve their own competence in using the language (K2)
- Understand the importance of reading for life (K2)
- Use language for speaking with confidence in an intelligible and acceptable manner (K3).
- Apply the language skills of students by offering adequate practice in professional contexts (K3).
- Focus on developing students' knowledge of domain specific registers and the required language skills. (K3)
- Read independently unfamiliar texts with comprehension and analyze the importance of writing in academic life (K4)

**Unit 1- Communicative Competence Listening** – Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions) Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions Reading: Two subject-based reading texts followed by comprehension activities/exercises Writing: Summary writing based on the reading passages.

**Unit 2 - Persuasive Communication Listening:** listening to a product launch- sensitizing learners to the nuances of persuasive communication Speaking: debates – Just-A Minute Activities Reading: reading texts on advertisements (on products relevant to the subject areas) and answering inferential questions Writing: dialogue writing- writing an argumentative /persuasive essay.

**Unit 3- Digital Competence Listening to interviews (subject related) Speaking:** Interviews with subject specialists (using video conferencing skills) Reading: Selected sample of Web Page (subject area) Writing: Reading Comprehension: Essay on Digital Competence for Academic and Professional Life.

**Unit 4 - Creativity and Imagination:** Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos) Speaking: Making oral presentations through short films – subject based Reading: Essay on Creativity and Imagination (subject based) Writing – Basic Script Writing for short films (subject based) - Creating blogs, flyers and brochures (subject based) - Poster making – writing slogans/captions (subject based)

**Unit 5-Workplace Communication & Basics of Academic Writing Speaking:** Short academic presentation using PowerPoint Reading & Writing: Product Profiles, Circulars, Minutes of Meeting. Writing an introduction, paraphrasing Punctuation and Capitalization.

**TEXTBOOK:**

1. Text book on Professional English for Life sciences (2020), TANSCHE

**REFERENCE BOOKS:**


1. **Sharma, Sangeeta and Binod Mishra(2015)** Communication Skills for Engineers and Scientists. New Delhi: PHI Learning (6th Reprint)
2. **Butterfield, J(2010)** Soft Skills for Everyone. New Delhi: Cengage Learning.
3. **Chauhan, G.S. (2016)** and Sangeeta Sharma. Soft Skills. New Delhi: Wiley publications
4. **Kumar, Sanjay and Pushp Lata (2011)** Communication Skills. New Delhi: OUP.
5. **Lucas, Stephen E. (2014)** The Art of Public Speaking McGraw-Hill Book Co. International Edition, (11th Ed.)
6. **Thorpe, Edgar and Showick Thorpe (2004)** Winning at Interviews. Pearson Education.
7. **Turk, Christopher (1985)** Effective Speaking. South Asia Division: Taylor & Francis.

## ANATOMY AND EMBRYOLOGY
## (SUB. CODE: 21UBOT31)

| SEMESTER – III | CORE - 3 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Acquire basic knowledge of various kinds and organization of plant tissues (K1).
- Understand the developmental aspects of plant structures (K2).
- Understand the development of male and female reproductive structures in plants (K2).
- Examine and illustrate the fertilization process in plants (K3).
- Differentiate the development of embryo and endosperm in dicots and Monocots (K2)
- Analyze the application of apomixis and polyembryony (K4)

**UNIT: I**

The cell wall – ultra structure and chemistry of the cell wall – Meristems: classification (based on position, origin and function) – shoot apex (Tunica Corpus theory). Root apex (Korper-Kappe theory). Xylem and phloem – structure, components and functions.

**UNIT: II**

Vascular cambium –origin,structure and function. Normal secondary thickening in dicot stem and dicot root.Anomalous secondary thickening in*Boerhaavia* and *Dracaena.*

Brief study on nodal anatomy: Unilacunar node (*Justicia*), trilacunar node (*Azadirachta*), multilacunar node (*Aralia*).

**UNIT: III**

Leaf anatomy: dicot leaf – dorsiventral (*Hibiscus*), isobilateral (*Eucalyptus*); monocot leaf (*Saccharum*), Kranz anatomy.

Structure and development of microsporangium; tapetum – types and functions; anther wall developmental types.

Microsporogenesis - structure and development of male gametophyte.

**UNIT: IV**

Megasporangium: structure of ovule, types of ovules, Megasporogenesis – structure and development of the female gametophyte (*Polygonum, Allium* and *Peperomia*).

Fertilization: germination and growth of pollen tube, entry of pollen tube into the ovule and embryosac – pollen tube discharge – double fertilization and post-fertilization changes.

**UNIT: V**

Types and development of endosperms (nuclear, cellular and helobial) – ruminate endosperm. Development of dicot embryo (*Capsella* type) and monocot embryo (*Luzula* type).

Polyembryony: Classification/ types and causes.
Apomixis: Vegetative reproduction – agamospermy – apospory and parthenogenesis.

**TEXTBOOKS**


1. **Pandey, B. P. 2001.** A text book of Botany: Angiosperms (Fifth Edition), S. Chand Publishing.
2. **Bhojwani, S. S. &Bhatnagar, S. P. 2008.** The Embryology of Angiosperms, VikasPublishing House Pvt. Ltd.,Noida.
3. **Chandurkar, P. J. 1977.** Plant Anatomy,Oxford and IBH.
4. **Pandey, S. N. &Chadha, A. 1997.** Plant Anatomy and Embryology, Sangam Books Ltd
5. **Fahn, A. 1990.** Plant Anatomy. Pergamon Press.


**REFERENCES**


1. **Vashishtha, P. C. 2000**. Plant Anatomy, S. Nagin& Co.
2. **Pandey, B. P. 1978.** Plant Anatomy, S. Chand & Co.
3. **Maheshwari, P. 1971.**An introduction to the Embryology of Angiosperms, Tata McGrawHill Publishing Co., New Delhi.
4. **Pandey, A K. 1997.** Introduction to Embryology of Angiosperms,CBS Publishers &Distributors, New Delhi.

**PRACTICAL - III**
**ANATOMY AND EMBRYOLOGY**
**(21UBOP32)**

| SEMESTER - III | HOURS - 2 | CREDIT - 1 |
|---|---|---|

**ANATOMY:**

1. Simple and complex permanent tissues
2. Stem: Dicot (young and old), monocot.
3. Root: Dicot (young and old), monocot.
4. Anomalous secondary thickening: dicot stem - *Boerhaavia,* Monocot stem - *Draceana*
5. Nodal anatomy: Unilacunar (*Justicia*), trilaculanar (*Azadirachta*) and multilacunar (*Aralia*).
6. Leaf anatomy: Dicot – Dorsiventral (*Hibiscus*), isobilateral (*Eucalyptus*). Monocot (*Saccharum)*.
7. Demonstration of maceration technique to study the components of wood (secondary xylem)
8. Submission of least five double stained permanent slides.

**EMBRYOLOGY:**

9. Different stages of anther development – *Datura*
10. Different types of ovules.
11. Pollen viability test (Acetocarmine method).
12. Observation of pollen germination – *in vivo* (on the stigma) and *in vitro*
13. Dissection of early stages of embryo development (*Tridax/* Cucumber/ Mustard).
14. Endosperm: Cellular/Nuclear. (Coconut, Maize, Rice).

**Field / Lab visits:** Visit to reputed research institutes engaged in anatomy and reproductive biology of angiosperms / collection of different wood samples from local saw mills.

**ZOOLOGY- I**
**ANIMAL STRUCTURE AND FUNCTION**
**(Subject Code: 21UZOA31)**

| Semester: III | Allied Theory: 1 | Credits: 4 | Hours: 4 |
|---|---|---|---|

**Course Objective:** To provide basic and advanced knowledge of animals on taxonomy, morphology and physiology of animals

**Course Outcomes:** At the end of the course the students will be able to:

1. Identify and classify animals
2. Distinguish the structural organization of an invertebrate from a vertebrate
3. Examine the process of digestion, respiration and excretion in humans
4. Illustrate circulatory and nervous system of human body
5. Summarize the role of hormones in reproduction.
6. Integrate animal structure with its functions.

**Unit I: Invertebrata** **12 Hours**

Salient features of invertebrates, classification up to phyla with diagnostic features and examples. Type study: Cockroach

**Unit II: Chordata** **12 Hours**

Classification up to classes of Vertebrata with diagnostic features and examples; Type study: Frog – External morphology, digestion, respiration and circulation, reproductive systems

**Unit III: Digestion, Respiration and Excretion in man** **12 Hours**

Digestion – structure of alimentary canal, Physiology of digestion and absorption; Respiration – structure of lungs, respiratory pigments, transport of oxygen and carbon dioxide, respiratory quotient; Excretion - structure of kidney and nephron, mechanism of urine formation.

**Unit IV: Circulation, Nervous system and Receptors in man** **12 Hours**

Circulation – structure of heart, composition and functions of human blood, cardiac cycle, blood pressure; Nervous system - structure of neuron, nerve impulse conduction, reflex action; Receptors - Structure of eye and physiology of vision.

**Unit V: Endocrine Glands and Reproductive System** **12 Hours**

Structure and hormones of endocrine glands - Pituitary, thyroid, adrenal, islets of Langerhans; Human reproductive system, female reproductive cycle, contraceptives.

**Textbooks:**


1. Jordan, E.L., Verma, P.S. 2012. Invertebrate Zoology, S. Chand and Company.
2. Verma, Tyagi, Agarwal, 1997. Animal Physiology, S. Chand and Company.
3. Ayyar, E. 2009. A manual of Zoology, Volume 11, S. Visvanathan P Ltd., Chennai.


**Reference books:**


1. EkambaranathaAyyar M., Ananthakrishnan, T.N. 1995. A Manual of Zoology, Vol. I (Invertebrata) Part I & II. Viswanathan Pvt. Ltd.
2. Kotpal, R.L. 2000. Invertebrates, Rastogi Publications.
3. Rastogi, S.C. 2001. Essentials of Animal Physiology, New Age International Publications.

**E-resources:**

1. https://www.pmfias.com/classification-animalia-animal-kingdom/
2. http://www.biologydiscussion.com/invertebrate-zoology/21-general-characteristics-of-invertebrates/28088
3. http://biology.tutorvista.com/organism/vertebrates.html
4. http://www.arvindguptatoys.com/arvindgupta/human-body-systems.pdf
5. https://www.wsfcs.k12.nc.us/cms/lib/NC01001395/Centricity/Domain/8472/Body%20Systems%20Interactions%20chart.pdf
6. http://www.cabrillo.edu/~jtice/HSERV%20162/FUNCTIONALOrganization%20of%20the%20Human%20Body.pdf
7. http://samples.jbpub.com/9781449652609/99069_ch05_6101.pdf
8. https://www.saylor.org/site/wp-content/uploads/2010/11/The-Endocrine-System.pdf
9. https://www.scarsdaleschools.k12.ny.us/cms/lib5/NY01001205/Centricity/Domain/214/BRGT0390.pdf

**PRACTICAL - ZOOLOGY -I**
**ANIMAL STRUCTURE AND FUNCTION - PRACTICALS**
**(Subject Code: 21UZOA32)**

| Semester: III | Allied Practical: 1 | Credit: 1 | Hours: 2 |
|---|---|---|---|

1. Virtual dissection of cockroach (Digestive system, Nervous system and Reproductive system).
2. Mounting of Cockroach, mosquito, housefly mouthparts
3. Mounting of prawn appendages
4. Collection, isolation of soil nematodes
5. Virtual dissection of frog (Digestive system, Nervous system and Reproductive system).
6. Effect of temperature on salivary amylase activity.
7. Qualitative estimation of excretory products.
8. Observation of cellular constituents of human blood.
9. Quantitative Estimation of haemoglobin using haemoglobin meter.
10. Demonstration of blood pressure.
11. Slide mounted specimens: *Paramecium, Leucosolenia*
12. Preserved specimens: *Hydra, Taenia solium, Ascaris, Megascolex, Palaemon, Pila globosa, Asterias, Amphioxus, Balanoglossus, Ascidian, Anguilla, Rhacophorous, Chamaeleon, Naja naja*, Pelican, Parrot, Rabbit, Bat, *Manis* (pangolin),
13. 3-D Models: Human system / organs: – digestive system, lungs, kidney, nephron, heart, neuron, eye, thyroid.

## HERBAL BOTANY
## (SUB. CODE 21USB 32)

| SEMESTER - III | SBE- 5 | HOURS - 2 | CREDITS – 2 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Identify the sources of food, medicine and cosmetics (K1)
- Describe the herbal wealth of our country (K2)
- Illustrate the significance of herbal medicines (K3)
- Justify the safety of herbal medicines (K4)
- Support the reintroduction of traditional food & medicine (K5)
- Integrate the usage of herbs in their daily life (K6)

**UNIT: I**

Herbs as a source of food, medicine, ornamentals, cosmetics. Herbal wealth of Tamil Nadu.

**UNIT: II**

Medicines: Ginger, holy basil, *Gloriosa superba*

Common herbal preparations used as medicine (any two)

**UNIT: III**

Ornamentals: *Chrysanthemum*, *Catharanthus roseus*, *Crossandra*

**UNIT: IV**

Cosmetics: *Aloe vera*, Turmeric, Henna (*Lawsonia inermis*)

**UNIT: V**

Food: Rice, Wheat, Ragi Common herbal preparations used as food (any two)

**TEXTBOOKS**


1. **Das, P.C. 2009.** Economic Botany, AITBS Publishers, New Delhi.
2. **Verma,V. 2009.** Text book of Economic Botany, Ane Books Pvt. Ltd., New Delhi.

## TAXONOMY OF ANGIOSPERMS
## (SUB. CODE: 21UBOT41)

| SEMESTER - IV | CORE - 4 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Analyze vegetative and reproductive morphology of plants (K4)
- Understand the role of Herbarium, use of Floras and Monographs (K2)
- Realize the classification and nomenclature of plants (K3)
- Examine and identify the taxonomic features of local plants and their respective families (K4).
- Remember various Species and Genus in each family (K1).
- Compare, contrast and categorize the features based on a simple taxonomic key for local plants (K5).
- Justify the economic importance of angiosperm in sustenance of human beings (K6)

**UNIT: I**

Objectives of Systematic botany. Morphology: Leaf types, stem, root and leaf modifications. Inflorescence, Flower structure and fruit types.Taxonomic hierarchy, Botanical Survey of India. Contributions to Indian Botany: Fyson, Gamble and Mathew.Flora of Tirunelveli hills.

**UNIT: II**

Herbarium Methodology: Definition, its utility in the study of plants; Procedure: Plant collection, poisoning, pressing, drying, mounting, identification, preservation, field book and field data. Nomenclature: Definition, importance of binomial nomenclature and ICN (Typification, Author citation, Retention and Rejection of names and valid publication). Principles of ICN and Rule of priority.

**UNIT: III**

Systems of Classification: Artificial, Natural and Phylogenetic. A detailed study of Bentham and Hooker's system-merits and demerits.Study of the following families with reference to the morphology, taxonomy and economic importance: *Annonaceae, Sterculiaceae,Rutaceae, Meliaceae.*

**UNIT: IV**

Study of the following families with reference to the morphology, taxonomy and economic importance: *Leguminosae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadaceae.*

**UNIT: V**

Study of the following families with reference to the morphology, taxonomy and economic importance: *Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Poaceae, Liliaceae.*

**TEXTBOOKS**

1. **Gangulee, Das, Datta& Sen. 1986.** College Botany Vol.I 6th Ed. New Central Book Agency.
2. **Singh, V & Jain, D. K. 1985.** Taxonomy of Angiosperms, 2nd Ed. S. Chand & Co.
3. **Lawrence, G. H. M. 1974.**Taxonomy of Vascular Plants,Macmillan, New Delhi.

**REFERENCES**

1. **Vashista, P. C. 1988.**Taxonomy of Angiosperms, S. Chand & Co., New Delhi.

**PRACTICAL - IV**
**TAXONOMY OF ANGIOSPERMS**
**(SUB.CODE. 21UBOP42)**

| SEMESTER - IV | HOURS - 2 | CREDITS - 1 |
|---|---|---|

1. Identification of commonly available Leaf, Inflorescence and Fruit types.
2. Technical description of plant parts, including floral parts (L. S. of flower, floral diagram and floral formula) with reference to the families prescribed in theory.
3. Identification of the plant specimens with reference to their families following the Bentham & Hooker's classification.
4. Study of local flora to acquire knowledge to identify them on the spot.
5. Field work (in one or two nearby floristic regions of the Western Ghats in Tirunelveli district) under supervision and submission of 10 herbarium sheets of widely occurring common plants, field book, etc., for internal and external valuation.
6. Submission of record work for valuation in the semester practical examination

***Field work at different habitats and submission of reports (10 marks)***

**ZOOLOGY -II**
**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**
**(Subject code: 21UZOA41)**

| Semester: IV | Allied Theory: 2 | Credits: 4 | Hours: 4 |
|---|---|---|---|

**Course Objective:** To inculcate the fundamental aspects of the immune system, antigen antibody reaction as well as techniques involved in animal cell culture and gene manipulation.

**Course Outcomes:** At the end of the course the students will be able to:

1. Describe the concepts, components and principles of immune system
2. Explain primary and secondary lymphoid organs
3. Demonstrate antigen and antibody interactions and their techniques
4. Classify hypersensitivity and autoimmune disorders
5. Summarize animal cell culture techniques.
6. Design techniques in gene manipulation

**Unit I: Immune system** **12 Hours**

Concepts, components and principles of innate and adaptive immune systems; Haematopoiesis; Cells of immune system - B cells, T cells and macrophages; Primary and secondary lymphoid organs.

**Unit II: Antigen and Antibodies** **12 Hours**

Antigens – properties, types and determinants; Antibody (Immunoglobulin) – classes, structure, mechanism of action, functions; Monoclonal and polyclonal antibodies; ELISA and RIA techniques and their applications.

**Unit III: Immuno-prophylaxis, Hypersensitivity and Autoimmunity** **12 Hours**

Vaccines – definite, types, mechanism of action, immunization schedule; Hypersensitivity - Definition, types, treatment of type I anaphylactic hypersensitivity; Autoimmunity – classification, disorders and therapy.

**Unit IV: Animal cells culture** **12 Hours**

Characteristic features of animal cells in growth; Requirement - culture media, Equipments; Isolation of animal tissue- physical and chemical methods; Establishment of cell culture - primary, secondary cell culture and cell lines; Organ and embryo culture.

**Unit V: Technique of gene manipulation in animals** **12 Hours**

Strategies of r-DNA technology; DNA finger printing ;Gene transfer methods; Cloning methods-Dolly; Transgenic animals; causes of infertility in male and female *; in vitro* fertilization (IVF) and embryo transfer.

**Textbooks:**

1. Chakravarthy Ashik, K. 1996. Immunology – Tata Mc Graw-Hill Publishing Company Ltd., New Delhi.
2. Purohit, S. S. 2000. Biotechnology Fundamentals and Applications, Agrobios, Jodhpur, India
3. Roitt I.M. 2000. Essential Immunology. Blackwell Scientific Publishers, London.

**Reference Books:**

1. Kuby, J. 1999. Immunology W.H. Freeman and Company, New York.
2. Roitt, Brostoff and Male, 1993. Immnunology, Mosby, London.
3. Gupta, P. K. 1999. Elements in biotechnology, Rastogi Publication, Meerut, India.

**E-resources:**

1. https://microbiologyinfo.com/antigen-properties-types-and-determinants-of-antigenicity/
2. http://www.kean.edu/~jfasick/docs/Fall%2009%20&%20SP10%20%20A&PII/Chapter%2021b.pdf
3. http://jeeves.mmg.uci.edu/immunology/CoreNotes/Chap04.pdf
4. http://cdrwww.who.int/immunization/documents/Elsevier_Vaccine_immunology.pdf
5. http://www.lab.anhb.uwa.edu.au/hb313/main_pages/timetable/lectures/2007%20Tissue%20Culture%20Lecture%202%20combinedBjanka.pdf

**ZOOLOGY PRACTICAL -II**
**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY - PRACTICAL**
**(Subject code: 21UZOA42)**

| Semester: IV | Allied Practical: 4 | Credit: 1 | Hours: 2 |
|---|---|---|---|

1. ABO Blood grouping and Rh factor.
2. WBC count in human blood
3. Double immuno diffusion technique
4. Radial immuno diffusion
5. Separation of lymphocytes
6. Haemagglutination test
7. Cell viability test
8. Blood coagulation/ Clotting time
9. Rat lymphoid organs
10. Extraction of protein from animal tissue
11. Extraction of genomic DNA from human blood
12. Tissue culture media preparation

13. Spotters: Immunoglobulins, Thymus, Bone marrow, Lymph node, Macrophage, Spleen, Bursa of fabricius, Antigen and antibody reaction, Engineered vaccine, Transgenic mice, Animal cloning – Dolly, Monoclonal antibodies, Cell growth curve, Embryo culture – *invitro* fertilization.

## PLANT BREEDING
## (SUB. CODE 21UBOTE41)

| SEMESTER - IV | ELECTIVE- 1 | HOURS – 4 | CREDIT – 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Describe the aim and objectives of plant breeding (K1)
- Interpret the genetic basis of pollination (K2)
- Explain various techniques involved in crop improvement programs (K3)
- Demonstrate the applications of plant breeding (K5)
- Analyze the significances of conventional and modern breeding methods (K4)
- Justify the role of plant breeding in fulfilling the material and food needs of growing human population (K6)

**UNIT: I**

History and objectives of plant breeding; centers of origin, plant introduction – history, agencies, procedure, germplasm collection, merits and demerits. Modes of reproduction; Control of pollination – self incompatibility, male sterility.

**UNIT: II**

Pollination, modes of pollinations, importance of pollinations and pollinators, Genetic consequences of pollination, Difference between self and cross pollinated crops (variation – heritable and non-heritable). Self incompatibility, Male sterility and its importance.

**UNIT: III**

Selection–mass selection, pureline selection, clonal selection with reference to methodology, merits and demerits, their application.

**UNIT: IV**

Heterosis and Inbreeding depression–effects of inbreeding, genetic basis of heterosis – theories explaining heterosis and inbreeding depression.

**UNIT: V**

Improvement of crop plants by pedigree method,bulk method, backcross method – procedure, merits and demerits of the above breeding methods.Breeding for specific characters.

**TEXTBOOK**

1.**Singh, B.D. 1990.**Plant Breeding. Kalyani Publishers, New Delhi.

**REFERENCES**

1. **Allard, R.W. 1960.**Principles of Plant Breeding, John Wiley and Sons, Inc. New York.
2. **Simmonds, N.W. 1979.**Principles of Crop improvement. Longman, London

## FLORICULTURE

**(SUB. CODE 21UBOTE41)**

| SEMESTER - IV | ELECTIVE- 1 | HOURS – 4 | CREDIT – 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Understand the various types of flowers cultivated in India (K1)
- Realize the various cultivation procedures for the different flowers (K2)
- Compare the importance of various flowers based on their marketing values (K3)
- Develop the attitude of becoming entrepreneur (K4)
- Adopt a system of cultivation method for the species which can be grown in their habitat (K5)
- Evaluate the methods of cultivation of various types of flowers that can be grown in their respective places (K6)

**UNIT: I**

Scope and importance of floriculture in India. Production techniques of ornamental plants for domestic and export markets. Growing of flowers under protected environments such as glass house, plastic house etc. Post-harvest technology of cut flowers in respect of commercial flower crops, dehydration techniques for drying of flowers, Production techniques for bulbous plants.

**UNIT: II**

Scope of cut flower in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, nursery management, media for nursery, special nursery practices.

**UNIT: III**

Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and $CO_2$ on growth and flowering.

**UNIT: IV**

Flower Production - water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

**UNIT: V**

Crops: Cut rose, cut chrysanthemum, carnation, gerbera, gladioli, orchids, anthurium, aster, cut foliages and fillers. Cultivation and marketing of crops.

**REFERENCES**


1. **Lauria, A. &Victor, H. R. 2001.**Floriculture - Fundamentals and Practices.Agrobios.
2. **Prasad S & Kumar U. 2003.**Commercial Floriculture.Agrobios

## ECOTOURISM
## (SUB. CODE 21USB 42)

| SEMESTER - IV | SBE- 6 | HOURS - 2 | CREDITS – 2 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Describe the management and conservation of Ecotourism spot. (K2)
- Identify the ecotourism places and to conserve the ecotourist spots without affecting the natural resources. (K1)
- Apply the knowledge about Ecotourism spots and management of ecotourism resorts. (K3)
- Describe the Economics and quality Management of Ecotourism. (K4)
- Apply the Knowledge to develop the different components of Successful ecotourism.(K5)
- Summarize the concept of Ecotourism and become a stakeholder, Operator and lodge owners of Ecotourism spots. (K6)

**UNIT: I**

Ecotourism-definition, history and evolution of ecotourism, advantages and disadvantages of ecotourism. Ecosystem management in ecotourism and protected areas. Ethics in ecotourism.

**UNIT: II**

Ecotourism development-international, national and regional perspectives. Identification of suitable spots for ecotourism. Eco-branding and Eco-labeling.

**UNIT: III**

Economics of ecotourism – Total quality management in ecotourism resorts.

**UNIT: IV**

Ecotourism and the community – ecotourism as a model for sustainable tourism.

**UNIT: V**

Components of successful ecotourism – stakeholders, industry, agents, operators and lodge owners. Future of ecotourism

**TEXTBOOKS**

1. **Kulwant Sing Pathania and Arun Kumar**. 2008. Ecotourism. Regal Publications.

**REFERENCES**


1. **Buckley, R. 2003.** Case studies in Ecotourism. Cambridge, CABI.
2. **Buckley, R. ed. 2004.** Environmental impacts of ecotourism. Oxfordshire, CABI.
3. **Bulbeck, C. 2005.** Facing the wild: ecotourism, conservation, and animal encounters. Earthscan.
4. **Ceballos-Lascurain,H. 1996.** Tourism, ecotourism, and protected areas. Gland: IUCN
5. **Diamantis, D. 2004.** Ecotourism: Management and Assessment,Thomson Press.
6. **Fennell, D. A. 1999.** Ecotourism: an introduction. Routledge Press.

## BIOCHEMISTRY & BIOPHYSICS
## (SUB. CODE: 21UBOT51)

| SEMESTER - V | CORE - 5 | HOURS - 4 | CREDITS – 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the various biomolecules that make up the body of aliving organism (K1)
- Understand the biomolecules that are very essential for the normal growth of living organisms (K2)
- Analyze the role of different biomolecules in the metabolism of living organism (K3)
- Compare the different cycle of pathways of living organism (K4).
- Explain the importance of reactions catalyzed by the enzymes (K5)
- Evaluate the role of light in the living world (K6)

**UNIT: I**

Biochemistry: Definition and scope. Basic concepts of atoms, molecules and types of bonding in biomolecules. Isomerism – types, structural – stereo and optical Basic principles and applications of colorimetry, centrifugation, chromatography and pH metry. Buffers – definition pH scale and biological significance of buffers.

**UNIT: II**

Carbohydrates: Nomenclature, definition and classification. -Monosaccharides: glucose – structure: linear/ open chain, ring form, chair and boat model. Properties of monosaccharides.- Disaccharides: structure and classification– maltose, lactose, sucrose. Polysaccharides: structure and classification – starch, cellulose, hemicellulose and pectin.

**UNIT: III**

Amino acids: classification based on polarity and electrical charge. Structure and properties of amino acids.

Proteins: classification based on composition, solubility, shape and function. Structure: primary – peptide bond, N and C terminals. Secondary – types of bonding in secondary structure. Tertiary – types of bonding in tertiary structure - Physical and chemical properties of proteins.

**UNIT: IV**

Lipids: Classification of lipids, saturated and unsaturated fatty acids. Cholesterol, bile acids, bile salts and porphyrins.Properties of lipids. Simple lipids: fats and oils. Compound lipids: Phospholipids – phosphoglyceride, glycolipids - Derived lipids: steroids, terpenes, carotenoids (with an example each).

Vitamins: structure, importance, source, deficiency symptoms of water-soluble vitamins e.g. thiamine, riboflavin, niacin – fat soluble vitamins: Vit A and D.

Plant pigments: structure and biological importance of chlorophyll, carotenoids and xanthophylls.

**UNIT: V Biophysics:**

Bioenergetics: energy and work – laws of thermodynamics. Concepts of entropy and free energy.

Enzymes – Classification, properties, active site, Mechanism of enzyme action.

Photobiology: dual nature of light – characteristics of electromagnetic radiation, action and absorption spectrum energy states, light emission – phosphorescence, fluorescence and bioluminescence.

**TEXT BOOK**

1. **Jain J. L. 2001.**Fundamentals of Biochemistry. S. Chand and Company Ltd., New Delhi

**REFERENCES**

1. **Conn, E. E. and Stumpf, P. K. 2004.**Outlines of Biochemistry, Wiley Eastern Ltd.
2. **Lehninger, A. L. 1974.**Biochemistry, Kalyani Publishers.

## CELL BIOLOGY, GENETICS & EVOLUTION
## (SUB. CODE: 21UBOT52)

| SEMESTER - V | CORE - 6 | HOURS - 5 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recite the importance of cells in the living world (K1)
- Explain the basic concepts of heredity (K2)
- Explain cell-cell communication and cell-environment communication (K2)
- Demonstrate the structure and functions of cell organelles (K3)
- Outline the fundamental differences between prokaryotes and eukaryotes (K4)
- Justify the concepts of evolution in the origin of life (K5)

**UNIT: I**

Structural and organizational differences between prokaryotic and eukaryotic cells. Chemical composition, structure and functions of plasma membrane, nucleus and ribosomes.

**UNIT: II**

Structure and functions of the cell organelles: endoplasmic reticulum, mitochondria, chloroplast and Golgi complex. Cell division: Stages of mitosis and meiosis - Different phases of cell cycle.

**UNIT: III**

Mendel's law of inheritance. Interaction of genes and modified Mendelian ratios (Epistasis, Complementary genes and duplicate genes). Chromosomal basis of heredity: Linkage and crossing over- three point crosses-construction of chromosomal map.

**UNIT: IV**

Sex determination (Chromosomal methods only). Multiple alleles: Blood group in man and self-sterility in plants. Polygenic inheritance- Ear length in maize. Extra chromosomal inheritance: Plastid inheritance in plants. Genetic Syndromes: Down's, Klinefelter's and Turner.

**UNIT: V**

Evolution: Concepts of origin of life. Theory of organic evolution (Oparin and Urey–Miller experiment**).** Theories of evolution: Lamark, Darwin, Post - Darwin's era and Hugo De Vries. Speciation – an overview and species radiation.

**TEXTBOOKS**


1. **Prescott, D. M.** 1988. Cells: Principles of molecular structure and functions.Jones and Barlett Publishers. Boston, U.S.A.
2. **Sinnot, Dunn &Dobzhansky**. 1958. Principles of Genetics. Tata McGraw-Hill Publishing Co., New Delhi.

**REFERENCES**


1. **Gardner, E. J., Simmons, M. J. &Snustad, D. P. 1984.** Principles of Genetics., John Wiley & Sons Inc., New York.
2. **Gupta, P.K.1997.** Cytology, Genetics and Evolution, Rastogi Publications, Meerut.
3. **Kavita B. Ahluwalia.1985.** Genetics, New Age International Publishers, New Delhi.
4. **Strickberger, M. W.2000.** Genetics, Prentice Hall of India, New Delhi.
5. **Winter, P. C., Hickey, G. I. & Fletcher, H.C**. 1999. Instant Notes in Genetics. Viva Books Private Ltd., New Delhi.

# ECOLOGY
## (SUB. CODE: 21UBOT53)

| SEMESTER - V | CORE - 7 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Describe or define the abiotic and biotic factors of interaction. (K1)
- Explain the importance of ecology and ecosystems for the survival of the biosphere will be learnt. (K2)
- Apply the knowledge of pollution control and biodiversity conservation. (K3)
- Analyze the reason for population increase, natality rate and mortality rate.(K4)
- Measure the environmental pollution factors and apply the knowledge how to control the pollution. (K5).
- Support the *in- situ* and *ex -situ* conservation of the environment.(K6)

**UNIT: I**

Definition, plant ecology and its divisions. Applications of plant ecology. Plant adaptations to the environment; ecophysiological adaptations, xerophytes, hydrophytes, epiphytes, mesophytes, heliophytes and halophytes.

**UNIT: II**

Ecosystem ecology: Definition, structure and components. Energy and its flow in ecosystem. Biogeochemical cycles – Carbon, water, nitrogen, phosphorus, water. Ecological niche and habitat.

**UNIT: III**

Population: definition, properties (density, natality, mortality, age – structure, population growth). Biotic interactions: positive and negative interactions. Community ecology: community concept, characteristics of community, community structure. Succession and climax concept, Kinds succession, hydrosere, xerosere.

**UNIT: IV**

Environmental Pollution: Definition, Causes and effect of water, soil, thermal and radiation pollution on ecosystem. Waste water treatment. Biological methods of control of water and soil pollution.

**UNIT: V**

Biodiversity concept and definition. Conservation biology: Principles and aims of conservation; *in-situ* conservation of biodiversity, sanctuaries, national parks, biosphere reserve, sacred groves. *Ex-situ* conservation, Zoological park, Botanical gardens.

Phytogeography- principles of phytogeography, types of plant distribution: continuous, discontinuous and endemic. Theories of distribution. Continental drift, theory of land bridges, age and area hypothesis, centres of origin of plants.

**TEXTBOOKS**

1. **ErachBharucha, 2005.** Text book of Environmental studies, UGC New Delhi.
2. **Misra, R., 1973.** Ecology workbook, Oxford & IBH Publishing Co New Delhi.
3. **Odum, E. P. 1996.** Fundamentals of Ecology, Sounders Co Philadelphia

**REFERENCES**


1. **Shanna, P. D. 2011.**Ecology and Environment, Rastogi publications, Meerut.
2. **Shukla, R. S. and Chandel, P. S. 2006.** A text book of Plant Ecology, S Chand & Company, New Delhi
3. **Verma, P. S. and Agarwal, V. K. 2014.** Environmental Biology, Principles of Ecology 2nd Edition, S. Chand & Company Ltd, New Delhi
4. **Verma, V. 2011.**Plant Ecology, Ane Books Pvt Ltd. Chennai.
5. **Weaver and Clements. 1938.** Plant Ecology, McGraw-Hill, University of California.

## MICROBIOLOGY AND PLANT PATHOLOGY
## (SUB. CODE: 21UBOT54)

| SEMESTER - V | CORE - 8 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the basic principles ofmicrobiology (K1)
- Understand the biological structure of microbes (K2)
- Analyze the importance of microbes in our lives and the ecosystem (K3)
- Compare the various facets of the life of a microorganism (K4)
- Apply the importance of microbes in the life of human beings and plants species (K5)
- Identify the diseases caused by microbes on plant and apply the control measures(K6)

**UNIT: I**

Contributions to microbiology by Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, Christian Gram.Morphology of bacterial cells - size, shape, arrangement- fine structure of bacterial cells. Cell wall and its chemical composition – flagella - pili (Fimbriae), capsule, cytoplasmic membrane, mesosomes and endospores. Nutritional types of bacteria- Outline of Bergey's classification of bacteria. Economic importance of Bacteria.

**UNIT: II**

Bacterial Growth – measurement of growth – phases of growth-physical conditions required for growth (temperature, gaseous atmosphere, pH). Reproduction of bacteria- binary fission, conjugation, transduction and transformation. Bacterial virus – morphology and structure-reproduction-lytic and lysogenic cycles. Plant virus–TMV – structure and multiplication.

**UNIT: III**

Control of microorganisms- sterilization, disinfectants, antiseptic germicide, bactericide, bacteriostasis, antimicrobial agents, physical and chemical agents for controlling microorganisms (high temperature, low temperature, desiccation, osmotic pressure, radiation, detergents and formaldehyde.)

Water microbiology: potable and non-potable water. Tests for detection of coliform bacteria in water, sewage treatment- primary, secondary and tertiary oxidation ponds-sewage treatment by aerobic digestion. Industrial microbiology: vinegar production- microorganisms involved uses.

**UNIT: IV**

Plant diseases- concept, classification and importance- Identification of plant diseases-Koch's Postulates-disease development: Inoculum, inoculum potential-penetration, infection, colonization of host- exit of pathogens-defence mechanisms-mechanical and structural.

**UNIT: V**

Study of the following diseases with reference to causal agents, symptoms and control measures a. Paddy blast, b. Powdery mildew of black gram, c. Tikka disease of groundnut, d. Bunchy top of banana, e. Black arm of cotton, f. Citrus canker, g. Little leaf of brinjal, h. Smut of Sorghum (Grain Smut), i. Red Rot of sugarcane and j. Wheat rust (Brown Rust)

**TEXT BOOK**

1. **Sharma, P. D. 2000.** Microbiology and Plant Pathology, Rastogi& Co., Meerut.

**REFERENCES**

1. **Purohit, S. S. 2000.** Microbiology - Agro Botanica, New Delhi
2. **Powar, C. B. &Daginawala. 2000.** General Microbiology Vols. I & II - Himalaya Publishing House
3. **Rangaswami, G. 1988.** Diseases of crop plants in India, Prentice Hall of India Pvt. Ltd. Delhi.

**PRACTICAL –V**
**BIOCHEMISTRY & BIOPHYSICS**
**(SUB. CODE: 21UBOP55)**

| SEMESTER - V | CORE - P5 | HOURS – 2 | CREDITS – 1 |
|---|---|---|---|

1. Qualitative tests for carbohydrates (glucose, lactose, sucrose and starch), proteins and lipids.
2. Quantitative estimation of total carbohydrates by DNSA method.
3. Estimation of proteins by Lowry method.
4. Estimation of lipids.
5. Estimation of total phenol.
6. Separation of amino acids/plant pigments by paper chromatography.
7. Separation of phospholipids by TLC.
8. Preparation of acetate/ phosphate buffers.
9. Saponification value of a vegetable oil.
10. Estimation of nitrate reductase / peroxidase activity.
11. Separation of plant pigments by paper chromatography.

## PRACTICAL– VI
## CELL BIOLOGY, GENETICS & EVOLUTION
## (SUB. CODE: 21UBOP56)

| SEMESTER - V | CORE – P6 | HOURS – 2 | CREDITS – 1 |
|---|---|---|---|

1. Solving simple problems including interaction of genes - Monohybrid Cross, Dihybrid Cross, Incomplete dominance, Lethal genes, Interaction of genes (Complementary Genes, Epistasis – Dominant and Recessive, Duplicate Genes).
2. Solving genetic problems using statistical methods: Chi-Square (Monohybrid, Dihybrid and Interaction of genes).
3. Construction of chromosome map from three point crosses.
4. Study of cell inclusions: Druses, Raphides, Cystoliths, Sclereids& Different types of starch grains.
5. Study of different stages of mitosis and meiosis by squash and smear technique.
6. Histochemical analysis of selective plant cell organelles.
7. Karyotype analysis.
8. Electron Micrographs of plant cell and living inclusions.

**PRACTICAL – VII**
**ECOLOGY**
**(SUB. CODE: 21UBOP57)**

| SEMESTER - V | CORE – P7 | HOURS - 2 | CREDIT – 1 |
|---|---|---|---|

1. Morphological and anatomical adaptations of
    a. Phyllode - *Parkinsonia*
    b. Cladode – *Asparagus*
    c. Cladophyll – *Opuntia*
    d. Stem – *Casuarina*
    e. Leaf – *Nerium*
    f. Stem – *Hydrilla*
    g. Petiole – *Eicchornia*
    h. Pneumatophore – *Avicennia*
    i. Aerial Root – *Vanda*
2. Vegetational Studies – Study of Vegetation by Line Transect, Quadrat method and Biological Spectrum
3. Water Analysis
    a. Estimation of phytoplanktons
    b. Estimation of DO, TDS, EC, turbidity, salinity and chlorinity
    c. Estimation of Na and K using Flame photometer
    d. Estimation of Phosphate
    e. Estimation of Alkalinity

**Fieldwork at different habitats and submission of report (10 marks)*

## PRACTICAL - VIII
## MICROBIOLOGY AND PLANT PATHOLOGY
## (SUB. CODE: 21UBOP58)

| SEMESTER - V | CORE – P8 | HOURS – 2 | CREDIT – 1 |
|---|---|---|---|

**MICROBIOLOGY**

1. Sterilization of glassware.
2. Preparation of media
   i. Nutrient medium
   ii. Czapeckdox agar medium
   iii. PDA medium.
3. Pour plate & Streak plate technique
4. Hanging drop experiment
5. Staining of bacteria by Gram's stain method.
6. Microbiological examination of different habitats (air, sewage, pond, well, tap water)
7. Tests to detect *E. coli* contamination.
8. Counting of microbes – cell count method

**PATHOLOGY**

9. Symptoms, Casual organisms and control measures of the diseases prescribed in the syllabus.
10. Infected leaf sectioning.

## BIOLOGICAL TECHNIQUES
## (SUB. CODE: 21UBOTE59)

| SEMESTER – V | ELECTIVE – 2 | HOURS - 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the physical basis of instruments (K1)
- Familiarize the principles and functions of various instruments routinely used in biological laboratory to analyze the biological samples (K2)
- Differentiate the higher end variations among instruments of same type (K2)
- Interpret the importance of instruments in measuring the variables among biological samples (K2)
- Apply the relevant techniques for their upcoming project works and experimental works (K3)
- Solve problems associated with safety features and SOP of instruments (K4)

**UNIT: I**

**Microscopic techniques:** Resolving power - Definition - Principles, design and applications of light (Bright field, dark field), Phase contrast, fluorescent microscope - Calibration and measurements in microscopy. Electron microscopy - principles and applications of TEM and SEM – Basic principles of classical and digital photomicrography.

**UNIT: II**

**Spectroscopic techniques:** Basic principles, Beer's and Lambert's law,Visible Spectroscopy and UV Spectroscopy, single beam and double beam spectrometer, design of spectrophotometer, fluorescence spectroscopy, IR spectroscopy, Applications of spectroscopy

**UNIT: III**

pH and pH metry, pH meter, Buffers, components of a pH meter, calomel electrode and silver electrode, Centrifugation– principles, basic design and components, rotors, different types of centrifuges, Applications.

**UNIT: IV**

Chromatographic methods- principle of paper, Thin Layer and Column chromatography, Applications of different principles in different types of chromatographic methods - GC, GLC and HPLC

**UNIT: V**

Electrophoretic techniques - Principles and construction of vertical and horizontal electrophoresis - supporting media preparation (gels for protein and nucleic acids).Buffers and electrolytic separation - detection and estimation of electrophorograms by transilluminators and gel doc.

**TEXTBOOKS**


1. **Anbalagan, K. 1999.** Electrophoresis, Biotech, Yercaud, Tamil Nadu, India.
2. **Bryan C Williams and Keith Wilson. 1983.** A biologist guide to practical techniques of practical biochemistry, Second Edition, Edward Arnold Publications.
3. **David Plummer. 1987**. An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi
4. **Gurumani, N. 2006.** Research Methodology, S. Chand and Co., New Delhi.
5. **Jayaraman, J. 1992.** Techniques in Biology, Higginbothams Pvt. Ltd., Madras.

**FORESTRY**
**(SUB. CODE: 21UBOTE59)**

| SEMESTER - V | ELECTIVE – 2 | HOURS - 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Understand the knowledge of the forest wealth of India and its Importance (K1)
- Realize the importance of forest products (K2)
- Apply the knowledge to manage the forests to maximize its return while conserving it for future generations (K3)
- Analyze the ways of protection of forest and wildlife biology (K4)
- Develop a method to conserve the existing forest ecosystem (K5)
- Adapt any suitable method for people involvement in protecting forest (K6)

**UNIT: I**

**Forest ecosystem:** Biotic and abiotic components; forest community concepts, nutrient cycling in forests, Forest types in India, Classification of Forests (Champion and Seth, 1968), Forest types in Tamil Nadu – eg. The Shola Forest and the Mangrove Forest.

**UNIT: II**

**Silviculture:** General Silvicultural Principles: Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests, Silviculture of economically important species in India: *Casuarina equisetifolia, Eucalyptus Sp, Pinus roxburghi, Tectona grandis.*

**UNIT: III**

**Forest Resources and Utilization:** Non-Timber Forest Products (NTFPs): gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants, charcoal, lac and shellac. Timber identification - general principles. Pulp, paper and rayon.

**UNIT: IV**

**Forest Protection & Wildlife Biology**: Injuries to forest - abiotic and biotic, destructive agencies, insect - pests and disease, effects of air pollution on forests and forest die back. Effect of wild animals on forest regeneration, human impacts; encroachment, poaching, grazing.

**UNIT: V**

**Conservation of forests:** Importance of forests in Carbon sequestration, the social, cultural and economic value of forests and ecosystem services, Indian Forest Policy (1990), National Forest Policy (1988), People's involvement in protecting forests, Joint Forest Management, Involvement of women in forest conservation.

**TEXTBOOK**

1. **Dietrich Brandis**, 2010. Indian Forestry, Nabu Press.
2. **Antony Joseph Raj and Lal, S. B.,** 2012. Forestry Principles and Applications, Scientific Publishers.

**REFERENCES**

1. **Frederick S. Backer, 1950.** Principles of Silviculture, McGraw Hill Book Co., New York.
2. **Donald Bruce and Grancis X. Schumacher, 1950.** Forest Mensuration, McGraw Hill Book Co., New York.
3. **Neilsen, L. B., Nielsen, D. C. and Balslev., 1989**. Tropical forests, Academic press, London.
4. **Chowdhuri (Ed.),** Indian Woods – Six volumes, Pub. Forest Research Institute, Dehra Dun
5. **Manikandan, K. and Prabhu, S., 2010.** Indian Forestry, Jain Brothers, New Delhi.

## PLANT PHYSIOLOGY
## (SUB. CODE: 21UBOT61)

| SEMESTER - VI | CORE - 9 | HOURS - 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall contributions made by scientists in exploration of physiology of plant cells (K1)
- Summarize physiological process that taken place in plant cells (K2)
- Discuss the importance of nitrogen and growth regulators in growth of plant (K3)
- Describe the mechanisms of photoperiodism, seed dormancy and seed germination (K2)
- Analyze the specificity of organelles in physiology of plants (K4)
- Justify importance of environment in the growth and functions of plant cells (K5)

**UNIT: I**

Importance of water, water absorbing organs, Water potential and its components - Absorption of water and minerals, Mechanism of water absorption, ascent of sap. Transpiration: types, mechanism of stomatal movement. Soil, plant air continuum (SPAC), Factors affecting transpiration, Anti-transpirants.Guttation.Role of macro and microelements – deficiency symptoms in plants.

**UNIT: II**

Photosynthesis: organization of thylakoids, Photosynthetic pigments, Photoelectron transport and photophosphorylation. Calvin cycle, C4 cycle, CAM cycle. Factors affecting photosynthesis.Translocation of photosynthates.

**UNIT: III**

Respiration: Aerobic and anaerobic respiration – fermentation – alcohol and lactic acid production - Glycolysis, Kreb's cycle, Electron transport system, Oxidative phosphorylation. Factors affecting respiration.

**UNIT: IV**

Nitrogen metabolism: Sources of nitrogen, nitrogen fixation, symbiotic and non-symbiotic - reductive amination and transamination, GS-GOGAT pathway.

**UNIT: V**

Growth, Growth curve, Factors affecting growth. Plant growth regulators - Auxins, Gibberellins, Cytokinins, Ethylene, Abscissic acid, Occurrence, structure and their physiological effects. Photoperiodism, vernalization and Senescence. Photoperiodism and Biological clock: Concepts – Circardian rhythm. Seed dormancy and physiology of seed germination. Overview of stress physiology.

**TEXTBOOKS**


1. **Gill, D. S. 2000.** Plant Physiology, S.Chand and Co., New Delhi.
2. **Malik, C. P. 1999.** Plant Physiology, Kalyani Publishers, Ludhiyana.
3. **Pandy, S. N. 1991.** Plant Physiology, Tata McGraw Hill Publishers (P) Ltd., New Delhi.
4. **Verma, V. 1991.** A Text Book of Plant Physiology, Emkay Publications, NewDelhi.


**REFERENCES**


1. **Devlin, K. M. 1969.** Plant Physiology, Reinehart and Winston and Affiliated East West Press (P) Ltd, New Delhi.
2. **Noggle, G. R. and Fritz, G. J. 1982.** Introductory Plant Physiology. Prentice Hall of India Private Ltd.
3. **Salisbury, F. B. and Ross, C. W. 1986.** Plant Physiology, CBS Publishers and Printers, New Delhi.
4. **Steward, F. C. 1904.** Plants at Work (A summary of Plant Physiology), Addition – Wertley publishing Co., Inc., Reading, Massachusetts, Pa loalto, London.

## MOLECULAR BIOLOGY & GENETIC ENGINEERING
## (SUB. CODE: 21UBOT62)

| SEMESTER - VI | CORE - 10 | HOURS – 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Describe the research and development of science in molecular level. (K1)
- Explain the hands-on experience of the various methods of doing scientific research. (K2)
- Apply the knowledge how to identify the genetic information in gene level. (K3)
- Analyze the genetic abnormalities and predict the remedy for that problem. (K4)
- Analyze the regulation of gene expression in cellular level. (K5)
- Summarize the overall functions of gene in human body and their importance. (K6)

**UNIT: I**

Identification of DNA as the genetic material – Structure of DNA. Forms of DNA.Organisation of DNA as a stable and self- replicating molecule – base specificity – Replication of DNA: semi-conservative model and experimental proof – molecular mechanism. Genetic code and its characteristics.

**UNIT: II**

Transcription in Prokaryotes: Molecular Mechanism – initiation, elongation and termination – types of RNA and their functions. Translation: aminoacylation, initiation, elongation and termination. Mutation genetics. Mutation – modern definition – biochemical basis – DNA repair – types of point mutation – mutagenic agents – physical and chemical.

**UNIT: III**

Regulation of gene expression – need for regulation – mechanism in prokaryotes :*Lac* Operon and *Trp* operon – In eukaryotes: transcription level – galactose metabolism. Yeast – hormonal control.

**UNIT: IV**

Recombinant DNA technology: gene cloning – cloning vectors – plasmids: types and characteristics – phages, cosmids, binary and shuttle vectors. Restriction enzymes: Exonucleases, endonucleases: type I, II and III – structure and mode of action. Ligases: types, structure and mode of action. Ligases: types, structure and mode of action, DNA polymerase and *Taq* polymerase.

**UNIT: V**

Isolation of gene of interest - Gene transfer methods –physical, chemical, biological methods of gene transfer. Transfer of foreign genes using *Ti* plasmid. Structure, genetic organization of *Ti* plasmids, mechanism of transfer and insertion of foreign gene into plant genome. Identification of recombinants: Genetic method, immunological method, nucleic acid hybridization method.

**TEXTBOOKS**


1. **Gupta, P. K. 1998.** Elements of Biotechnology. Rastogi Publications.
2. **Gupta, P. K. 2003.** Cell and Molecular Biology. Rastogi Publications.
3. **Kumar, H. D. 2000.** A text book on Biotechnology: Affiliated Eastwest Press.
4. **Old, R. W. and Primrose, S. B. 2003.** Principles of gene manipulation. Blackwell Science, London.


**REFERENCES**


1. **Twyman, R. M. and Widen, W. 1998.** Advanced Molecular Biology. Viva Books Pvt. Ltd.
2. **Verma, P. S. and Agarwal, V. K. 1998.** Concept of Molecular Biology, S. Chand and Co. Ltd.
3. **Walker, J. M. and Gingold, E. B. 2004.** Molecular Biology and Biotechnology: Royal Soc. of Chemistry.

## PLANT BIOTECHNOLOGY
## (SUB. CODE: 21UBOT63)

| SEMESTER - VI | CORE - 11 | HOURS - 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the techniques used with the biological organisms (K1)
- Understand the methods of biotechnology used for the welfare of human beings (K2)
- Apply the concepts of genetic engineering for human wellbeing (K3)
- Compare the advanced areas of various techniques of plant biotechnology (K4)
- Synthesize any new ideas or methods of plant biotechnology (K5)
- Evaluate the various methods of plant biotechnology (K6)

**UNIT: I**

Biotechnology - scope and definition Plant tissue culture – definition and scope – laboratory requirements for plant tissue culture, culture media and their constituents. Totipotency – explant culture – callus initiation and maintenance – micropropagation - organogenesis, somatic embryogenesis and; organ culture, anther, embryo and meristem culture.

**UNIT: II**

Single cell culture, Suspension cultures –types - batch, continuous - methods for growth measurement - experiments for assessing the cell viability - applications - production of secondary metabolites (alkaloids) - somaclonal variation.

**UNIT: III**

Isolation, purification and culture of protoplasts – regeneration of protoplasts – protoplast fusion and somatic hybridization, Haploid production – anther, pollen culture and embryo culture.

**UNIT: IV**

Biofertilizers – mass production of *Rhizobium, Azospirillum* and Blue Green Algae, VAM Fungi – Single cell protein – microorganisms and substrates used – nutritional value of SCP and advantages. Mushroom culture: Cultivation methods – preparation of spawns – spawning and cropping

**UNIT: V**

Cryobiology: definition - methods of cryopreservation - cell and pollen banks - achievements through cryopreservation - transgenic plants and GM crops – merits and demerits. Intellectual property rights and protection - patenting of biological material.

**TEXTBOOKS**


1. **Chawla, H. S. 2004.** Introduction to plant Biotechnology, Second Edition, Oxford and IBH, New Delhi.
2. **Dubey, R. C. 2000.** A text book of Biotechnology, S. Chand and Co.
3. **Ramavat, K. G. 2004.** Plant Biotechnology, S. Chand & Co., New Delhi.


**REFERENCES**


1. **Gupta, P.K. 2000.** Elements of Biotechnology, Rastogi and Co, Meerut.
2. **Nirmal H Kumar. 2000.** An introduction to plant tissue and cell culture. Emkay Pub.
3. **Timer BaranJha, BiswajitGhosh. 2005.** Plant Tissue culture university press.

**PRACTICAL– IX**
**PLANT PHYSIOLOGY**
**(SUB. CODE: 21UBOP64)**

| SEMESTER - VI | PRACTICAL - 9 | HOURS – 3 | CREDITS -2 |
|---|---|---|---|

1. Determination of water potential by leaf plasmolytic method.
2. Determination of water potential by Gravimetric method
3. Effect of temperature and detergent on membrane permeability.
4. Estimation of photosynthetic pigments
5. Transpiration index by cobalt chloride method
6. Estimation of amylase
7. Cell free photosynthesis
8. Rate of photosynthesis in variegated leaves
9. Estimation of flavonoids.
10. Stomatal Index and Frequency
11. Measurement of Leaf Area Index by Leaf Area Meter.

## PRACTICAL - X
## MOLECULAR BIOLOGY, GENETIC ENGINEERING AND PLANT BIOTECHNOLOGY
## (SUB. CODE: 21UBOP65)

| SEMESTER - VI | PRACTICAL - 10 | HOURS - 5 | CREDITS - 2 |
|---|---|---|---|

**MOLECULAR BIOLOGY, GENETIC ENGINEERING**

1. Paper electrophoresis of proteins
2. Isolation and separation of proteins
3. Designing a primer
4. Isolation of Plant DNA
5. Isolation of Plasmid DNA
6. Quantification of DNA
7. Polymerase Chain Reaction
8. Agarose gel electrophoresis using dyes
9. Exercises on the genetic code
10. Analysis of DNA for profile matching
11. Restriction Digestion Analysis problems

**PLANT BIOTECHNOLOGY**

1. Cleaning and sterilization of glass wares
2. Preparation of Plant Tissue Culture media
3. Establishment of callus – internodal and leaves segment as explants
4. Micropropagation using shoot tip and nodal segments as explants
5. Haploid Production - Culture of anther
6. Culture of embryos
7. Production of synthetic seeds
8. Spore culture
9. Isolation of single cells
10. Isolation of leaf protoplasts
11. Isolation of BGA from *Azolla*
12. Isolation and identification of AM Fungi.

## BIOSTATISTICS AND BIOINFORMATICS
**(Sub. Code: 21UBOTE66)**

| SEMESTER - VI | ELECTIVE - 3 | HOURS - 5 | CREDITS – 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the principles and concepts of biology, computer science and mathematics (K1)
- Describe the basic concepts of bioinformaticsand its significance in biological data analysis (K2)
- Explain the basics of sequence alignment and analysis (K3)
- Demonstrate the technique in retrieval of data from biological databases (K3)
- Solve the problems associated with molecular modeling and phylogenetic analysis (K4)
- Outline the application of bioinformatics tools in biology (K5).
- Justify the necessities of bioinformatics in modern biological research (K6).

**UNIT: I**

Biostatistics - introduction – applications – data - primary and secondary data- collection of data - methods of collection of data - classification of data - frequency tables - presentation of data – tabulation of data – elements of a statistical table - graphs - pictures and diagrams.

Measures of central tendency and dispersion - arithmetic mean, median and mode, standard deviation and co-efficient of variation.

**UNIT: II**

Sampling methods and Sample size determination - Advantages of sampling method – Sample surveys - uses of sample surveys - The principal steps in a sample survey.

Sampling theory - Probability sampling - Alternatives to Probability sampling. Normal distribution - Use of normal distribution. Sampling Bias and its effects, The mean square error - Simple random sampling, Selection of simple random sample, properties of the estimate.

**UNIT: III**

Introduction to Hypothesis Testing - Null and alternative hypothesis - Simple hypothesis - Critical region - Level of significance - one tailed and two tailed testing. Types of errors (Type I & II) - Power and Sample size, P - value interpretation and its associated misconceptions- Nonparametric Tests - Test of goodness of fit - Chi square test.

**UNIT: IV**

Introduction to Bioinformatics – aims and scope and applications – Major areas of Bioinformatics – genomics – Proteomics – databases in bioinformatics- types of databases-

resources in NCBI, EMBL, DDBJ, PDB, PIR and SWISSPROT. Specialized databases- data retrieval methods

**UNIT: V**

Tools and softwares in bioinformatics- similarity search- BLAST- FASTA- sequence alignment tools- molecular visualization tools- Prediction tools- docking tools- Homology modelling – drug designing

**TEXTBOOKS**


1. **Ravindra Reddy, B., Sharma, K. L. A. P and Pullaiah, T. 2012**. Biostatistics.Astral International.
2. **Rajan S.S. and Balaji R. 2002.**Introduction to Bioinformatics, Himalaya Publishing House.


**REFERENCES**


1. **Balaji, K. P., Raghavaiah, V. S. and Jayaveera, K. N. 2012.**Biostatistics. I. K. International Publishing House Pvt. Ltd.
2. **Bergeron, B. 2003.**Bioinformatics Computing, Prentice Hall of India.
3. **Bozdogan, H. 2003.** Statistical Data Mining & Knowledge Discovery, CRC Press
4. **Shanmughavel, P. 2005**. Principles of Bioinformatics, Pointer Publishers.

***PRACTICALS**

**BIOSTATISTICS AND BIOINFORMATICS**

| **SEMESTER - VI** ` | **HOURS - 2** |
|---|---|

1. Collection of data– census method; population size– sampling methods– random sampling lottery method, table of random numbers
2. Arrangement and classification of the data –Five tally frequency tables for continuous and discontinuous data– Histograms
3. Presentation of the data– Bar diagrams, Graphs, Cartograms, Pictograms, Pie chart
4. Measures of central tendency—Mean, Median and Mode.
5. Problems—probability
6. Solving the problems using softwares

**Bioinformatics**

1. Browsing the internet using website address
2. Browsing the internet using search engines
3. Searching the databases
4. Retrieving gene sequences
5. Retrieving protein sequences
6. Retrieving protein structure
7. BLAST

* *Internal only*

## AGRICULTURAL BOTANY
## (SUB. CODE: 21UBOTE66)

| SEMESTER – V | ELECTIVE - 3 | HOURS - 5 | CREDITS - 5 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Recall the methods and importance of agricultural system (K1)
- Understand the various principles of crop production (K2)
- Realize the importance of various crops and their cultivation practices (K3)
- Compare the nutritious level of various crop that have been cultivable (K4)
- Demonstrate the parameters that are required for the effective yield of various crops (K5)
- Adapt the suitable method of breeding for the crops which are cultivated (K6)

**UNIT: I Principles of Crop Production**

Definition and scope of Agronomy. Classification of Crops on Different basis. General principles of Crop production: Climate, soil, preparation, seed and sowing, post sowing-tillage, water management, nutrition, plant protection measures, harvesting, threshing and storage.

**UNIT: II Nutrition Management of Crops**

Nutritional requirements of Different types of crops. Different types of nutrients. Different types of fertilizers available – natural and synthetic. Nutritional management of crops including application of manures, fertilizers and bio-fertilizers.

**UNIT: III Irrigation and Water Management**

Importance of water in crop production. Soil Moisture. Evapo-transpiration.Water requirement of crops and factors affecting it. Irrigation. Systems and methods of irrigation – drip, sprinkler and mist Irrigation. Quantity and quality of irrigation. Measurement of irrigation water. Elementary idea of drainage on farms.

**UNIT: IV Soil Fertility, Fertilizers and Integrated Nutrient Management**

Soil fertility concept, soil productivity, factors influencing soil fertility, maintenance of soil productivity. Essential plant nutrients, Criteria of essentiality; functions, deficiency Symptoms, Critical levels of deficiency and toxicity. Mechanism of uptake and transport of minerals salts in plants. Soil fertility evaluation, soil and plant analysis. Integrated nutrient management (INM) concept.

**UNIT: V Breeding of Field Crops**

Breeding methods adopted and achievements with reference to following crops: (a) Cereals: Wheat, rice and maize (b) Millets : Sorghum and pearl millet (c) Pulses : Gram, Pea and Arhar (d) Oil-seeds : mustard, groundnut and sunflower (e) Others : cotton and potato.

**TEXT BOOK**

1. **Shovan Ray. 2009.**Handbook of Agriculture. Oxford Pub. Co.

**REFERENCES**


1. **Reddy**, S. R. 2010. Introduction to Agronomy and Principles of Crop Production, Kalyani Publishers.
2. **MajumdarD.K .** 2011. Pulse Crop Production: Principles and Technologies, PHI Learning.
3. **Mukund Joshi & T.K. PrabhakaraSetty**.A Text Book of Irrigation and Water Management, Kalyani Publishers.
4. **Mukherjee, S and T. Biswas.** Textbook of Soil Science, McGraw Hill.
5. **D.N. Bhardwaj.** Breeding of Field Crops, Agrobios (India)


## PRACTICALS*
## AGRICULTURAL BOTANY

| SEMESTER - VI ` | HOURS - 2 |
|---|---|

## PRACTICALS:

1. Bulk Density and Specific gravity of soils.
2. Capillarity of soils.
3. Water holding capacity of soils.
4. Nutrient content of the soils (Carbonate, Sulphate, Nitrate and Nutrient deficiency).
5. Soil pH.
6. Alkalinity of soils
7. Lime status of soils
8. Phosphate content of soils (Olsen method)
9. Total Nitrogen of soils (Macrokhjeldal method)
10. Total Carbon content of the soils.
11. Heavy metal analysis using ASS and Flame Photo meter.

**Internal only*

**ENTREPRENEURSHIP BOTANY**
**21UBOTECC1**

| ECC: 1 | Hours: 30 | Credits: 2 |
|---|---|---|

**Staff -in - Charge: Dr. G. Sahaya Anthony Xavier**

**COURSE OUTCOME (CO)**

- Students would be motivated to start a business with botanical materials
- The students will understand that there are business opportunities in botany

**UNIT: I**

Gardening: Garden Installation as a business- Types of Gardening: Watergarden (Aqua Garden), Desert and Rock Garden (Xeric Garden), Landscape Garden. Establishment of a Nursery, Nursery practices, Management and Marketing of garden plants.

**UNIT: II**

Olericulture and Floriculture: Major Vegetables of Tamilnadu- Onion &Brinjal. Floriculture: Aromatic flowers. Cultivation and export of Flowering Plants - Rosa, Chrysanthemum, and Jasmine. Flower arrangement, cut flowers, Bouquet Making. Industrial uses of Flowers - Dyes preparation from flowers.

**UNIT: III**

Medicinal plants cultivation in Tamil Nadu – Senna, Coleus, *Aloe*, Gloriosa, Mucuna, *Centellaasiatica*and *Bacoppamonieri*. Methods of harvesting, value addition and export of the above medicinal plants.

**UNIT: IV**

Mushrooms – Cultivation of paddy straw and oyster mushroom. Medicinal and Nutritional value of mushrooms. Pathology of Mushrooms.Harvesting and Post harvesting technology - Packing, Storage and Marketing. Export of vegetable oils.

**UNIT: V**

Entrepreneurship - funding agencies (NABARD), Rural Banking, FAO. Entrepreneurship Development Programme (EDP). Need and their significance. Import – Export procedures for agricultural produce. GST and its impact on business.

**REFERENCES**


1. **Randhawa, G. S. and A. Mukhopadhyay.**Floriculture in India. Allied Publishers.
2. **Dey, S. C.** Indoor Gardening.
3. **Rana, M.K.**Scientific cultivation of vegetables, Kalyani Publishers.
4. **Kokate, C. K., A.S. Gokhale, S. B. Gokhale.** 2007. Cultivation of Medicinal Plants. Nirali Publications.
5. **Bahl, N.** Handbook on Mushrooms, 4th Ed., CBS Publishers.


Eligibility: Any II year UG students

## INTRODUCTION TO MICROSCOPY
## 18UBOTECC2

| ECC: 2 | Hour: 30 | Credits: 2 |
|---|---|---|

**Staff -In- Charge: Dr. A. Vinoth**

**COURSE OUTCOME (CO)**

- An Introduction to Microscopy helps students master the foundational principles of microscopy.
- Understanding the fundamentals of microscopy provides students with a relevant and marketable skill that can be readily applied in many fields.

**UNIT: I**

Introduction to microscopes – History of early microscopes – The light microscope: components, principle, working and maintenance – Historical contributions from light microscope

**UNIT: II**

Histology – Tissue Processing: Fixation, Dehydration, Clearing, Embedding and Sectioning - Various stains used in plant histology – Microtome: Principle, Components and Working

**UNIT: III**

Dissection and Stereo microscope – Applications in external surface anatomy

**UNIT: IV**

Digital imaging – Photomicrography and its applications in biology

**UNIT: V**

Live cell microscopy – various types and applications – Fluorescence microscopy – Principles and Applications – Innovations in Microscopy

**REFERENCE BOOKS**


- **Tribe, M. A., Eraut, M. R and Snook, R. K. 1975.** Basic Biology Course Unit I: Volume 1, Light Microscopy
- **Murphy, D. B. and Davidson, M. W. 2012.** Fundamentals of Light Microscopy and Electronic Imaging.


**Eligibility:** Course offered to students of I B. Sc., Botany and Zoology

**Mode of Evaluation:** A project report on digital micrographs of the miniature living world.

## MUSHROOM TECHNOLOGY
## 18UBOTECC3

| ECC: 3 | Hours: 30 | Credits: 2 |
|---|---|---|

**Staff in charge: Dr. M. Joe Virgin Largia**

**COURSE OUTCOME (CO)**

- Students will know about the cultivation of edible mushrooms
- Students will have knowledge about marketing of the mushrooms

**UNIT: I**

History, classification and morphological identification of mushrooms.

**UNIT: II**

Nutrient profile, Medicinal value and health benefits of mushrooms.

**UNIT: III**

Construction of mushroom house, Bed and Polythene bag method of cultivation, Breeding conditions.

**UNIT: IV**

Principles and methods of composting, Spawn cultivation and harvesting of Oyster, Paddy and Button mushrooms.

**UNIT: V**

Post-harvest techniques - storage freezing, dry freezing, drying, canning, quality assurance and entrepreneurship.

**TEXTBOOKS**


1. **Kannaiyan, S. and Ramasamy, K**. 1980. A handbook of edible mushrooms, Today and Tomorrow Printers and Pub, New Delhi.
2. **Tripathi, D. P**. 2005. Mushroom cultivation, Oxford and IBH Pub. Co. Ltd, New Delhi.


**REFERENCES**


1. **Pathak, V. N. and Yadav, N.** 1998. Mushroom Production and Processing Techniques, Jodhpur.
2. **Pandey, B. P.** 1996. A textbook of Fungi, S. Chand and Com. New Delhi.


**COURSE STRUCTURE:**

* Power point presentations will be conducted.
* Study material will be provided.
* A compulsory training programme will be arranged.

Eligibility: Any II year UG students

## RENEWABLE ENERGY RESOURCES
## 18UBOTECC4

| ECC: 4 | Hours: 30 | Credits: 2 |
|---|---|---|

**Staff - in -Charge: Dr. G. Sahaya Anthony Xavier**

**COURSE OUTCOME (CO)**

- The students will have an understanding and appreciation of renewable energy resources.
- List and generally explain the main sources of renewable energy and their primary applications
- List and describe the primary renewable energy resources and technologies.
- Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

**UNIT: I**

Introduction to energy systems and resources.Energy, sustainability & the environment. Fossil fuels - past, present & future. Problems due to fossil fuel usage.Remedies & alternatives for fossil fuels. Nuclear energy – issues.

**UNIT: II**

Renewable energy resources – Solar, wind, thermal, biomass and biogas as sources of energy.Advantages and disadvantages of using renewable energy resources.
Wave energy and tidal energy

**UNIT: III**

Solar energy – energy incident and use – plants as converters of solar energy – solar panels – types, solar power plants – scope for solar power plants in India – problems and solutions.
Wind as a source of energy – windmills – site selection for windmills – electricity generation using different types of windmills – issues.

**UNIT: IV**

Biomass – different types of biomass and their uses as energy sources – ethanol production and useBiogas – production, usesAlgae as a source of energy, Hydrogen as a source of energy

**UNIT: V**

Wind energy – windmills, location and functioning; Tidal energy - its use, advantages and disadvantages; Geothermal energy.

## BOTANY FOR COMPETITIVE EXAMINATIONS
## 18UBOTECC5

| ECC: 5 | Hours: 30 | Credits: 2 |
|---|---|---|

**Staff - in -Charge: Dr. T. Leon Stephan Raj**

**COURSE OUTCOME (CO)**

- The students will be empowered to face the competitive examinations.
- The students will have the capacity to prepare multiple choice questions and other type of questions to prepare for various examinations

**UNIT: I**

Phycology, Mycology & Lichenology Phycology - Fritsch's classification of Algae - pigmentation - Thallus organization - Life - cycles pattern of Algae - Evolutionary trends in the Sexulity of algae - Economic importance - Algea as food, feed fodder, fetilizer and medicines - phytoplankton and their role. Mycology - classification of fungi by Alexopoulos - structure, reproduction and economic importance of phycomycetes, Ascomyates, Basidiomycetes and Deuteromyates. Lichenology - structure, reproduction and economic importance of lichens.

**UNIT: II**

Bryology and Pteridology Byrophytes - general characteristics, structure; reproduction and alternation of generations.Pteridophytes - general characteristics - Psilopsida, Lycopsida, Spenopsida and Pteropsida - Stelarorganisation - origin of heterospory and seed habit.

**UNIT: III**

Gymnosperms and Paleobotany A comparative account of vegetative and reproductive structure of Cycadales, Conifierales and Gnetales - Structure of wood in Gymnosperm - Economic importance of Gymnosperm - PaleoBotany Geological Time Scale - Fossilization methods - Fossil types.

**UNIT: IV**

Angiosperm Morphology, Taxonomy and Economic Botany Root and Stem modification in relation to habitat.Infloresence: Raceme, Cyme and special types Pollination - contrivances for cross pollination. Taxonomy - Angiosperm Classification - Bentham and Hooker's system - International code of Botanical Nomenclature (outline). Family characteristics and economic importance of the following:- 1) Magnoliaceae 2) Rutaceae 3) Anacardiaceae 4) Leguminosae 5) Asteraceae 6) Apiaceae 7) Euphorbiaceae 8) Arecaceae 9) Poaceae Economic Botany of plants yielding wood timber fibre, Oil and medicines.

**UNIT: V**

Anatomy and Embryology Anatomy:- Meristems and its types. Permanent tissues simple and complex tissues - normal and abnormal secondary thickening Embryology:- Micro sporogenesis, Megasporogenesis - types of embryo sacs (Mono-bi-and tetrasparic). Double fertilization and Triple fusion, Types of endosperm - Embryos development in Dicots and Monocots. Apomixis and Polyembryony Culture techniques - anther and embryo.

**Eligibility:** 12th Biology students pursuing Bachelor degree
**Mode of Evaluation:** Multiple choice test -100 questions internal and external evaluation

**PROJECT**

**21UBOTECC6**

**Course offered to students of III B.Sc., Botany**

| | | |
|---|---|---|
| **Semester: VI** | **ECC: 6** | **Credits: 2** |

# Certificate
# and
# Diploma Courses

**FOOD TECHNOLOGY**
**Certificate course**
(Duration: 1 Semester– Weekly 2hrs)

**UNIT: I**

History and development of food microbiology: Common food borne Bacteria, Molds and Yeasts. Role and significance of microorganisms in foods.

**UNIT: II**

Methods for detection of microorganisms in food: Meat dairy, sea foods, vegetables. Physical, Chemical, Immunological and biochemical assays.

**UNIT: III**

Food spoilage-basic principles, conditions for spoilage (extrinsic and intrinsic factors).

**UNIT: IV**

Food borne diseases, preventing food borne diseases, food spoilage.

**UNIT: V**

Food processing and preservation- physical and chemical methods- Chopping- Mixing- Homogenizing- Cooking- Pastuerizing- Emulsifying- Spray-drying - Refrigeration and freezing- Canning- Irradiation- Dehydration- Freeze-drying- Pickling- Fermentation

Microorganisms as Foods and Food Amendments

**REFERENCE BOOKS**


1. **M. R. Adams. 1995.** Food Microbiology, 1st Edition.
2. **Frazier, Westhoff, Vanitha, N. M. 2014.** Food Microbiology, 5th Edition.
3. **Harrigan F.W. 2013.** Laboratory Methods in Food Microbiology, 3rd Edition
4. **Ray. 2011.** Fundamentals Food Microbiology, 4th Edition

**BIOINFORMATICS**

**Diploma Course**

(Duration: 2 Semesters– Weekly 2hrs)

**UNIT I:**

Features of computers, Significance of computers, organization of computers, digital and analogue computers, various devices, memory, hardware and software, computer languages, operating systems, Data storage devices, applications of computers, LAN, WAN, MAN, internet, modem, protocols, brousers, search engines, world wide web, e-mail, internet realy chat, video conferencing, applications of information technology.

**UNIT II:**

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

Databases - Introduction, Biological Databases, Classification, format of Biological Databases, Biological Database Retrieval System. National Center for Biotechnology Information (NCBI), EMBL Nucleotide Sequence Database (EMBL-Bank), DNA Data Bank of Japan (DDBJ), Protein Information Resource (PIR), Protein Data Bank (PDB), Swiss-Prot., Specialized Databases.

**Unit III:**

Tools- Similarity Search Tools –BLAST and FASTA, Sequence Analysis Tools – Clustal-W, T-Coffee, Molecular Visualization Tools – RasMol, Deep View, Prediction Tools – Modeller, PASS, Docking Tools – Auto Dock and Chem Dock.

**Unit IV:**

Alignments - Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), Scoring Matrices, Percent Accepted Mutation (PAM), Molecular Phylogeny - Methods of Phylogeny, Software for Phylogenetic Analyses

**UNIT V:**

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement, Applications of Bioinformatics

**REFERENCE BOOKS**


1. **Ghosh Z. and Bibekanand M. 2008.** Bioinformatics: Principles and Applications. Oxford University Press.
2. **Pevsner J. 2009.** Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. **Campbell A. M., Heyer L. J. 2006.** Discovering Genomics, Proteomics and Bioinformatics.II Edition. Benjamin Cummings.

# SYLLABUS FOR
# II B. Sc. ZOOLOGY STUDENTS
# (CORE SUPPORTIVE)

## PLANT DIVERSITY
## (SUB. CODE: 21UBOTA31)

| SEMESTER - III | CORE SUPPORTIVE - 1 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- Explain the diversity of lower and higher group of plants up to gymnosperms. (K1)
- Understand the classification of these different groups. (K2)
- Differentiate the different groups of plants based on their general characters. (K2)
- Understand the relations between plants and their evolution (K2)
- Explain the morphological and anatomical characters of at least one representative species from different plant groups. (K3)
- Analyze the economic importance of these groups of plants. (K3)

**UNIT: I (Algae)**

Classification of plants according to G.M. Smith. General characteristic features of Algae. Detailed study of the following types *Volvox* and *Caulerpa* (Occurrence, structure of cell and thallus, reproduction and life cycle). Economic importance of Algae.

**UNIT: II (Fungi & Lichens)**

General characters of Fungi.Detailed study of *Polyporous* (Occurrence, structure of cell and thallus, reproduction and life cycle).Economic importance of Fungi. Structure and reproduction in *Usnea*.Economic importance of Lichens.

**UNIT: III (Bryophytes)**

General characters of Bryophytes.Detailed study of *Marchantia* (Occurrence,structure of thallus, reproduction and life cycle).Economic importance of Bryophytes.

**UNIT: IV (Pteridophytes)**

General characters of Pteridophytes.Detailed study of *Selaginella* (Distribution, morphology, anatomy, reproduction and life cycle).Economic importance of Pteridophytes.

**UNIT: V (Gymnosperms)**

General characters of Gymnosperms.Detailed study of *Pinus* (Distribution, morphology, anatomy, reproduction and life cycle).Economic importance of Gymnosperms.

**TEXTBOOKS:**


1. **Pandey, S.N. & P.S. P. Trivedi 1994.**Text Book of Botany Vol. I, Vikas Publishing House Pvt. Ltd., Delhi.
2. **Pandey S.N., S.P Misra and P.S. Trivedi. 1998.** A text book of Botany Vol. II. Vikas Publishing House, Pvt. Ltd. New Delhi.


**REFERENCES:**


1. **Singh, Pandey and Jain. 2000.** A Text Book of Botany, Rastogi Publications
2. **Vashishta, B. R.2002.** The Algae, S. Chand & Co.
3. **Vashishtha, B. R. 2002.** The Fungi, S. Chand & Co.
4. **Vashishtha, B. R. 2003.** The Bryophytes, S. Chand & Co.

5. **Vashista, P.C. 1997.**Pteridophyta. S.Chand and Company Ltd., New Delhi
6. **Vashista, P.C. 1991.** Gymnosperms. S. Chand and Company Ltd., New Delhi.

**PRACTICALS**
**PLANT DIVERSITY**
**(SUB. CODE: 21UBOPA32)**

| SEMESTER - III | HOURS - 2 | CREDIT - 1 |
|---|---|---|

**Study of the following types:**

| | |
|---|---|
| Algae | : *Volvox, Caulerpa,* |
| Fungi | : *Polyporus* |
| Lichen | : *Usnea.* |
| Bryophyte | : *Marchantia* |
| Pteridophytes | : *Selaginella* |
| Gymnosperms | : *Pinus* |

## TAXONOMY OF ANGIOSPERMS AND PLANT PHYSIOLOGY
## (SUB. CODE: 21UBOTA41)

| SEMESTER - IV | CORE SUPPORTIVE - 2 | HOURS - 4 | CREDITS - 4 |
|---|---|---|---|

**COURSE OUTCOMES (CO)**

**By the end of the course the students will be able to:**

- To understand the principles of biosystematics, classification and nomenclature of plants (K2)
- To discussthe modem trends in Plant Taxonomy (K2)
- To understand the functions of plants (K2)
- To realize the importance of water and minerals in the life of plants (K2)
- To understand the role of light in the plants life (K2)
- To demonstrate the basic experiments in Plant Physiology (K3).

**UNIT: I**

Objectives of Systematic botany. Morphology: Leaf types, Inflorescence, Flower structure and fruit types. Taxonomic hierarchy, Botanical Survey of India.Flora of Tirunelveli hills.

**UNIT: II**

Herbarium Methodology: Definition, its utility in the study of plants; Procedure: Plant collection, poisoning, pressing, drying, mounting, identification, preservation, field book and field data. Nomenclature: Definition, importance of binomial nomenclature

**UNIT: III**

Systems of Classification: A detailed study of Bentham and Hooker's system - merits and demerits. Study of the following families with reference to the morphology, taxonomy and economic importance: *Fabaceae, Solanaceae, Euphorbiaceae, Poaceae*

**UNIT – IV**

Water potential.Absorption of water and minerals, ascent of sap – cohesion and tension theory. Transpiration: types, mechanism of stomatal movement – Stewart hypothesis. Factors affecting transpiration.Guttation. Role of macro (N, P, K) and microelements (B, Mo, Zn) inplants.

**UNIT – V**

Photosynthesis: ultra-structure of chloroplast, photosynthetic pigments, light reaction and dark reaction.Calvin cycle,C4 cycle. Factors affecting photosynthesis.

**Text Book:**

1. **Vashista, P.C.1988.**Taxonomy of Angiosperms, R.Chand&Co.
2. **Singh,V& D.K. Jain 1985.**Taxonomy of Angiosperms, 2nd Ed. S. Chand & Co.
3. **Lawrence, G.H.M,1974.**Taxonomy of Vascular Plants.
4. **Pandy, S.N. 1991.** Plant Physiology, Tata McGraw Hill Publishers (P) Ltd., New Delhi.
5. **Verma, V., 1991.**A Text Book of Plant Physiology, Emkay Publications, NewDelhi.

**PRACTICALS**
**TAXONOMY OF ANGIOSPERMS AND PLANT PHYSIOLOGY -**
**(SUB. CODE: 21UBOPA42)**

| SEMESTER - IV | HOURS - 2 | CREDITS - 1 |
|---|---|---|

1. Determination of DPD by Gravimetric method and plasmolytic method
2. Effect of temperature and detergent on membrane permeability.
3. Estimation of photosynthetic pigments
4. Demonstration of Clinostat, Ganong's photometer, Khun's tube, Phototrophic chamber.
5. Identification of commonly available Leaf, Inflorescence and Fruit types
6. Technical descriptions of plant parts, including floral parts (L. S. of flower, floral diagram and floral formula) with reference to the families prescribed in theory.
7. Submission of record work for valuation in the semester practical examination

**St. Xavier's College (Autonomous), Palayamkottai**
**Department of Botany**
**Title of the Paper**
**CIA - CORE/ELECTIVE PAPERS**

**Class: I/II/III B. Sc.,** **Semester: I-VI**
**Time: 1.30 Hrs** **Marks: 50**

**Part –A: Answer all the questions.** **(1 × 5 = 5)**

1. a. b. c. d.
2. a. b. c. d.
3. a. b. c. d.
4. a. b. c. d.
5. a. b. c. d.

**Part –B: Answer any four of the following questions.** **(4 × 5 = 20)**

06.
07.
08.
09.
10.
11.

**Part – C: Answer any one of the following questions** **(1×10=10)**

12.
13.

**Part – D: Answer any one of the following questions** **(1×15=15)**

14.
15.

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**Department of Botany**
**Title of the Paper**
**CIA - SBE/NME PAPERS**

**Class: I/II B. Sc.,** **Semester: I-IV**
**Time: 1 Hr** **Marks: 30**

**Part –A: Answer all the questions.** **(1 × 5 = 5)**

1. a. b. c. d.
2. a. b. c. d.
3. a. b. c. d.
4. a. b. c. d.
5. a. b. c. d.

**Part B. Answer any two of the following questions (2 × 5 = 10)**

6.
7.
8.

**Part B. Answer any two of the following questions (1 × 15 = 15)**

9.
10.