



PSGR
Krishnammal College for Women



DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)

(Semesters– I-VI)

**BACHELOR OF BOTANY
(2023 – 2026 Batch)**



**BACHELOR OF SCIENCE - BOTANY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED
CURRICULUM FRAMEWORK (LOCF)**

**SYLLABUS & SCHEME OF EXAMINATION
2023-2026 Batch, Semesters I-VI**

Programme Learning Outcomes (PLO's)

Courses within the Botany curriculum will address goals and objectives at the appropriate level through measurable student learning outcomes developed by course instructors

PLO 1: Students will be able to remember, comprehend, apply, analyze and synthesize the core concepts in Botany, like evolution, biodiversity, structure and function, information flow, exchange and storage, pathways and transformations of energy and matter.

PLO 2: Students will develop the ability to apply and understand the defining characteristics of various processes of science and its uncertainty.

PLO 3: Students will also develop the ability to practice the skills of the scientific method. Engage in research projects and apply the quantitative skills to biological problems.

PLO 4: Students will be able to communicate and collaborate within and outside of biology and tap into the interdisciplinary nature of science.

PLO 5: Students will understand the relationship between science and society and to evaluate the impact of science as well as ethical implications of science in the society.

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

At the end of the programme the student will

PSO1: Obtain strong foundation in classical botany, interdisciplinary subjects such as Bioinformatics, Biostatistics, and advance topics in Cell and Molecular biology, Biochemistry and Plant Biotechnology.

PSO2: Build capacity in Horticulture and production of cut flowers from the skill based courses offered.

PSO3: Carry out individual short term internship and project work to acquire knowledge on research using basic and advanced instruments/equipments.

PSO4: Find opportunities for higher studies in top ranking universities.

PSO5: Gain career in teaching/research in Botany.



BACHELOR OF SCIENCE - BOTANY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED
CURRICULUM FRAMEWORK (LOCF)

SYLLABUS & SCHEME OF
EXAMINATION
2023-2026 Batch, Semesters I- VI

| SEM | Part | Subject Code | Title of the Paper | | Instruction hours/week | Contact hours | Tutorial | Duration of Examination | Examination Marks | | | Credits | |
|------|-----------|--|--|--|------------------------|---------------|----------|-------------------------|-------------------|-----|-------|---------|----------|
| | | | | | | | | | CA | ESE | TOTAL | | |
| I | I | TAM2301/ HIN2301/ FRE2301 | Language T/H/F Paper I | Language | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | II | ENG2301 | English Paper-I | English | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | III A | | PL23C01 | Core Paper I- Microbiology & Plant diversity I | CC | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 5 |
| | | | PL23CP1 | Core Practical – I | CC | 3 | 45 | - | - | - | - | - | - |
| | | | CE23A01 | Allied Chemistry for Biologists Paper-I/ Allied Physics Paper-I/ Allied Paper I -Mathematical for Sciences - I | GE | 4 | 58 | 2 | 3 | 20# | 55# | 75 | 4 |
| | | | CE23AP1 /PS23AP1 | Allied Practical Chemistry / Physics | GE | 7 | 103 | 2 | 3 | 20 | 55 | 75 | 5 |
| | IV | NME22B1/A1 NME23ES | Basic Tamil/Advanced Tamil** Introduction to Entrepreneurship | AEC | 2 | 28 30 | 2 - | - - | 100 | - | 100 | 2 | |
| II | I | TAM2302/ HIN2302/ FRE2302 | Language T/H/F Paper - II | Language | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | II | ENG2302 | English Paper-II | English | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | III A | | PL23C02 | Core Paper II– Plant Diversity II | CC | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 5 |
| | | | PL23CP1 | Core Practical I (Core Paper I & II) | CC | 3 | 45 | - | 3 | 25 | 75 | 100 | 4 |
| | | | CE23A02 | IDC- Chemistry for Biologists II | GE | 5 | 73 | 2 | 3 | 20# | 55# | 75 | 4 |
| | | | CE23AP1 | IDC- Chemistry Practical for Biologists | GE | 3 | 45 | - | 3 | 15* | 35* | 50 | 2 |
| | IV | | NME23B2/A2 | Basic Tamil/Advanced Tamil** | AEC | 2 | - | - | - | 100 | - | 100 | Grade ** |
| | | | 23PELS1 | Professional English for Life Sciences | AEC | 2 | 25 | 5 | - | 100 | - | 100 | 2 |
| IIIB | NM23GAW | Foundation Course –1 (General awareness) | | Self study (Online) | 100 | - | 100 | Grade ** | | | | | |
| III | I | TAM2303/ HIN 2303/ FRE2303 | Language T/H/F Paper III | L | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | II | ENG2303 | English Paper-III | E | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 3 | |
| | III | PL23C03 | Core Paper III - Cell and Molecular Biology | CC | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 5 | |
| III | PL23CP2 | Core Practical - II (Core Paper III) | CC | 2 | 30 | - | - | - | - | - | - | - | |
| III | PL23SCE1/ | Skill Based Course Coursera -Climate Change and Health: From Science to Action | SEC | 3 | 45/ 44 | -/1 | - | 100 | - | 100 | 3 | | |

| | | | | | | | | | | | | |
|--------|-----|---------------------------------|--|------|-------|------------|----|----|-----------|-----------|------------|----------------|
| III | | CS23SBGP | GEN-AI | | | | | | | | | |
| | III | AS23A01 | Allied- II-Paper I- Zoology - Invertebrata and Chordata | GE | 5 | 73 | 2 | 3 | 20 | 55 | 75 | 4 |
| | III | TH23A09 | Allied-II - Mathematics for Sciences- Paper-I | GE | 7 | 103 | 2 | 3 | 25 | 75 | 100 | 5 |
| | III | AS23AP1 | Zoology Practical | GE | 2 | 30 | - | - | - | - | - | - |
| | IV | NM23DTG | Design Thinking | AEC | 2 | 30 | - | - | 100 | - | 100 | 2 |
| | IV | NM23UHR | Universal Human Values and Human Rights # | AECC | - | - | - | - | 100 | - | 100 | Gr. |
| IV | VI | 16BONL1 16BONL2 | Online Course 1 Online Course 2 | ACC | - | - | - | - | - | - | - | - |
| | I | TAM2304/ HIN2304/ FRE2304 | Tamil Paper IV/ Hindi Paper IV/ French Paper IV | L | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 3 |
| | II | ENG2304 | English Paper-IV | E | 6 | 88 | 2 | 3 | 25 | 75 | 100 | 3 |
| | III | PL23C04 | Plant Anatomy, Wood Technology and Embryology | CC | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 5 |
| III/IV | III | PL23SCE1/ CS23SBGP | Climate Change and Health: From Science to Action/ GEN-AI | SEC | 3 | 45 | - | - | 100 | - | 100 | 3 |
| | III | AS23A02/ TH23A14 | General Principles in Zoology ⁶ / Mathematics for Sciences II | GE | 5/7 | 73/ 103 | 2 | 3 | 20/ 25 | 55/ 75 | 75/ 100 | 4/ 5 |
| IV | III | AS23AP1 | Zoology Practical* | GE | 2 | 30 | - | 3 | 15 | 35 | 50 | 2 |
| | IV | NM23EII | Entrepreneurship and Innovation (IgniteX) | AECC | 2 | 30 | - | - | 100 | - | 100 | 2 |
| | IV | NM23EVS | Environmental Studies | AECC | SS | - | - | - | 100 | - | 100 | Gr. |
| | V | COCOACT | Co- curricular activities | GC | - | - | - | - | 100 | - | 100 | 1 |
| I-IV | VI | COM15SER | Community Services 30 Hours | GC | - | - | - | - | - | - | - | - |
| I-V | VI | 16BONL1 16BONL2 | Online Course 1 Online Course 2 | ACC | - | - | - | - | - | - | - | - |
| V | III | PL23C05 | Taxonomy of Angiosperms | CC | 4 | 58 | 2 | 3 | 25 | 75 | 100 | 4 |
| | III | PL23C06 | Genetics, Plantbreeding and Biostatistics | CC | 4 | 58 | 2 | 3 | 25 | 75 | 100 | 4 |
| | III | PL23E01/ PL23E02/ PL23E03 | Dietetics, Food Processing and Preservation/ Bioinoculants- Paper I/ Environmental Biotechnology | DSE | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 5 |
| | III | PL23CP3 | Core Practical III | CC | 3+3+2 | 12 0 | - | 3 | 25 | 75 | 100 | 4 |
| | III | PL23SB01 | Essentials of Horticulture & Agripreneurship | SEC | 3 | 43 | 2 | 2 | 10 0 | - | 100 | 3 |
| | III | PL22AC1/ PL22AC2 | Food Microbiology / Nutrition Science | ALC | SS | - | - | 3 | 25 | 75 | 100 | 5 ⁵ |
| | III | PL23PROJ | Project and Viva voce | DSE | 4 | 60 | - | - | 25 | 75 | 100 | 5 |
| | III | PL23COM | Comprehensive Examination | GC | -- | - | -- | -- | 10 0 | - | 100 | Gr. |
| | IV | NM21CS1 | Cyber Security I | AECC | 2 | 30 | - | - | 10 0 | - | 100 | Gr. |
| | IV | PL23INST | Fieldwork/Internship | DSE | - | - | - | - | 10 0 | - | 100 | 2 |

| | | | | | | | | | | | | |
|------|--------------|---------------------------------|---|-----|-----------|-----|---|---|-----|----|-------------|------------|
| I-V | VI | COM15SER | Community Services 30 hrs | GC | - | - | - | - | - | - | - | - |
| | | 16BONL1 16BONL2 | Online Course Online Course | ACC | - | - | - | - | - | - | - | - |
| VI | III | PL23C07 | Plant Physiology and Biochemistry | CC | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 4 |
| | III | PL23C08 | Basics of Bioinformatics | CC | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 4 |
| | III | PL23C09 | Plant Ecology and Phytogeography | CC | 4 | 58 | 2 | 3 | 25 | 75 | 100 | 4 |
| | III | PL23E04/ PL23E05/ PL23E06 | Plant Biotechnology/ Bioinoculants- Paper II/ Pharmacognosy | DSE | 5 | 73 | 2 | 3 | 25 | 75 | 100 | 5 |
| | III | PL23CP4 | Core Practical IV | CC | 3+3+2 | 120 | - | 3 | 25 | 75 | 100 | 6 |
| | III | PL23SBP1 | Essentials of Horticulture and Agripreneurship Practical | SEC | 3 | 45 | - | 2 | 100 | - | 100 | 3 |
| | III | PL22AC3/ PL22AC4 | Industrial Biotechnology/ Mushroom Culture Techniques | ACC | SS | - | - | 3 | 25 | 75 | 100 | 5 |
| I-V | VI | 16BONL1 16BONL2 | Online Course Online Course | ACC | - | - | - | - | - | - | - | - |
| I-VI | Total | | | | 30 | | | | | | 3800 | 140 |

not considered for grand total and CGPA; Grade - outside class hours.

€ Allied theory CA & ESE will be evaluated for 25/75 converted into 20/55

*Allied Practical CA & ESE will be evaluated for 25/75 converted into 15/35

\$ Credits applicable to candidates who take up Advanced level Course examination

L- Language

CC – Core Courses

GE – Generic Elective

SEC- Skill Enhancement Course

ACC-Additional Credit Course

GC- General Courses

Gr. – Grade

E- English

CA – Continuous Assessment

ESE - End Semester Examination

AECC - Ability Enhancement Compulsory Course

DSE – Discipline Specific Elective

SS- Self study

CA Question Paper Pattern and distribution of marks Language and English

Section A 5 x 1 (No choice) : 5 Marks

Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)

Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)

Total : 45 Marks

CA Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

Total : 45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks Language and English

Section A 10 x 1 (10 out of 12) : 10 Marks

Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)

Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)

Total : 75 Marks

UG - Core and Allied courses:

Core - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 3 = 6$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

Total : 45 Marks

ALC

Section A (Paragraph answer) (4 out of 6) 4 x 4 : 16 Marks

Section B (Essay type) 1 out of 2 : 9 Marks

Total: 25 Marks

ESE Question Paper Pattern: 5 x 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : $2 \times 5 = 10$

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 5 = 25$ One question

with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 5 = 40$

Continuous Internal Assessment Pattern Theory

CIA Test : 5 marks (conducted for 45 marks after 50 days)

Model Exam : 7 marks (Conducted for 75 marks after 85 days (Each Unit 15 Marks))

Seminar/Assignment/Quiz: 5 marks Class Participation : 5 marks

Attendance : 3 marks

Total : 25 Marks

Practical

Lab Performance: 7 marks

Regularity : 5 marks

Model Exam : 10 marks

Attendance : 3 marks

Total : 25 marks

For allied courses with practical as 50 marks, the split-up is 15 marks as internal and 35 as external. Conversion will be carried out by CoE from 25 marks to 15 marks through ERP.

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

Project: Evaluation of Individual / Group Project & Viva Voce for UG

| | | | | | |
|--------------|--------|---|--|----------|-----------------|
| I | Review | - | Selection of the field of study, Topic & literature collection | : | 5 Marks |
| II | Review | - | Research Design & Data Collection | : | 10 Marks |
| III | Review | - | Analysis & Conclusion Preparation of rough draft | : | 10 Marks |
| Total | | | | : | 25 Marks |

End semester examination:

| | | |
|---------------------------|---|-----------------|
| Evaluation of the project | : | 25 Marks |
| Viva Voce | : | 50 Marks |
| Total : | | 75 Marks |

Skill Based Subject : 100 Marks

| | |
|------------|---|
| Test I | 30 Marks (Conducted for 50 marks and converted to 30 Marks) |
| Test II | 50 Marks |
| Assignment | 10 Marks |
| Seminar | 10 Marks |
| Total | 100 Marks |

Departments can plan the pattern for SBS according to their course as Test 1 & 2- Theory / one theory and one practical / both practical / one theory or practical with one project.

Part IV

Introduction to Entrepreneurship / Women Studies / Universal Human Values and Human Rights / Environmental Studies / Design Thinking/IGNITE X

Quiz : 50 marks

Assignment : 25marks

Project / Case study : 25 marks

Total : 100 Marks

Cyber Security I

| | | |
|------------|---|----------|
| Quiz | : | 60 Marks |
| Case Study | : | 20 Marks |
| Poster | : | 20 Marks |

Attendance

| | |
|---------|---------|
| 91-100% | 3Marks |
| 81-90% | 2 Marks |
| 75-80% | 1 Mark |

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|----------------------|--|-----------------|-----------|----------|----------|---------------|
| PL23C01 | Core Paper I - Microbiology & Plant diversity I | CORE | 88 | 2 | - | 5 |

Preamble

To study the characteristics and life cycle of Bacteria, Virus, Algae, Fungi and Lichens.
 To study various plant diseases and their control measures.
 To impart knowledge on Artificial Intelligence and its types.

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|-------------------|---|------------------------|
| CLO1 | Understand the cellular, biochemical, and physiological aspects of microorganisms and recognize the similarities and differences between microbial groups (bacteria, algae, fungi, protozoa, viruses) | K1 |
| CLO2 | Acquire knowledge about the diversity of Algae based on structure and reproduction | K2 |
| CLO3 | Know about the morphology, reproduction and economic importance of fungi and lichens | K3 |
| CLO4 | Identify the causes, symptoms and control measures of plant diseases | K4 |
| CLO5 | Apply the artificial intelligence to the biological science | K5 |

Mapping with Programme Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------------|-------------|-------------|-------------|-------------|-------------|
| CLO1 | S | M | M | M | M |
| CLO2 | S | S | S | M | M |
| CLO3 | S | S | M | S | S |
| CLO4 | S | M | S | M | M |

S- Strong; M-Medium

Syllabus

Unit I : Microbiology

20 hrs

History and scope of microbiology. Structure and reproduction of viruses. Bacteria: Morphology, ultra structure, growth and reproduction. Bacterial classification (Bergey, 1923). Microbial techniques - methods of sterilization, culture media and pure culture techniques. Study of bacterial growth- growth curve. Gram staining.

Unit II: Algae

19 hrs

General characteristics of algae, Classification of algae (Fritsch, 1935). A detailed study on structure, reproduction and life cycle of *Anabaena*, *Chlamydomonas*, *Oedogonium*, *Ectocarpus* and *Polysiphonia* (developmental studies on sex organs not required). Economic importance of Algae.

Unit III: Fungi and Lichens

20 hrs

General characteristics of Fungi. Classification (Alexopoulos and Mims, 1972). Detailed study of morphology and reproduction of *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Polyporus* and *Aspergillus* (developmental studies on sex organs not required). Economic importance of Fungi.

Lichens: General characteristics, classification (Alexopoulos and Mims, 1979), reproduction and economic importance of Lichens. Detailed study of *Usnea*.

Unit- IV Plant Pathology

19 hrs

Classification of diseases– general symptoms. Penetration and disease development. Morphological and biochemical defense mechanisms in plants. A detailed study of the following plant diseases – Mosaic disease of tobacco, Citrus canker, Late blight of Potato, Red rot of sugarcane, Tikka disease of groundnut (causal organisms, symptoms, disease cycle and bio-control measures).

Unit-V

10 hrs

Artificial Intelligence-Definition; Types- Weak AI or Narrow AI, General AI and Super AI. Brief introduction to solutions to real-world problems by implementing the following AI processes/ techniques: 1-Machine Learning, 2- Deep Learning, 3- Natural Language Processing and 4- Robotics. AI to reintegrate biology: Biological knowledge discovery and assembly, Behavioural ecology, Genes to phenotypes, Prediction, evolution, and control of infectious diseases.

Text Books

| S. No. | Authors | Year of publication | Title of the book | Publishers |
|--------|--|---------------------|-------------------|-------------------------------------|
| 1. | Vashishta, B.R., Sinha, A.E and Singh, V.P | 2013 | Algae | S Chand and Company Ltd., New Delhi |
| 2. | Sharma O.P | 2011 | Algae | Tata Mc Graw-Hill |

| | | | | |
|----|---|------|--|--------------------------------------|
| | | | | Education |
| 3. | Sharma O.P | 2011 | Fungi and allied microorganisms | Tata Mc Graw-Hill Education |
| 4. | Purohit, S.S | 2017 | Microbiology-Fundamentals & Applications (7 th edition) | Rastogi Publications, Meerut |
| 5. | Pandey, B.P | 2005 | College Botany Vol I | S Chand & Company, New Delhi. |
| 6. | Vashishta B.R./ Sinha A.K. & Kumar Adarsh | 2016 | Botany for degree students Fungi | S. Chand and Company Ltd., New Delhi |

Reference Books

| S. No. | Authors | Year of publication | Title of the book | Publishers |
|--------|--|---------------------|---------------------------------------|--|
| 1. | Alexopoulos, CJ, Mims CW & Blackwell M | 2007 | Introductory Mycology | John Wiley & Sons, New York |
| 2. | Gangulee, HC. & Kar AK | 2011 | College Botany, Vol-II | New Central Book Agency Pvt. Ltd. Calcutta. |
| 3. | Mehrotra, RS & Aneja, KR | 2015 | An introduction to Mycology, 2nd Ed., | New Age International Private Limited, New Delhi |

Online course materials

1. <https://www.researchgate.net/publication/354185787>
2. <https://www.edureka.co/blog/types-of-artificial-intelligence/>
3. <https://www.mygreatlearning.com/blog/what-is-artificial-intelligence/#WhatisArtificialIntelligence>

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

1. Dr. C. Krishnaveni
2. Dr. M. Kanchana
3. Dr. H. Rehana banu

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|------------------------------------|----------|----|---|---|--------|
| PL23C02 | Core Paper II - Plant Diversity II | CORE | 88 | 2 | - | 5 |

Preamble

To study the classification, characteristics and life cycle of Bryophytes, Pteridophytes and Gymnosperms

To study the process of fossilization, geo-chronology and radio-carbon dating

Course Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Know the lifecycle of Bryophytes, Pteridophytes and Gymnosperms | K1 |
| CLO2 | Understand the characteristics of Bryophytes, Pteridophytes and Gymnosperms | K2 |
| CLO3 | Know the process of fossilization | K2 |
| CLO4 | Assess the evolutionary features of Bryophytes, Pteridophytes and Gymnosperms | K3 |

Mapping with Programme Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | M | M | M | M | M |
| CLO2 | M | M | S | M | M |
| CLO3 | S | S | M | M | S |
| CLO4 | S | S | M | M | M |

S- Strong; M-Medium

Syllabus

Unit I - Bryophytes

17hrs

General characteristics, Classification of Bryophytes (Reimers-1954), occurrence, distribution, common species, structure and reproduction of *Marchantia*, *Anthoceros* and *Funaria* (developmental studies on sex organs not required). Economic and ecological importance of Bryophytes. Evolution of Bryophytes

Unit II - Pteridophytes

17 hrs

General characteristics and Classification of Pteridophytes (Sporne, 1975). Stellar Evolution Homospory, heterospory and seed habit. Apogamy and apospory. Economic importance of Pteridophytes.

Unit III – Pteridophytes(Contd..)

17hrs

A detailed study of morphology, anatomy and reproduction of *Psilotum*, *Lycopodium*, *Equisetum* *Marsilea* (developmental studies on sex organs not required). Origin and evolution of

Pteridophytes.

Unit IV- Gymnosperms

17hrs

General characters, distribution and classification of Gymnosperms(Sporne, 1965). Detailed study of morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*(developmental studies on sex organs not required). Economic importance of Gymnosperms with special reference to oil, resin, timber, etc.

Unit V- Palaeobotany

20hrs

Fossils-fossilization process and Types of fossils - compression, impression, petrification, coal balls. Geological time scale. Radiocarbon dating. A detailed study of external and internal features and reproduction in *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Williamsonia sewardiana*.

Text Books

| S.No | Authors | Year of publication | Title of the book | Publishers |
|------|---|---------------------|--|--|
| 1. | Vasishta.B.R , Sinha & Adarsh Kumar | 2012 | Botany for Degree students –Bryophyta | S Chand And Company Ltd., New Delhi |
| 2. | Sharma O.P | 2011 | Bryophyta | Tata Mc Graw-Hill Education |
| 3. | Sharma O.P | 2011 | Pteridophyta | Tata Mc Graw-Hill Education |
| 4. | Vasishta PC, Sinha AK & Anilkumar | 2005 | Botany for degree students, | S Chand And Company Ltd., New Delhi. |
| 5. | Pandey, B.P | 2003 | College Botany Vol II | S Chand & Company, New Delhi |

Reference Books

| S.No | Authors | Year of publication | Title of the book | Publishers |
|------|--|---------------------|---|-------------------------------------|
| 1. | Arnold. C. A. | 2013 | An Introduction to Palaeobotany | McGraw Hill Book Company, London |
| 2. | Sporne, KR | 1974 | The Morphology of Gymnosperms | Hutchinson & Co., London. |
| 3. | Sporne, KR | 2015 | The Morphology of Pteridophytes | Hutchinson & Co., London |
| 4. | Steward.N.Wilso n & Rothwell, W. Gar | 2005 | Palaeobotany and evolution of Plants | Cambridge University Press |

Pedagogy

E-content, Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers:

- 1.Dr.C. Krishnaveni
- 2.Dr.K.S.Tamilselvi
- 3.Dr.B. S.Chithra Devi
- 4.Dr.R. Sumathi

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|--|----------|---|---|----|--------|
| PL23CP1 | Core Practical – I (Theory Paper - I & II Microbiology, Plant diversity I and Plant Diversity II) | CORE | - | - | 90 | 4 |

Preamble

- To observe, characterize and identify the different types of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and fossilized plants.
- To identify and differentiate the various plant diseases and the causative organisms.
- To isolate microorganisms from soil and establish pure cultures
- To distinguish between Gram positive and Gram negative bacteria

Course Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Identify the different forms of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and fossilized plants. | K1 |
| CLO2 | Know the host – pathogen interactions | K2 |
| CLO3 | Prepare sterile microbial culture media and demonstrate pure culture techniques | K3 |
| CLO4 | Interpret the industrial impact of fermentation process | K3 |

Mapping with Programme Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | M | M | M | M |
| CLO2 | S | S | M | M | M |
| CLO3 | S | S | M | M | M |
| CLO4 | S | S | M | M | M |

S- Strong; M-Medium

Syllabus: Microbiology & plant Diversity I**45 Hrs**

Algae - *Anabaena*, *Chlamydomonas*, *Oedogonium*, *Ectocarpus* and *Polysiphonia*

Fungi - *Albugo*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Polyporus* and *Aspergillus*

Lichens – *Usnea*

Plant pathology- Mosaic disease of tobacco, Citrus canker, Late blight of potato, Red rot of sugarcane, Tikka disease of groundnut.

Microbial Techniques

Sterilization techniques.

Preparation of culture media: Nutrient broth and Nutrient Agar medium Potato Dextrose Agar Medium

Preparation of slants

Soil dilution, Plating techniques, Enumeration of bacteria and fungi. Microscopic observation of fungi-

Lactoglycerol trypan blue staining, Microscopic observation of bacteria- Gram staining

Fermentation using yeast

Plant Diversity II:**45 Hrs**

(Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany)

Study of the following types

Bryophyta- *Marchantia*, *Anthoceros* and *Funaria*. **Pteridophyta**- *Psilotum*, *Lycopodium*, *Equisetum* and *Marsilea* **Gymnosperms** - *Cycas*, *Pinus* and *Gnetum*

Palaeobotany - *Rhynia*, *Lepidodendron*, *Lepidocarpan* and *Calamites*

Course Designers:

1. Dr. C. Krishnaveni
2. Dr. M. Kanchana
3. Dr. K.S. Tamil Selvi
4. Dr. H. Rehana banu
5. Dr.E. Uma

| COURSE NUMBER | COURSENAME | Category | L | T | P | Credit |
|----------------------|---|-----------------|-----------|----------|-----------|---------------|
| 23PELS1 | PROFESSIONAL ENGLISH FOR LIFE SCIENCES | - | 25 | 5 | -- | 2 |

Objectives

1. To develop the language skills of students by offering adequate practice in professional contexts.
2. To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
3. To focus on developing students' knowledge of domain specific registers and the required language skills.
4. To develop strategic competence that will help in efficient communication
5. To sharpen students' critical thinking skills and make students culturally aware of the target situation.

Course outcome

On the successful completion of the course, students will be able to

| CLO Number | CO Statement | Knowledge Level |
|-------------------|--|------------------------|
| CLO1 | Recognize their own ability to improve their own competence in using the language | K1 |
| CLO2 | Use language for speaking with confidence in an intelligible and acceptable manner | K2 |
| CLO3 | Read independently unfamiliar texts with comprehension and understand the importance of reading for life | K3 |
| CLO4 | Understand the importance of writing in academic life | K3 |
| CLO5 | Write simple sentences without committing error of spelling or grammar | K3 |

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

Mapping with Programme Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------------|-------------|-------------|-------------|-------------|-------------|
| CLO1 | S | S | S | M | M |
| CLO2 | S | S | S | M | M |
| CLO3 | S | S | M | M | S |
| CLO4 | S | S | M | M | M |
| CLO5 | S | S | S | S | S |

S- Strong; M-Medium

Syllabus

UNIT 1: Communication

5 hours

Listening: Listening to audio text and answering question Listening to Instructions

Speaking: Pair work and small group work.

Reading: Comprehension passages –Differentiate between facts and opinion

Writing: Developing a story with pictures.

Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 2: Description

5 hours

Listening: Listening to process description.-Drawing a flow chart.

Speaking: Role play (formal context)

Reading: Skimming/Scanning- Reading passages on products, equipment and gadgets.

Writing: Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.

Vocabulary: Register specific -Incorporated into the LSRW tasks.

UNIT 3: Negotiation Strategies

5 hours

Listening: Listening to interviews of specialists / Inventors in fields (Subject specific)

Speaking: Brainstorming. (Mind mapping).Small group discussions (Subject- Specific)

Reading: Longer Reading text.

Writing: Essay Writing (250 words)

Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 4: Presentation Skills

5 hours

Listening: Listening to lectures.

Speaking: Short talks.

Reading: Reading Comprehension passages

Writing: Writing Recommendations Interpreting Visuals inputs

Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 5: Critical Thinking Skills

5 hours

Listening: Listening comprehension- Listening for information.

Speaking: Making presentations (with PPT- practice).

Reading : Comprehension passages –Note making.Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)

Writing: Problem and Solution essay– Creative writing –Summary writing

Vocabulary: Register specific - Incorporated into the LSRW tasks

Textbooks

| S.No. | Authors | Title of the Book | Publishers | Year of Publication |
|-------|---|--------------------------------------|------------|---------------------|
| 1 | TamilNadu State Council for Higher Education (TANSICHE) | English for Life Sciences Semester 1 | -- | -- |

Reference Books

| S.No. | Authors | Title of the Book | Publishers | Year of Publication |
|-------|--|-----------------------------------|------------------|---------------------|
| 1 | Sreedharan, Josh | The Four Skills for Communication | Foundation books | 2016 |
| 2 | Pillai, G Radhakrishna, K Rajeevan, P Bhaskaran Nair | Spoken English for you | Emerald | 1998 |
| 3 | Pillai, G radhakrishna, K Rajeevan, P Bhaskaran Nair | Written English for you | Emerald | 1998 |

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|---|----------|----|---|---|--------|
| PL23C03 | Core Paper - III Cell and Molecular Biology | Theory | 73 | 2 | - | 5 |

Preamble

- To study the structure and function of basic components of prokaryotic and eukaryotic cells, cell membranes and cell wall
- To study the structure and function of cell organelles
- To appreciate the cellular components underlying mitotic cell division.
- To understand the structure and function of DNA, RNA.
- To appreciate the central dogma of life, protein synthesis

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1. | Understand the structure and function of prokaryotic and eukaryotic cells, cell membranes, cell wall and cell organelles | K1, K2, K3 |
| CLO2. | Know the process of cell cycle and cell division | K1, K2, K3 |
| CLO3. | Understand the structure and function of DNA, RNA | K1, K2, K3 |
| CLO4. | Appreciate the concept of transcription and translation | K1, K2, K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | S | M | S |
| CLO2. | S | S | S | M | S |
| CLO3. | S | S | M | M | M |
| CLO4. | S | S | M | M | M |

S- Strong; M-Medium

Syllabus

Unit-1

15 hrs

Prokaryotic and eukaryotic cell – structure: cell wall, plasma membrane and cytoplasm – structure and function. Cell organelles- Endoplasmic reticulum, Golgi body, Lysosomes, Vacuoles and Ribosomes, Mitochondria, chloroplast – structure and function.

Unit-II

14 hrs

Nucleus- structure and function; Cell cycle, Cell division- mitosis and meiosis. Chromosomes- Structure and function, Classification of chromosomes based on centromere. Special types of chromosomes- Lampbrush and Polytene chromosomes.

Unit-III

15 hrs

Nucleic acids: DNA as genetic material, Structure (Watson and Crick Model), forms and function of DNA. DNA replication- conservative and semi-conservative. Dispersive. Organization of DNA into chromosomes. Gene Mutation – types, causes.

Chromosomal aberrations

Unit-IV

14 hrs

RNA– structure, function & Types (tRNA, mRNA and rRNA). Central dogma of life
Transcription– initiation, elongation and termination. Post transcriptional
modifications. Genetic code- concept and properties, wobble hypothesis.

Unit-V

15 hrs

Translation – initiation, elongation and termination. Regulation of Gene expression-
prokaryotes-operon concept- *lac* operon and *trp* operon. Post translational
modifications.

Text Books

| S.No. | Authors | Title of the book | Publishers | Edition & Year of publication |
|-------|--------------------------------|---|----------------------------------|-------------------------------|
| 1. | Gupta P.K. | Cell and Molecular Biology | Rastogi publications. | 2 nd ed. 2017 |
| 2. | Arumugam N & Meyyan RP | Cell Biology, Molecular Biology & Genetics- Vol I | Saras Publications. | 1 st ed. 2014 |
| 3. | Verma, P.S. and Agarwal, V.K | Cytology | S.Chand & Co, New Delhi | 16 th ed. 2018 |
| 4. | Shukla, R.S. and Chandel, P.S. | Cytogenetics, evolution, Biostatistics and Plant Breeding | S. Chand & Co, New Delhi | 1 st ed. 2014 |
| 5. | Verma P.S. and Agarwal V.K. | Cell biology, Genetics, Molecular Biology, Evolution and Ecology. | S. Chand and Company, New Delhi. | 2 nd ed. 2022 |

Reference Books

| S.No. | Authors | Title of the book | Publishers | Edition & Year of publication |
|-------|---|----------------------------------|--|-------------------------------|
| 1. | Geoffrey M. Cooper and Robert E. Hausman, | The Cell – A Molecular Approach. | Sinauer Associates, Inc. Publishers - Sunderland, Massachusetts U.S.A. | 6 th ed. 2013 |
| 2. | Clark, D. P., Pazdernik, N. J. | Molecular Biology | Netherlands: Elsevier Science | 3 rd ed. 2018 |
| 3. | Ajoy Paul | Cell and Molecular Biology | Books and Allied Pvt Ltd., Kolkatta | 3 rd ed. 2011 |
| 4. | De Robertis and De Robertis. | Cell and Molecular biology | Lippincott Williams and Wilkins. UK | 8 th ed. 2017 |

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designers

Dr. K.S. Tamil Selvi

Dr.E.Uma

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|--|-----------|---|---|----|--------|
| PL23CP2 | Core Practical II (Core Paper III and IV) | Practical | - | - | 60 | 4 |

Preamble

- To study the structural and functional aspects of various tissue systems and organs of dicots and monocots.
- To discuss the structure and functions of the meristematic, primary & complex tissues.
- To understand the structure of cells in relation to the functional aspects.
- Understand the cellular components underlying cell division.

Course learning outcomes

On the successful completion of the course, students will be able to

| CO Number | CO Statement | Knowledge Level |
|-----------|--|-----------------|
| CLO1 | Recall the structure of the cell organelles through electron micrographs. | K1 |
| CLO2 | Understand the structure and functions of the meristematic, primary and complex tissues. | K2 |
| CLO3 | Distinguish between normal and anomalous secondary growth. | K2 |
| CLO4 | Discuss the development of the endosperm and embryo. | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | M | M | S |
| CLO2. | M | S | S | M | S |
| CLO3. | S | S | M | S | M |
| CLO4. | M | S | S | M | S |

S- Strong; M-Medium

Syllabus

Paper III - Cell and Molecular Biology (30hrs)

- Study of plant cell organelles through photomicrographs/permanent slides- Cell wall, plasma membrane (Fluid Mosaic model), nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi body, lysosomes, vacuoles and ribosomes. Lampbrush and polytene chromosomes.
- Study of Nucleic acids by micrographs
DNA (Watson & Crick model), t-RNA (clover leaf model).
- Study of various stages of mitosis using cytological preparation of Onion root tips.
- Study of various stages of meiosis using cytological preparation of Flower bud-anther.

Paper IV – Plant Anatomy, Embryology and Wood technology: (30hrs)

Sectioning and Identification:

Plant Anatomy: Primary structure of Leaf, stem and root of dicot and monocot. Secondary thickening in dicot stem -*Polyalthia* and root-*Vigna*. Anomalous secondary thickening in the stems - *Nyctanthus* and *Boerhaavia*; root – *Beta vulgaris*. Anomalous secondary thickening in the monocot stem-*Dracaena*.

Spotters: Book diagram/Permanent slides/Photographs

Meristems – shoot and root apex, Xylem – tracheids and vessels, Phloem. Annual rings, Wood preservatives, Defects in wood.

Embryology: T.S of anther, Types of ovules, Types of embryosac- uninucleate, binucleate and mature embryosac; Types of endosperms – nuclear, cellular and helobial. Embryo mounting (*Tridax*).

Course Designers

Dr.K.Gajalakshmi

Dr. K.S.Tamil Selvi

Dr.E.Uma

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|--|----------|----|---|---|--------|
| PL23A01 | Allied Paper – I: Fundamentals of Botany - I | Theory | 73 | 2 | - | 4 |

Preamble

- To study the characteristics and life cycle of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms
- To gain knowledge of adaptations of plants to different environments
- To learn the horticulture techniques.

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Know about characteristics and life cycle of algae, fungi, bryophytes, pteridophytes, gymnosperms | K1 |
| CLO2 | Know about characteristics and life cycle of angiosperms | K1 |
| CLO3 | Understand the concept of plant adaptations to different environments | K2 |
| CLO4 | Appraise the horticulture techniques. | K2 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | M | M | S | S |
| CLO2 | S | S | M | M | M |
| CLO3 | S | S | S | S | S |
| CLO4 | S | S | S | M | M |

S- Strong; M-Medium

Syllabus

Unit I

15 hrs

General characteristics and classification of Algae (Fritsch-1935,1948) - A study of distribution, structure, reproduction and life cycle of *Volvox*. *Economic importance of algae, General characteristics and classification of Fungi (Alexopoulos and Mims, 1979) –A study of distribution, structure, reproduction and life cycle of *Saccharomyces*. *Economic importance of Fungi. General characteristics, classification (Zahlbruckner,1907), reproduction and *Economic importance of Lichens.

Unit II**15 hrs**

*General characteristics and Classification of Bryophyte (Engler,1892)- Structure, Reproduction and Life cycle of *Riccia*, *General characteristics and Classification of Pteridophytes (Reimer,1954) - Structure, Reproduction and Life cycle of *Lycopodium*, *General characteristics and Classification of Gymnosperms (Sporne-1965) - Structure, Reproduction and Life cycle of *Cycas*.

Unit III**15 hrs**

General Characteristics and Classification of Angiosperms (Bentham and Hooker, 1883). *Morphology of stem, *root, *leaf, *inflorescence, *flower and *fruit. Study of the following families with their Economic importance – Annonaceae, Rutaceae, Rubiaceae, Lamiaceae, Amarantaceae and Poaceae.

Unit- IV**14 hrs**

Ecology –*Plant adaptations. Xerophytes - *Nerium*, *Opuntia*. Mesophytes -*Helianthus*, *Hibiscus*. Hydrophytes-*Hydrilla*, *Nelumbium*. *Phytogeography –*Vegetations of Tamil Nadu: *Evergreen, *scrub jungle, *Mangrove

Unit V**14 hrs**

Horticulture: scope and importance, *propagation methods –*cutting, *layering and *grafting techniques), gardening and landscaping, *irrigation methods, manures, lawns, indoor plants, bonsai techniques.

Note: *Online Learning**Text Books**

| S.No. | Authors | Title of the book | Publishers | Edition & Year of publication |
|-------|-------------------------|------------------------------------|---------------------------------|-------------------------------|
| 1. | Srivastava, H.N | Algae | Pradeep Publications, Delhi | 10 th Ed. 2004 |
| 2. | Srivastava, H.N. | Fungi. | Pradeep Publications, Delhi | 10 th Ed. 2004 |
| 3. | Srivastava, H.N. | Pteridophytes | Pradeep Publications, Delhi | 10 th Ed. 2004 |
| 4. | Pandey, P.B | Plant Anatomy | S. Chand & Co, New Delhi | 1 st Ed. 2001 |
| 5. | Singh, V. and Jain | Taxonomy of Angiosperms | Rastogi Publications, New Delhi | 2 nd Ed. 1985 |
| 6. | Purohit S.S & Ranjan .R | Ecology, Environment and Pollution | Agrobios, India, Jodhpur | 1 st Ed. 2003 |

Reference Books

| S.No | Authors | Title of the book | Publishers | Edition & Year of publication |
|------|---------------|-------------------------|-------------------------------------|-------------------------------|
| 1. | Sharma O.P. | Plant Taxonomy | Tata McGraw Hill Comp, New Delhi | 2 nd Ed. 2018 |
| 2. | Pandey, B. P. | Taxonomy of Angiosperms | S. Chand & Co, New Delhi | 6 th Ed. 2015 |

Pedagogy: Powerpoint, lecture, seminar, quiz and discussion.

Course Designers

Dr. R. Sumathi

| COURSE NUMBER | COURSE NAME | Category | L | T | P | Credit |
|---------------|-----------------|----------|----|---|---|--------|
| NM23DTG | DESIGN THINKING | Theory | 30 | - | - | 2 |

Preamble:

1. To expose the students to the concept of design thinking as a tool for innovation
2. To facilitate them to analyze the design process in decision making
3. To impart the design thinking skills

Course learning outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Understand the concepts of Design thinking and its application in varied business settings | K1 |
| CLO2 | Describe the principles, basis of design thinking and its stages | K2 |
| CLO3 | Apply design thinking process in problem solving | K3 |
| CLO4 | Analyse the best practices of design thinking and impart them in business and individual day to day operations. | K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | M | M | S | S |
| CLO2 | M | S | S | M | M |
| CLO3 | S | S | S | M | S |
| CLO4 | S | S | S | S | S |

S-Strong; M-Medium

UNIT –1

(6 Hours)

Design Thinking Overview: Introduction to Design Thinking and Design Research Strategies
-Design Thinking Skills

UNIT– II

(6 Hours)

Design Thinking Mindset- Principles of Design Thinking-Basis for design thinking- Design Thinking Hats - Design thinking team

UNIT–III

(6 Hours)

Empathize - definition - Listen & Empathize with the Customers and/ or Users - Tools and Techniques

UNIT–IV

(6 Hours)

Define -Definition -Defining the Problem -Tools and Techniques-Journey mapping and Ideate - definition - Ideation techniques

UNIT –V

(6

Hours)

Prototype-Definition-Prototype Alternate Solutions-Test the Solutions-

Visualization-Story Telling - Cautions and Pitfalls - Best Practices

Text Books:

| S. No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|--------|--|--|-------------------------------|---------------------|
| 1. | Christian Mueller-Roterberg | Handbook of Design Thinking Tips & Tools for how to design thinking | Amazon Kindle Version | 2018 |
| 2 | Gavin Ambrose Paul Harris | Design Thinking | AVA Publishing Switzerland | 2010 |
| 3 | Sambrant Srivastava and Vijay Kumar | A Text Book of Design Thinking | Vayu Education of India | 2022 |

Reference Books:

| Sl.No. | Author(s) | Title of the Book | Publisher | Year of Publication |
|--------|---|---|--------------------------------------|---------------------|
| 1 | Maurício Vianna Ysmar Vianna Isabel K. Adler Brenda Lucena Beatriz Russo | Design Thinking-Business Innovation | MJVPress | 2011 |
| 2 | Moritz Gekeler | A practical guide to design thinking | Friedrich-Ebert-Stiftung | 2019 |
| 3 | J.Berengueres | The Brown Book of Design Thinking | UAE University College, Al Ain | 2014 |

Blended Learning Links

| UNIT | TOPICS | LINK |
|-----------------|---|--|
| UNIT I | Introduction to Design Thinking | https://www.digimat.in/nptel/courses/video/109104109/L01.html |
| | Design Thinking skills | https://www.youtube.com/watch?v=b-9Id-Jt_PI |
| UNIT II | Principles& Basis of Design Thinking | https://youtu.be/6-NRiom8K9Y |
| | Design Thinking hats | https://www.youtube.com/watch?v=bc-BvFQDmmk |
| UNIT III | Empathize | http://acl.digimat.in/nptel/courses/video/109104109/L02.html http://acl.digimat.in/nptel/courses/video/109104109/L03.html https://youtu.be/ls2mqHs02B0 |
| UNIT IV | Define | http://acl.digimat.in/nptel/courses/video/109104109/L04.html https://youtu.be/veixQsRnZZU https://youtu.be/6-bDSKZJEAM |
| | Ideate | http://acl.digimat.in/nptel/courses/video/109104109/L11.html http://acl.digimat.in/nptel/courses/video/109104109/L12.html http://acl.digimat.in/nptel/courses/video/109104109/L13.html |
| | Prototype | http://acl.digimat.in/nptel/courses/video/109104109/L15.html |
| UNIT V | Testing | http://acl.digimat.in/nptel/courses/video/109104109/L16.html http://acl.digimat.in/nptel/courses/video/109104109/L17.html http://acl.digimat.in/nptel/courses/video/109104109/L18.html http://acl.digimat.in/nptel/courses/video/109104109/L19.html |

| COURSE CODE | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|-------------|--|----------|----|---|---|--------|
| PL23C04 | Paper - IV – Plant Anatomy, Wood Technology and Embryology | Theory | 73 | 2 | - | 5 |

Preamble

- To know the anatomical structure of the Angiosperm plants
- To identify woods of commercial importance
- Methods of preserving and seasoning woods.
- To study the structure and development of embryo

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Know the fundamental structure of different plant tissue system | K1 |
| CLO2 | Understand the development of different types of cells in plant system | K2 |
| CLO3 | Identify the quality of wood | K3 |
| CLO4 | Analyse the Anatomical variation between the plant species | K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | M | S | M |
| CLO2 | S | M | S | M | M |
| CLO3 | S | S | M | S | M |
| CLO4 | S | S | M | M | M |

S- Strong; M-Medium

Syllabus

Unit I

(15 hrs)

Plant Anatomy: General account on Meristems. Shoot Apical Meristems, theories - apical cell theory, histogen, tunica and corpus. Root Apical Meristems- Korper and Kappe theory and Quiscent centre theory. Simple tissues- parenchyma, collenchyma and sclerenchyma.

Unit II

(14 hrs)

Evolution of plant vascular system. Complex tissues – primary xylem and phloem, secondary xylem and phloem. Primary structure of dicot and monocot stem; dicot and monocot root. Anatomical structure of dicot and monocot leaf. Epidermal Tissues -Types of stomata and Secretory tissues.

Unit III:

(15 hrs)

Formation of Secondary thickening in Dicot stem and Dicot root. Anomalous secondary thickening in Dicot stems - *Nyctanthus* and *Boerhaavia*; Dicot root of *Beta vulgaris*. Anomalous secondary thickening in monocot stem – *Dracaena**.

Unit IV: (14 hrs)

Wood Technology: Brief account on the formation and types of woods. Annual rings and Dendrochronology. Physical, Chemical, and Mechanical properties of wood. Defects in woods. Seasoning of woods, Methods of preservation of wood, and uses of wood.

Unit V: (15 hrs)

Embryology: Microsporogenesis and development of male gametophyte; Megasporogenesis and development of female gametophyte. Structure of 8 nucleate monosporic embryo sac (*Polygonum*), Bisporic (*Allium*), tetrasporic (*Peperomia*). Fertilization and Double Fertilization. Types of endosperm. Development of monocot (*Luzulla*) and dicot (*Capsella*) embryo.

Text Books

| S.No | Authors | Title of the book | Publishers | Edition & Year of publication |
|------|------------------------------------|---------------------------------------|-----------------------------|-------------------------------|
| 1. | Pandey.BP. | Plant Anatomy | S.Chand and company. | 6 th Ed. 2001 |
| 2. | Tayal, MS | Plant Anatomy | Rastogi Publications | 3 rd Ed. 2004 |
| 3. | Katherine Esau | Anatomy of seed plants | John Wiley and Sons. U.S.A. | 3 rd Ed. 2011 |
| 4. | Singh, V., Pande, PC. and Jain, DK | Anatomy and Embryology of Angiosperms | Rastogi Publications | 3 rd Rev. Ed. 2018 |
| 5. | Christian Brischke | Wood Protection and Preservation | Mdpi AG | 1 st Ed. 2020 |

Reference Books

| S.No | Authors | Title of the book | Publishers | Edition & Year of publication |
|------|--|---|----------------------------------|-------------------------------|
| 1. | D.F.Cutter, C.E.J Bottla, D.W.Stevenson, | Plant Anatomy, An applied Approach | Blackwell Publishing. Australia. | 1 st Ed. 2011 |
| 2. | Franz F. P. Kollmann, Wilfred A. Côté | Principles of Wood Science and Technology | Springer Berlin, Heidelberg | 1 st Ed. 2020 |
| 3. | Bhojwani, SS., Bhatnagar, SP and Dantu, PK | The Embryology of Angiosperms | S Chand publishers | 6 th Ed. 2020 |

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion

and Video/ Animation

Links for blended learning

| S.No. | Topic | Link for the topic |
|--------------|-----------------|---|
| 1. | Plant Anatomy | https://www.youtube.com/watch?v=03K82iPyWS0 https://m.youtube.com/watch?v=lp4rIgsRdLc https://byjus.com/biology/ts-of-dracaena-stem/ |
| 2. | Wood Technology | https://www.youtube.com/watch?v=9zT3qaZJxIw https://www.youtube.com/watch?v=qHzIWI7CS8E |
| 3. | Embryology | https://www.youtube.com/watch?v=dgFY7WUTASQ https://www.youtube.com/watch?v=bUjVHUF4d1I |

Course Designer

Dr.M.Kamalam

| COURSE CODE | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|-------------|--|-----------|---|---|----|--------|
| PL23CP2 | Core Practical II (Core Paper III and IV) | Practical | - | - | 60 | 4 |

Preamble

- To study the structural and functional aspects of various tissue systems and organs of dicots and monocots.
- To discuss the structure and functions of the meristematic, primary & complex tissues.
- To understand the structure of cells in relation to the functional aspects.
- Understand the cellular components underlying cell division.

Course learning outcomes

On the successful completion of the course, students will be able to

| CO Number | CO Statement | Knowledge Level |
|-----------|--|-----------------|
| CLO1 | Recall the structure of the cell organelles through electron micrographs. | K1 |
| CLO2 | Understand the structure and functions of the meristematic, primary and complex tissues. | K2 |
| CLO3 | Distinguish between normal and anomalous secondary growth. | K2 |
| CLO4 | Discuss the development of the endosperm and embryo. | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | M | M | S |
| CLO2. | M | S | S | M | S |
| CLO3. | S | S | M | S | M |
| CLO4. | M | S | S | M | S |

S- Strong; M-Medium

Syllabus

Paper III - Cell and Molecular Biology

(30hrs)

- Study of plant cell organelles through photomicrographs/permanent slides- Cell wall, plasma membrane (Fluid Mosaic model), nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi body, lysosomes, vacuoles and ribosomes. Lampbrush and polytene chromosomes.
- Study of Nucleic acids by micrographs
DNA (Watson & Crick model), t-RNA (clover leaf model).
 - Study of various stages of mitosis using cytological preparation of Onion root tips.
 - Study of various stages of meiosis using cytological preparation of Flower bud-

anther.

**Paper IV – Plant Anatomy, Wood technology and Embryology:
Sectioning and Identification:**

(30hrs)

Plant Anatomy: Primary structure of Leaf, stem and root of dicot and monocot. Secondary thickening in dicot stem -*Polyalthia* and root-*Vigna*. Anomalous secondary thickening in the stems - *Nyctanthus* and *Boerhaavia*; root – *Beta vulgaris*. Anomalous secondary thickening in the monocot stem-*Dracaena*.

Spotters: Book diagram/Permanent slides/Photographs

Meristems – shoot and root apex, Xylem – tracheids and vessels, Phloem. Annual rings, Wood preservatives, Defects in wood.

Embryology: T.S of anther, Types of ovules, Types of embryosac- uninucleate, bi-nucleate and mature embryosac; Types of endosperms – nuclear, cellular and helobial. Embryo mounting (*Tridax*).

Course Designers

Dr.K.Gajalakshmi

Dr. K.S.Tamil Selvi

Dr.E.Uma

| COURSE CODE | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|-------------|---|----------|----|---|---|--------|
| PL23SCE1 | Climate Change and Health: From Science to Action | Theory | 45 | - | - | 3 |

| S.No. | Topic of the Course | Link of the Course | Duration in hrs |
|-------|--|---|-----------------|
| 1. | What is Climate Change? | https://www.coursera.org/learn/what-is-climate-change?specialization=our-responses-climate-change | 6 |
| 2. | Tropical Forest Landscapes 101: Conservation & Restoration | https://www.coursera.org/learn/tropicalforests101 | 20 |
| 3. | Climate change and Indigenous People and local communities | https://www.coursera.org/learn/climate-change-indigenous-communities | 14 |
| 4. | Our Earth's future | https://www.coursera.org/learn/earth-climate-change | 8 |

2. What is Climate change?

Week 1 - The Climate System and Climate Change – 2 hours

Week 2 - Impacts of Climate Change – 2 hours

Week 3 - Attitudes About Climate Change – 3 hours

3. Tropical Forest Landscapes 101: Conservation & Restoration

Week 1 - Why conserve and restore tropical forest landscapes? – 3 hours

Week 2 - Ecology of tropical forest landscapes – 3 hours

Week 3 - Social considerations for restoration and conservation – 3 hours

Week 4 - Conservation strategies – 3 hours

Week 5 - Restoration fundamentals – 3 hours

Week 6 - Agroforestry and agroecology – 3 hours

Week 7 - Funding conservation and restoration – 4 hours

4. Climate change and Indigenous People and local communities

Week 1 - Climate change and Indigenous Peoples and local communities – 1 hour

- Introduction – 2 hours

Week 2 - Climate change impacts on indigenous peoples and local communities – 3 hours

Week 3 - Coping and adapting to climate change impacts – 3 hours

Week 4 - Local Indicators of climate change impacts – 2 hours

Week 5 - The role of IPLC in global climate governance – 3 hours

5. Our Earth's future

Week 1 - Climate Change Is Happening: See It – 2 hours

Week 2 - It All Comes Down to the Ocean – 1 hour

Week 3 - Climate Change is Happening: Model It – 1 hour

Week 4 - Living with Climate Change – 1 hour

Week 5 - Mitigate, Adapt, or Suffer? – 2 hours

| COURSE CODE | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|-------------|--|----------|----|---|---|--------|
| PL23A02 | Allied Paper II – Fundamentals of Botany- II | Theory | 73 | 2 | - | 4 |

Preamble

- To Gain Knowledge of the anatomy of plants
- To Gain Knowledge of the embryology of plants
- To study the metabolism of plants
- To know about the plant tissue culture techniques
- To Gain Knowledge of the microbial techniques

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Appreciate the anatomy of plants | K1 |
| CLO2 | Appreciate the embryology of plants | K2 |
| CLO3 | Appreciate the metabolism of plants | K3 |
| CLO4 | Understand the plant tissue culture techniques | K3 |
| CLO5 | Understand the microbial techniques | K2 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | M | S | M | M | M |
| CLO2 | S | S | M | S | S |
| CLO3 | M | M | M | M | M |
| CLO4 | S | S | S | S | M |
| CLO5 | S | M | M | M | M |

S- Strong; M-Medium

Syllabus

Unit I

15 hrs

A brief account of meristems. Simple and complex permanent tissues Primary structure of dicot and monocot stem, root and leaf; Secondary structure of dicot stem and root.

Unit II

14 hrs

Microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, structure of monosporic 8 – nucleate embryo sac (*Polygonum*). Types of endosperm, development of dicot and monocot embryos.

Unit III

15hrs

Plant Physiology- osmosis and diffusion. Passive and Active absorption of water, Photosynthesis - Photosynthetic apparatus, light and dark reaction. Transpiration.Plant movements, plant growth regulators –Auxin and Cytokinin.

Unit IV

14hrs

Tissue culture: Concept and Techniques– Sterilization, Medium preparation (MS medium),

Callus culture, organogenesis and regeneration. Hardening and field transfer.

Unit-V Microbial techniques

15 hrs

Methods of sterilization, Culture media- PDA, Serial dilution techniques. Pure culture techniques, Microbial growth and Growth curve. Typical Fermentation process.

Text books

| S.No | Authors | Title of the book | Publishers | Edition& Year of publication |
|------|------------------------------------|--|--|-------------------------------|
| 1. | Tayal, MS | Plant Anatomy | Rastogi Publications | 3 rd Ed. 2004 |
| 2. | Singh, V., Pande, PC. and Jain, DK | Anatomy and Embryology of Angiosperms | Rastogi Publications | 3 rd Rev. Ed. 2018 |
| 3. | Jain.V.K | Fundamentals of plant physiology | Chand & Company, New Delhi | 19 th Ed. 2017 |
| 4. | Kalyan Kumar, De. | An Introduction to Plant Tissue Culture. | New Central Book Agency Pvt.Ltd. Howrah. | 1 st Ed. 2004 |
| 5. | Kumaresan, V | Biotechnology | Saras Publication, Nagercoil, TamilNadu | 6 th Ed. 2017 |

Reference books

| S.No | Authors | Title of the book | Publishers | Edition& Year of publication |
|------|---|-------------------|--|------------------------------|
| 1. | Sharma, P.D | Microbiology | Rastogi Publications, Meerut. | 3 rd Ed. 2010 |
| 2. | Michael J. Pelczar, E.C.S. Chan and Noel R Krieg. | Microbiology | Mc Graw Hill, New Delhi. | 5 th Ed. 1988 |
| 3. | Mukherji.S. and A.K. Ghosh. | Plant Physiology | New Central Book Agency Pvt Ltd. Kolkatta. | 1 st Ed. 2017 |

Pedagogy: Powerpoint, lecture, seminar, quiz and discussion.

Links for blended learning

| S.No. | Unit | Topic | Link for the topic |
|-------|---------|------------|---|
| 1. | Unit I | Anatomy | https://www.youtube.com/watch?v=SiZiTeQ-nHk https://www.youtube.com/watch?v=LzFDghMoMRQ https://www.youtube.com/watch?v=bbgwE-h84iE |
| 2. | Unit II | Embryology | https://www.youtube.com/watch?v=EgiET_piGpA https://www.youtube.com/watch?v=DPcSTA3EUE4 https://www.youtube.com/watch?v=x26Fg8ltCGw |

| | | | |
|----|----------|------------------|---|
| 3. | Unit III | Plant Physiology | https://www.youtube.com/watch?v=eeOcGX5qPp8 https://www.youtube.com/watch?v=iP6PtdhgzSk https://www.youtube.com/watch?v=zt9ja6p8q6U https://www.youtube.com/watch?v=Py2O9rXENIg https://www.youtube.com/watch?v=DMWB9b58Rt4 |
| 4. | Unit IV | Tissue culture | https://www.youtube.com/watch?v=eMv_PMNPYMc https://www.youtube.com/watch?v=YodPROvjroU |
| 5. | Unit V | Microbiology | https://www.youtube.com/watch?v=Bh-ytzY5uVY https://www.youtube.com/watch?v=OLz9JOrJepU https://www.youtube.com/watch?v=Ppe_bgnPFHU |

| COURSE CODE | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|-------------|--------------------------|-----------|---|---|----|--------|
| PL23AP1 | Allied Paper - Practical | Practical | - | - | 60 | 2 |

Preamble

- To observe and identify the different types of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- To obtain knowledge on anatomy of plants.

Course learning outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Differentiate the different forms of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. | K1 |
| CLO2 | Preparation of culture media. | K2 |
| CLO3 | Illustrate the internal structure of plant tissues. | K3 |
| CLO4 | Analyse the various pigments in plants | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | M | S | M | M | M |
| CLO2. | S | S | M | S | S |
| CLO3. | M | M | M | M | M |
| CLO4. | S | S | S | S | M |

S- Strong; M-Medium

Syllabus

Semester- III

30 hrs

Specimens

Bryophytes - Habit of *Riccia*

Pteridophytes - Habit of *Lycopodium cernuum*, *L. clavatum*, *L. phlegmaria* Gymnosperms - Habit of *Cycas*, Male cone, Female cone

Taxonomy - Study of plants belonging to the families (Annonaceae, Rutaceae, Rubiaceae, Lamiaceae, Amaranthaceae, and Poaceae) and their economic importance

Ecology- Habit of *Nerium*, *Opuntia*, *Helianthus*, *Hibiscus*, *Hydrilla*, *Nelumbium*

Slides

Algae - *Volvox*- Daughter colonies, Oogonia and Antheridia. Fungi - *Saccharomyces*-Single cell structure

Bryophytes - *Riccia*- Reproductive Structures-Antheridium, Archegonium and Sporangium Pteridophytes - *Lycopodium*- L.S. of Cone

Gymnosperms - *Cycas*- T.S. of Corolloid root

Sectioning

Bryophytes - *Riccia*- T.S. of Thallus

Pteridophytes - *Lycopodium*- T.S. of Stem

Gymnosperms - *Cycas* - T.S. of Leaflet, T.S. of Rachis

Demonstration – cutting, layering, Grafting and bonsai

Semester- IV

30 hrs

Slides

Anatomy - Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma), Complex Tissues (Xylem and Phloem)

Embryology- T.S. of Mature anther, 8- nucleated Embryosac, Mature Embryo

Sectioning

Anatomy- Primary structure of Dicot stem, root and leaf Primary structures of Monocot stem and root

Experiments

Physiology - Determination of osmotic potential by Plasmolytic method.

Separation of leaf pigment by Paper chromatography.

Microbiology- Preparation of Potato Dextrose Agar Medium, Serial dilution techniques and culture techniques –Pour plate, spread plate, streak plate & slant.

Demonstration Experiments

Physiology – hill reaction,

Tissue culture – sterilization, preparation of MS medium, inoculation, callus induction and organogenesis.

Spotters Microbiology – fermentor

Course Designers

Dr.C.Krishnaveni

Dr. R. Sumathi

Dr.E.Uma

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-------------------------|----------|----|---|---|--------|
| PL23C05 | Taxonomy of Angiosperms | Theory | 58 | 2 | - | 4 |

Preamble

- Provides comprehensive knowledge of plant taxonomy, covering historical perspectives, classification systems, and plant morphology.
- Equips students with the ability to apply scientific rules of botanical nomenclature and understand taxonomic hierarchy based on international standards.
- Develops skills to identify and classify angiosperm families through analysis of morphological and reproductive characteristics.
- Enhances understanding of the economic significance of various plant groups and their contributions to human welfare.
- Integrates traditional taxonomy with modern tools, including Artificial Intelligence applications and image-based plant identification systems.

Course Learning Outcomes

On the successful completion of the course, students will be able to:

| CLOs | CLO Statement | Knowledge Level |
|------|--|-----------------|
| CLO1 | Understand the history, classification, plant morphology, floral diagram and formula, and herbarium techniques. | K1, K2, K3, K4 |
| CLO2 | Apply the rules of botanical nomenclature, including taxonomic hierarchy, codes of nomenclature. | K1, K2, K3, K4 |
| CLO3 | Analyze the diagnostic characters to identify plants and summarize the economic importance of selected family. | K1, K2, K3, K4 |
| CLO4 | Evaluate the economic significance of important plant products and demonstrate conceptual understanding of AI tools in plant identification. | K1, K2, K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | M | M | M | S |
| CLO2. | S | M | S | M | M |
| CLO3. | S | S | M | M | S |
| CLO4. | S | M | S | S | M |

S- Strong; M-Medium

Syllabus

Unit I**14 hrs**

Introduction to Plant Taxonomy: History of Plant Taxonomy. Systems of classification: Artificial – Linnaeus; Natural – Bentham and Hooker; Phylogenetic– Arthur Cronquist, Modern - APG system IV. Plant Morphology: Root, Stem Leaf, Flower and Fruit. Construction of floral diagram and floral formula. Herbaria: National, International and Virtual; and Herbarium techniques: Specimen preparation, Mounting and Deposition.

Unit II**12 hrs**

Botanical Nomenclature: Taxonomic hierarchy. Important Botanical Code of Nomenclature: Paris Code, Rochester Code, Vienna Code, Cambridge Code, Leningrad Code. Priority, Typification, Effective and Valid Publication, and Author Citation with updation to Shenzhen Code. Polynomial and Binomial system. Guidelines for writing author citation.

Unit III**11 hrs**

Systematic Botany I: A study on the diagnostic characteristics and economic importance of the following families: Annonaceae, Nymphaeaceae, Capparidaceae, Tiliaceae, Rutaceae, Anacardiaceae, Myrtaceae, Cucurbitaceae, Rubiaceae and Asteraceae.

Unit IV**11 hrs**

Systematic Botany II: A study on the diagnostic characteristics and economic importance of the following families: Sapotaceae, Apocynaceae, Asclepiadaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae and Poaceae.

Unit V**10 hrs**

Economic Botany: The importance and uses of plant products – fibres: Cotton (*Gossypium hirsutum* L.) and Jute (*Corchorus olitorius* L.); Food plant – Rice (*Oryza sativa* L.); Dye –*Indigofera tinctoria* L.; Spices and Condiments – Cardamom (*Elettaria cardamomum* Maton.) and Clove (*Syzygium aromaticum* (L.) Merr. & L.M.Perry).

Artificial Intelligence in Plant Taxonomy: Introduction to the role of Artificial Intelligence in Plant Taxonomy. AI Tool in plant identification using images – Google Lens and Flora Incognita. Image classification in Plant Taxonomy using machine learning models (no coding required): Convolutional Neural Networks (CNNs), Random Forest and Support Vector Machines (SVM).

Text Books

| S.No. | Author name | Title of the book | Publishers | Year & Edition |
|-------|--|--|--|----------------|
| 1. | Henry, A. N. and M.Chandrabose | An aid to the International Code of Botanical Nomenclature | Today and Tomorrow's Printers and Publisher, New Delhi | 2009, 1 Edn. |
| 2. | Simpson, M.G. | Plant Systematics | Academic Press, New York. | 2011, II Edn. |
| 3. | Sharma, O.P. | Plant Taxonomy | Mc Graw Hill, New Delhi. | 1993, II Edn. |
| 4. | Pandey, B.P. | Text book of Economic Botany | S. Chand & Company, New Delhi | 1999, V Edn. |
| 5. | Sambamurthy, A.V.V.S. and N.S.Subramanya | Text book of Economic Botany | Wiley Eastern Limited, New Delhi | 1989, 1 Edn. |

| | | | | |
|----|-------------|--------------------|---|------|
| | m. | | | |
| 6. | Fyson, P.F. | A Botany for India | The Christian Literature Society For India (Madras Branch) | 1912 |

Reference Books

| S.No. | Author name | Title of the book | Publishers name | Year & Edition |
|-------|------------------------------|--|--|----------------|
| 1. | Gurucharan Singh | Plant Systematics: An Integrated Approach, | CRC Press | 2018, III Edn. |
| 2. | Davis, P.H. and Heywood, V.M | Principles of Angiosperm Taxonomy | Oliver Boyd London | 2011, 1 Edn. |
| 3. | Michael G. Simpson | Plant systematics | Academic Press | 2010, II Edn. |
| 4. | Henk Bentjee | The Kew: Plant Glossory | Royal Botanic Gardens, Kew | 2010 |
| 5. | David L. Hawksworth | Terms Used in Bionomail Nomenclature | Global Biodiversity Information Facility, Copenhagen | 2010 |

Pedagogy

Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

Dr. C. Krishnaveni, Dr. K. Kiruthika

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|--|----------|----|---|---|--------|
| PL23C06 | Genetics, Plant breeding and Biostatistics | Theory | 58 | 2 | - | 4 |

Preamble

- To study the Mendelian principles of genetics
- To study the inheritance pattern of characters
- To understand the breeding methods with specific objective
- To understand the quality trait of each crop
- To study the application of statistics in biology

Course Learning outcomes

On the successful completion of the course, students will be able to:

| CLOs | CLO Statement | Knowledge Level |
|------|--|-----------------|
| CLO1 | Understand the Mendelian principles, different types of inheritance pattern and basic statistics | K1,K2,K3, K4 |
| CLO2 | Develop critical understanding of basis of genes and their interactions at population levels | K1,K2,K3, K4 |
| CLO3 | Impart knowledge of objectives, quality traits and breeding methods for crop improvement | K1,K2,K3, K4 |
| CLO4 | Develop analytical, quantitative and problem-solving skills from genetics and statistics | K1,K2,K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | S | M | S |
| CLO2. | S | S | S | M | S |
| CLO3. | S | S | M | M | M |
| CLO4. | S | S | M | M | M |

S- Strong; M-Medium

Syllabus

Unit I-Genetics

12 hrs

*Mendelism- Mendel's Laws of heredity - Monohybrid and Dihybrid Cross; Test Cross and Back Cross. Deviation from Mendelian principle - Incomplete Dominance; Gene Interaction - Complementary, Supplementary, Duplicate and Inhibitory factors, Epistasis. Linkage- Complete and incomplete linkage and its importance.

Unit II- Genetics

11hrs

Extra nuclear inheritance - Cytoplasmic Inheritance (plastid inheritance in *Mirabilis jalapa*, Polygenic Inheritance (skin colour in man and Kernel colour in wheat). Multiple Alleles (ABO

Blood Groups in Man); Sex Determination XX-XO, XX–XY methods. Sex determination in plants. Sex linked inheritance in Human – colour blindness and Haemophilia.

Unit III- Plant Breeding

12 hrs

Objectives, Plant Introduction-types, procedure, purpose, merits and demerits, Hybridization Techniques-objectives, types, procedure-choice of parents, evaluation of parents, emasculation, bagging, tagging, pollination, harvesting and F₁ generation. Heterosis and inbreeding depression (outline only).

Unit IV- Plant Breeding

11 hrs

Methods of breeding for Self-pollinated, cross-pollinated and asexually propagated crops; pure line selection, mass selection and pedigree selection.

Breeding for crop Quality - Rice, Cotton and Tomato. Breeding for nutritional quality. Sources for quality traits. Vitamin A in tomato.

Unit V- Biostatistics

12 hrs

Biostatistics: – definition, basic principles; Sample and sampling, Collection and representation of data-Tabulation of data, Graphical representation-Histogram, Line Diagram, Bar Diagram, and Pie chart. Measures of Central Tendency- Mean, Median and Mode; Measures of Dispersion – Range, Standard Deviation and Standard error. Students ‘t’ test, Chi-square test.

Text Books

| S.No. | Author name | Title of the book | Publishers name | Year and Edition |
|-------|--------------------------------|---|---|------------------|
| 1. | Gupta, P.K. | Genetics, | Rastogi publications, Meerut. New Delhi | 2014, IV Edn |
| 2. | Verma, P.S. and Agarwal, V.K. | Cytology, Genetics and plant breeding | S.Chand & Co, New Delhi | 2010 |
| 3. | Shukla, R.S. and Chandel, P.S. | Cytogenetics, evolution, Biostatistics and Plant Breeding | S. Chand & Co, New Delhi | 2009, III Edn. |
| 4. | Singh, B.D | Plant Breeding: Principles and Methods | Kalyani Publishers, New Delhi | 2005, VII Edn. |
| 5. | Chaudhari, H.K. | Elementary Principles of Plant Breeding | Oxford – IBH, New Delhi | 1984, III Edn. |

Reference Books

| S.No. | Author name | Title of the book | Publishers name | Year and Edition |
|-------|--|---------------------------|-----------------------------|------------------|
| 1. | Zar, J.H. | Bio statistical Analysis, | Pearson Publication. U.S.A. | 2012, IV Edn |
| 2. | Gardner, E.J, Simmons, M.J, Snustad, D.P | Principles of Genetics | Wiley-India. | 2008, VIII Edn |

| | | | | |
|----|-----------------------|----------|----------------------------|---------------|
| 3. | Strickberger, N.W. | Genetics | Macmillan Co. New York. | 1985, III Edn |
|----|-----------------------|----------|----------------------------|---------------|

Pedagogy

Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

Dr. H. Rehana Banu, Dr. R. Sumathi, Dr. E.Uma

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|---|----------|----|---|---|--------|
| PL23E01 | Dietetics, Food Processing and Preservation | Theory | 73 | 2 | - | 5 |

Preamble

- To study the nutritive importance of foodstuffs.
- To understand food security and RDA.
- To recognize the value of food processing methods.
- To gain knowledge in food preservation and packaging.
- To appreciate the role of AI in dietetics, food processing, and preservation.
- To explore methods of quality control enhanced by AI technologies.

Course Learning outcomes

On the successful completion of the course, students will be able to:

| CLOs | CLO Statement | Knowledge Level |
|------|--|-----------------|
| CLO1 | Impart knowledge on the nutritive value of foodstuffs and the various sources of food. | K1, K2, K3, K4 |
| CLO2 | Recognize diet-based foods on the needs of people. | K1, K2, K3, K4 |
| CLO3 | Illustrate food processing methods and AI-driven innovations in food safety and quality control. | K1, K2, K3, K4 |
| CLO4 | Apply knowledge in preventing food spoilage using AI-enhanced techniques. | K1, K2, K3, K4 |
| CLO5 | Employ good manufacturing practices with AI-integrated monitoring systems. | K1, K2, K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | S | M | S |
| CLO2. | S | S | S | M | S |
| CLO3. | S | S | M | M | M |
| CLO4. | S | S | M | M | M |
| CLO5. | S | S | S | S | S |

S- Strong; M-Medium

Syllabus

Unit I

14 hrs

Introduction – Nutritive importance of proteins, carbohydrates, fats, vitamins and minerals. Food sources – Plant and animal food. Fermented vegetables. Milk Products. Nutritional requirements and food security. Introduction to AI in dietetics: AI-driven personalized nutrition, AI-based dietary analysis tools.

Unit II

15 hrs

Balanced diet, Recommended Dietary Allowances (RDA). Diet counseling and AI assisted Menu planning. Nutritional and food requirements of infants, expectant mothers, lactating women and old ages. Diet therapy and therapeutic diets. Diet for obesity, cardiovascular disease and diabetes. AI applications in disease-based diet recommendations. AI-driven prediction of nutritional deficiencies.

Unit III

14 hrs

Food processing: processing of legumes, milk, vegetables, fruits, fish, meat, poultry and eggs. Food additives- mono-sodium glutamate, aspartame for flavor, enzymes for texture modification;

synthetic/natural food coloring agents. AI in food processing: Smart sorting, AI-based food quality assessment, robotic food processing.

Unit IV

15 hrs

Food preservation: Physical, chemical and biological methods - drying, cooling, freeze- drying, heating, curing, jellying, salting, pickling, smoking, canning, and irradiation, Ultra High Temperature (UHT). Food spoilage and food adulterants. AI in food spoilage detection and food adulterant identification. Food sanitation- safe methods of handling food. AI-assisted food safety monitoring and predictive analysis.

Unit V

15 hrs

Packing of preserved foods: concepts, definition, significance, classification, Primary packaging materials, methods of packaging - vacuum packaging, Modified Atmosphere Packaging (MAP), Controlled Atmosphere Packaging (CAP) & bio-degradable packages. AI-driven quality control systems in food packaging. Quality control; foodstandards: Agricultural Marketing (AGMARK), Food Safety and Standards Authority of India (FSSAI), Prevention of Food Adulteration (PFA). Good laboratory practice (GLP) Good Manufacturing Practice. AI-enabled monitoring of food safety compliance. Nutrition information on labels. AI-based nutritional information analysis on food labels.

Text Books

| S.No. | Author name | Title of the book | Publishers | Year and Edition |
|-------|-----------------------------------|---------------------------------------|--|------------------|
| 1. | Srilakshmi, B. | Dietetics | New Age International Limited, Publishers, New Delhi | 2024, IX Edn |
| 2. | Gordon L. Robertson | Food Packaging Science and Technology | New age International Ltd. Publishers, New Delhi | 2019, 1 Edn |
| 3. | Michael Saltmarsh, Mike Saltmarsh | Essential Guide to Food Additives | RSC Publishing, UK | 2013, 1 Edn |
| 4. | James M Jay | Modern Food Microbiology | CBS Publishers & Distributors, New Delhi | 2005, IV Edn |

Reference Books

| S.No. | Author name | Title of the book | Publishers | Year and Edition |
|-------|-------------------------------------|--|---|------------------|
| 1. | Winton, A. and Winton, K.B. | Milk and milk products | Agrobios, Jodhpur | 2022, 1 Edn |
| 2. | Fellows, P.J. | Food processing technology: Principle and Practice | Woodhead Publishing, United Kingdom | 2020, IV Edn |
| 3. | William C Frazier, Dennis C Westoff | Food Microbiology | McGraw-Hill Publishing Company, New Delhi | 2017, V Edn |
| 4. | Jung H. Han | Innovations in Food Packaging | Academic Press, Inc | 2014, II Edn |

Pedagogy

Lecture, Power point presentation, Seminar, Assignment, Quiz, Group Discussion, Video / Animation

Course Designers

Dr. K.S. Tamil Selvi, Dr. B.S Chitra Devi

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-----------------------|----------|----|---|---|--------|
| PL23E02 | Bioinoculants Paper I | Theory | 73 | 2 | - | 5 |

Preamble

- To study the classification of bioinoculants.
- To study the growth of microbes and their distribution like bacterial, fungal and algal bioinoculants.
- To understand the Microbial solubilization, ecto and endo mycorrhiza.

Course Learning outcomes

On the successful completion of the course, students will be able to understand the following:

| CLOs | CLO Statement | Knowledge Level |
|------|---|-----------------|
| CLO1 | Identify the type of bioinoculants | K1,K2,K3,K4 |
| CLO2 | Recognize and appreciate soil as the medium for the growth of microbes and their diversity | K1,K2,K3,K4 |
| CLO3 | Working of the different groups of bacterial, fungal and algal bioinoculants. | K1,K2,K3,K4 |
| CLO4 | Use phosphorus mobilization, ecto and endomycorrhizal activities for improving plant growth | K1,K2,K3,K4 |
| CLO5 | Analyse the microbial solubilization in silicates and zinc. | K1,K2,K3,K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | S | M | S |
| CLO2. | S | S | S | M | S |
| CLO3. | S | S | M | M | M |
| CLO4. | S | S | M | M | M |
| CLO5. | S | S | S | S | S |

S- Strong; M-Medium

Syllabus

Unit -1

15 hrs

Definition, Classification of fertilizers (synthetic fertilizers & organic manures), Bioinoculants, Microbial inoculants in Agriculture - contributions of microorganisms to soil fertility. Advantages and limitations of bioinoculants over chemical fertilizers.

Unit-II **15 hrs**
 Soil as a medium for growth of plants- Soil microorganisms- Distribution of microorganisms in soil. Factors influencing the microbial populations in soil. Rhizosphere and mycorrhizosphere concept.

Unit-III **15 hrs**
 Different groups of bioinoculants- bacterial, fungal and algal bioinoculants. Phosphate solubilizers- Aluminium/iron solubilisation – *Bacillus megaterium*, *Bacillus circulans* and *Pseudomonas* sp.

Unit-IV **14hrs**
 Phosphorus mobilization in the soil– Mycorrhizal types – Endomycorrhiza, Ectomycorrhiza and Orchid mycorrhiza.

Unit- V **14 hrs**
 Microbial solubilisation of silicates and zinc- Plant growth promoting rhizobacteria- application of silica nanoparticles as manures.

Text Books

| S.No. | Author name | Title of the book | Publishers | Year and Edition |
|-------|------------------|------------------------------|--|------------------|
| 1 | Satyanarayana, U | Biotechnology | Books and Allied Publishers. Ltd. Kolkatta | 2005, 1 Edn. |
| 2 | Dubey, R.C. | A Text book of Biotechnology | S. Chand & Co, New Delhi | 2004, IV Edn. |
| 3 | Kumaraesan, V. | Biotechnology | Saras Publication, Nagercoil | 2001, 1 Edn. |

Reference Books

| S.No. | Author name | Title of the book | Publishers | Year and Edition |
|-------|----------------|--|---|------------------|
| 1. | Subba Rao, N.S | Advances in Agricultural Microbiology | Oxford and IBH Publ. Co., New Delhi. | 2020, III Edn. |
| 2. | Subba Rao. N.S | Biofertilizers in Agriculture and Forestry | Oxford and IBH Publ. Co., New Delhi P.242 | 2019, III Edn. |
| 3. | Nutman, P.S. | Symbiotic nitrogen fixation in plants | Cambridge Univ. Press, London, P.584. | 1976 |

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. R.Sumathi

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-----------------------------|----------|----|---|---|--------|
| PL23E03 | Environmental Biotechnology | Theory | 73 | 2 | - | 5 |

Preamble

- To study the biodiversity, conservation of endangered plants and Global biodiversity information system.
- To study the concepts, types, data structure of GIS.
- To understand the strategies for effluent treatment in different industries using microbes.
- To appreciate the types of IPR, biohazards and biosafety guidelines.

Course Learning outcomes

On the successful completion of the course, students will be able to understand the following:

| CLOs | CLO Statement | Knowledge Level |
|------|---|-----------------|
| CLO1 | Study the biodiversity types, conservation methods, endangered plants and Global biodiversity information system. | K1,K2,K3, K4 |
| CLO2 | Concepts, types, data structure of GIS and output of geographical data. | K1,K2,K3, K4 |
| CLO3 | Familiarize the sewage and waste water treatments at primary, secondary and tertiary levels. | K1,K2,K3, K4 |
| CLO4 | Study the strategies for effluent treatment in different industries using microbes. | K1,K2,K3, K4 |
| CLO5 | Analyze the types of IP, biohazards and biosafety guidelines. | K1,K2,K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|-------|------|------|------|------|------|
| CLO1. | S | S | S | M | S |
| CLO2. | S | S | S | M | S |
| CLO3. | S | S | M | M | M |
| CLO4. | S | S | M | M | M |
| CLO5. | S | S | S | S | S |

S- Strong; M-Medium

Syllabus

Unit -1-Biodiversity

15 hrs

Definition; Geographical causes for diversity; Types of diversity: Genetic diversity, Species diversity and Ecosystem diversity; Quantifying biodiversity; importance of biodiversity; *in-situ&ex-situ* conservation; Gene banks; Cryopreservation; Assessing, analyzing and documenting biodiversity; Introduction to biodiversity database: Endangered plants, Endemism and Red data books; Global biodiversity information system.

Unit II-GIS and Environmental Monitoring**14 hrs**

Concept of Remote sensing; Concept of GIS; Types of Geographical Data; Data Structure; Vector and Raster data: their Advantages and Disadvantages; Input, verification, storage and output of geographical data; Importance of Geographical Information System in environmental studies.

Unit III - Effluent treatment systems**15 hrs**

Sewage and waste water treatments systems; Primary, secondary and tertiary treatments. Biological treatments- aerobic versus anaerobic treatments; Environmental pollution control- Bioremediation, Bioaugmentation and Biostimulation; Biofilms in treatment of waste water; Aerobic Biofilms; Bioreactors for Sewage and waste water treatments systems; Primary, secondary and tertiary treatments.

Unit IV- Removal of specific pollutants**14 hrs**

Physicochemical characteristics and treatment strategies for effluent generated by Distillery and Fermentation industry, Fertilizers and Pesticide manufacturing industries, Dyes and textile industries, Paper and pulp industries, Food and dairy industries. Bioremediation.

Unit V-IPR & Biosafety**15 hrs**

Types of Intellectual Property Rights (IPR): Patents, Trademarks, Copyright and Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

Biosafety

Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of Genetically Modified Organisms (GMOs) & Living Modified Organisms (LMOs).

Text Books

| S.No. | Author name | Title of the book | Publishers | Year and Edition |
|-------|--------------|--|---|------------------|
| 1. | Kumar.S. | Basics of Remote Sensing and GIS | Laxmi Publications, Chennai. | 2019, 1 Edn. |
| 2. | Acharya,N.K. | Text book on Intellectual Property Rights. | Jain Book Depot, New Delhi | 2014, VII Edn. |
| 3. | Agarwal,S.K. | Environmental Biotechnology | APH Publishing Corporation | 2009, 1 Edn. |
| 4. | Sateesh.M.K | Bioethics and Biosafety | IK International Publishing House Pvt Ltd, New Delhi. | 2008 |

Reference Books

| S.No. | Author name | Title of the book | Publishers name | Year of publication & Edition |
|-------|-------------------|--|--------------------------------------|-------------------------------|
| 1 | John R and Jenson | Remote Sensing of the Environment an Earth | Dorling Kindersly Pvt Ltd, New Delhi | 2009, II Edn. |

| | | Resource Perspective: | | |
|---|---------------------------|---|-------------------------|--------------|
| 2 | Marcos Von Sperling | Basic principles of Waste Water Treatment | IWA Publishing, Newyork | 2007 |
| 3 | Purohit S.S and Ranjan. R | Ecology, Environment and Pollution | Agrobios, India,Jodhpur | 2003, 1 Edn. |

Pedagogy: E-content, Lecture, Power point presentation, Seminar, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr.R.Sumathi

| COURSE NUMBER | COURSE NAME | CATEGORY | L | T | P | CREDIT |
|---------------|--|-----------|---|---|-----|--------|
| PL23CP3 | Core Practical III (Core Paper V, VI & AOS I/II/III) | Practical | - | - | 120 | 4 |

Preamble

- Collection, identification and preparation of herbarium
- To understand the factor interaction in plants and solve the problems involved in it.
- To apply common statistical tools to derive inference.
- To get acquainted with the techniques of food preservation

Course Learning outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1. | Identify the plants using taxonomically and to observe the economic importance | K1,K2,K3, K4 |
| CLO2. | Interpret the genetic problems and the hybridization techniques involved in plants | K1,K2,K3, K4 |
| CLO3. | Apply common statistical tools to derive inference. | K1,K2,K3, K4 |
| CLO4. | Analyze the nutritional quality and adulterants of various food stuffs | K1,K2,K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | M | S | M | S | S |
| CLO2 | S | M | S | S | M |
| CLO3 | S | S | M | M | S |
| CLO4 | M | S | S | M | S |

S- Strong; M-Medium

Syllabus

Paper V - Plant Taxonomy and Economic Botany (45 hrs)

Plant Taxonomy:

Systematic Botany: Study of diagnostic character of plants belonging to the families mentioned in the syllabus.

Economic Botany - Spotters: Fruit- *Elettaria cardamomum* Maton., Leaves- *Indigofera tinctoria* L., Bast Fibre- *Gossypium hirsutum* L., Jute-*Corchorus olitorius* L., Flower bud-*Syzygium aromaticum* (L.) Merr. & L.M.Perry, Grains-*Oryza sativa* L., Spices - *Elettaria cardamomum* Maton.

Artificial Intelligence in Plant Taxonomy:

1. Plant Species Identification using Leaf Image Classification
2. Feature Extraction from Plant Images using AI

Herbarium: Submission of herbarium of 15 plants representing the families mentioned in the syllabus.

Field visit: One day field visit will be carried out to study the vegetation and of the plants belonging to the families mentioned in the syllabus.

Paper VI - Genetics, Plant breeding and Biostatistics (45hrs)

Genetics and Plant breeding: Simple problems in genetics. Hybridization techniques – different types of Emasculation, bagging, tagging.

Field visit to any one Plant breeding research Institutes-Sugarcane breeding institute/ central institute for cotton research, Coimbatore. IARI –Wellington/ Tamilnadu Agricultural University, Coimbatore.

Biostatistics -1. Mean, Median, Mode, Standard Deviation & Standard errors, 2. Students 't' test
3. Chi-square test

Dietetics, Food Processing and Preservation (30 hrs)

Individual experiments:

1. Qualitative detection of nutrients in food:
 - i. Carbohydrates
 - ii. Proteins
 - iii. Fats
 - iv. Vitamins
 - v. Minerals
2. Detection of Food additives
 - i. Mono-sodium glutamate
 - ii. Aspartame
3. Detection of Adulterants in oils and Fats.
4. Detection of Adulterants in spices and spices powder.

Demonstrations:

1. **AI-assisted dietary analysis:**
 - Using AI tools for nutrient profiling in different food groups.
2. **AI-based meal planning demonstrations:**
 - AI-powered diet suggestions for different age groups and medical conditions.
3. **Food processing quality assessment using AI:**
 - AI-driven freshness detection in processed foods.
 - AI-based food sorting and grading.
4. **AI in food packaging quality control:**
 - Smart packaging technology with freshness indicators.
 - AI-based food labeling compliance checking.

Or
Bioinoculants Paper I

1. Isolation of Rhizobium from legume root nodules; purification and characterization of Rhizobium.
2. Testing the efficiency- leonard jar technique and plant infection test.
3. Rhizobium strain identification by immunological methods.
4. Isolation of *Azospirillum* from rhizosphere.
5. Identification and characterization of *Azospirillum*.
6. Isolation of Phosphobacterium from soils.
7. Quantitative determination of Phosphate solubilization by phosphobacteria

Or

Environmental Biotechnology

a. Environmental Parameters

1. Estimation of halides in water samples by potentiometer.
2. Estimation of CO^{2+} and Ni^{2+} by colorimeter/spectrophotometer.
3. Estimation of sulphates by turbidometer.
4. Detection of heavy metals- Zinc, Cobalt, Cadmium, Lead, Ferrous in anyone of the polluted sample.
5. Sampling techniques: wastewater analysis for physico-chemical characteristics such as pH, conductivity, Total dissolved solids (TDS), Dissolved oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD), CO_2 , alkalinity, nutrients, chlorides, hardness, set ability of solids.

b. Bioremediation

1. Microbial degradation of textile dyes/pesticides/hydrocarbons and oils
2. Assay of enzymes involved in biotransformation.
3. Phytoremediation of metal contaminated soil samples using Tomato/Brassica plants and estimation of metal removal in soil and metal accumulation in plants using Atomic Absorption Spectrum (AAS).
4. Pollutant removal using microorganisms from industrial effluent.
5. Effect of Heavy metals on microbial growth and microbial leaching of metals.
6. Effect of Pesticides on soil microorganism

Course Designers

Dr. K.Gajalakshmi

Dr. K.S. Tamil Selvi

Dr. B. S.Chithra Devi

Dr. R. Sumathi

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|--------------------|--------------------------|-----------------|----------|----------|----------|---------------|
| PL22AC1 | Food Microbiology | Theory | - | - | - | 5 |

Preamble

- To understand the interaction between micro-organisms and food
- To understand the factors affecting the growth of microbes.
- To understand the contamination, preservation and spoilage of different foods
- To realize the microbes underlying food spoilage and food borne illnesses.
- To appreciate the role of government agencies involved in food sanitation and control

Course Learning outcomes

On the successful completion of the course, students will be able to understand the following:

| CLO Number | CLO Statement | Knowledge Level |
|-------------------|--|------------------------|
| CLO1 | Understand the interaction between micro-organisms and food | K1,K2,K3, K4 |
| CLO2 | Know the factors affecting the growth of microbes | K1,K2,K3, K4 |
| CLO3 | Analyze the Contamination, preservation and spoilage of different foods | K1,K2,K3, K4 |
| CLO4 | Realize the microbes underlying food spoilage and food borne illnesses. | K1,K2,K3, K4 |
| CLO5 | Appreciate the role of government agencies involved in food sanitation and control | K1,K2,K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|--------------|-------------|-------------|-------------|-------------|-------------|
| CLO1. | S | S | M | S | S |
| CLO2. | S | S | M | M | S |
| CLO3. | S | S | M | M | S |
| CLO4. | S | S | M | M | S |
| CLO5. | S | S | M | M | M |

S- Strong; M-Medium

Syllabus

Unit I

Food and microorganisms- Food as a substrate, important microbes, contamination of food, principles underlying spoilage: chemical changes caused by microorganisms. Principles of food preservation: Asepsis, removal of microbes, maintenance of anaerobic conditions

Unit II

Contamination, preservation and spoilage of foods: cereals and cereal products; spoilage of sugar and sugar products, fruits and vegetables, milk and milk products.

Unit III

Contamination, preservation and spoilage of foods: meat– meat products; fish and other sea foods, eggs and poultry; canned foods and miscellaneous foods.

Unit IV

Foods and Enzymes from microorganisms. Food related diseases: food borne illness, food poisoning, toxins and intoxicants. Primary sources of food poisoning - bacteria and moulds. Prevention of food borne diseases.

Unit V

Microbiology in relation to food sanitation; enforcement and control agencies- International, national, state and private agencies. Microbiological criteria for foods.

Text Books

| S.No. | Author name | Title of the book | Publishers name | Year of publication & Edition |
|-------|--|------------------------------|----------------------------------|-------------------------------|
| 1. | William C Frazier, Dennis C Westoff, Vanitha, K.N. | Food Microbiology | McGraw-Hill Education, New York. | 2008, V Edn. |
| 2. | Frazier C., D.C. Westhoff. | Food Microbiology | Tata McGraw Hill, New Delhi | 2000, IV Edn. |
| 3. | Steinkraur K.H. | Indigenous Food Fermentation | Academic Press, New York | 1988, 1 Edn. |

Reference Books

| S.No. | Author name | Title of the book | Publishers name | Year of publication & Edition |
|-------|---------------------------|-------------------------|---|-------------------------------|
| 1 | Adams, M.R and Moss, M.O. | Food Microbiology | New International (P) Ltd. Publ., New Delhi | 1996, II Edn. |
| 2 | Benwart, G.J. | Basic Food Microbiology | CBS Publishers & Distributors, New Delhi | 1987, 1 Edn. |

Course Designer

Dr. K.S. Tamil Selvi

Dr.E.Uma

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|--------------------|--------------------------|-----------------|----------|----------|----------|---------------|
| PL22AC2 | Nutrition Science | Theory | - | - | - | 5 |

Preamble

- To understand the vital link between nutrition and health
- To gain knowledge on functions of nutrients
- To understand the metabolism of nutrients
- To realize the importance of deficiency of nutrients
- To appreciate the role of government agencies involved in combating malnutrition

Course Learning outcomes

On the successful completion of the course, students will be able to understand the following:

| CLOs | CLO Statement | Knowledge Level |
|-------------|---|------------------------|
| CLO1 | Understand the Vital link between nutrition and health | K1,K2,K3, K4 |
| CLO2 | Acquire knowledge on functions of nutrients | K1,K2,K3, K4 |
| CLO3 | Appreciate the Metabolism of nutrients | K1,K2,K3, K4 |
| CLO4 | Relate the Importance of deficiency of nutrients | K1,K2,K3, K4 |
| CLO5 | Comprehend the Role of government agencies involved in combating malnutrition | K1,K2,K3, K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|--------------|-------------|-------------|-------------|-------------|-------------|
| CLO1. | S | S | L | M | S |
| CLO2. | S | S | L | M | S |
| CLO3. | S | S | L | M | S |
| CLO4. | S | S | L | M | S |
| CLO5. | S | S | L | M | M |

S- Strong; M-Medium

Syllabus

Unit I

Introduction to nutrition science– definitions and history. Nutritional importance of carbohydrates, proteins and fats.

Unit II

Energy metabolism– determination of energy value of food, determination of energy requirements, under nutrition and protein energy malnutrition

Unit III

Macro minerals functions and its deficiency disorders– Calcium and Phosphorus; micro minerals functions and its deficiency disorders– Iron, Iodine, Copper, Fluorine, Zinc and Chromium.

Unit IV

Vitamins functions and its deficiency disorders – Fat soluble - A, D, E and K; water soluble– Thiamin, Riboflavin, Niacin, Folic acid, Vitamin B complex and Vitamin-C

Unit V

Antioxidants, Water and electrolyte balance. Assessment of nutritional status, National nutrition policy. Role of International and National agencies in combating malnutrition. Computers in management of nutrition practice.

Text Books

| S.No. | Author name | Title of the book | Publishers name | Year of publication & Edition |
|-------|--|------------------------------------|---|-------------------------------|
| 1. | Srilakshmi, B. | Nutrition Science. | New age International Ltd. Publishers, New Delhi. | 2012, IV Edn. |
| 2. | Mudambi, R. Sumathy and Rajagopal, M.V | Fundamentals of food and nutrition | New age International Ltd. Publishers, New Delhi | 2005, IV Edn. |
| 3. | Sheel Sharma | Human nutrition and Meal planning | Jnananda Prakashan, P&D, New Delhi | 2000, 1 Edn. |

Reference Books

| S.No. | Author name | Title of the book | Publishers name | Year of publication & Edition |
|-------|--|---|--|-------------------------------|
| 1. | Swaminathan, M. | Advanced textbook on food and nutrition | Bangalore printing and publishing company, Bangalore | 2002, II Edn. |
| 2. | Arti Bhatia | Nutrition and Dietetics | Anmol Publications, PVT. LTD., NewDelhi | 2000 |
| 3. | Sizer, Francis Sienkiewicz and Whitney Eleanar Whitney | Nutrition – concepts and controversies | Wadsworth, Australia | 2000, VIII Edn. |
| 4. | Srilakshmi, B | Food science | New age international ltd. Publishers, New Delhi. | 1997, 1 Edn. |

Course Designer

Dr. K.S. Tamil Selvi

Dr.E.Uma

| COURSE CODE | COURSE TITL | CATEGORY | L | T | P | CREDIT |
|-------------|-----------------------|----------|---|---|----|--------|
| PL23PROJ | Project and Viva-voce | Project | - | - | 60 | 5 |

Preamble

To make the students to understand the importance of experimental analysis, scientific approach in solving problems related to the environment and society and to educate and train the students to write scientific papers

Group Project & Viva Voce

Each group comprising of 3 to 5 students (based on the number of students on roll) will be allotted to a staff Co-ordinator. A specific problem will be assigned to the students or they will be asked to choose a problem /area of their interest. The topic / area of work will be finalized at the end of the IV Semester, allowing scope for the students to gather relevant literature during the vacation. The research work can be carried at the college or any other organization approved by the staff Co-ordinator and the HoD.

Area of work

Cytology, Plant Biology, Plant Biotechnology, Microbiology, Tissue culture, Medicinal Botany & Environmental Sciences, Food and nutrition.

Methodology

Each project should contain the following details:

Brief introduction on the topic

Review of literature

Materials and Methods

Experimental Results and Discussion – evidences in the form of figures, tables and photographs can be enclosed

Summary

Bibliography

The above content should not exceed 50 pages.

Evaluation *Internal evaluation of the project work will be carried out in stages as described below.*

Evaluation of Individual / Group Project & Viva Voce for UG & PG

| | | | | | |
|-----|--------|---|--|---|-----------------|
| I | Review | - | Selection of the field of study, Topic & literature collection | : | 5 Marks |
| II | Review | - | Research Design & Data Collection | : | 10 Marks |
| III | Review | - | Analysis & Conclusion Preparation of rough draft | : | 10 Marks |
| | | | Total | : | 25 Marks |

End semester examination:

Evaluation of the project : 25 Marks

Viva Voce : 50 Marks

Total : 75 Marks

Viva Voce / presentation will be conducted by a panel of internal examiners including the HoD and the staff Co-ordinator guiding the project. A PowerPoint presentation by the group before the audience will be evaluated on the basis of student's response to questions.

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|--------------------|--|-----------------|-----------|----------|----------|---------------|
| PL23SB01 | Skill Based Subject- Essentials of Horticulture & Agripreneurship | SBS | 43 | 2 | - | 3 |

Preamble

- To impart the knowledge on the horticultural wealth of India
- To impart skill-oriented knowledge on the fundamental aspects of horticulture
- To get acquainted to commercial floriculture
- To develop skill in post-harvest technology
- To understand the concept of commercial horticulture
- To understand agripreneurship and its concepts

Course Learning Outcomes

On the successful completion of the course, students will:

| CLO Number | CO Statement | Knowledge Level |
|-------------------|--|------------------------|
| CLO1. | Acquire knowledge about the fundamental aspects of horticulture | K1,K2,K3, K4 |
| CLO2. | Promote the cultivation of horticultural plants through various propagation techniques | K1,K2,K3, K4 |
| CLO3. | Apply the techniques in commercial horticulture | K1,K2,K3, K4 |
| CLO4. | Skilled in the post-harvest technology | K1,K2,K3, K4 |
| CLO5. | Understand the strategies to become women entrepreneurs | K1,K2,K3, K4 |

Mapping with Programme Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO4 |
|-------------|-------------|-------------|-------------|-------------|-------------|
| CLO1. | S | S | S | S | S |
| CLO2. | S | S | S | M | S |
| CLO3. | M | S | M | S | S |
| CLO4. | M | S | S | S | S |
| CLO5. | M | S | S | M | S |

S-Strong; M- Medium

Syllabus

Unit I

8 hrs

History and importance of horticulture, Branches in horticulture, Techniques in horticulture - Selection of site, Preparation of soils, Soil types, Inorganic fertilizers, Irrigation, Weeding and pruning.

Unit II

9 hrs

Propagation techniques, Plant growing structures- Shade Houses, Green house: Greenhouse types. Miscellaneous Propagating Structures-Mist beds, Mist chambers, Nursery bed, Fluorescent Light Boxes, Propagating Cases, Plastic Mulch, Mini-Green Houses, Light Chamber, High-Humidity Chambers.

Unit III

8 hrs

Landscape gardening-Importance; Principles; Garden adornments; Garden Types- Formal, Informal, Free style; Garden features -Walls, Fencing, Hedges, Edges, Arches, Pergola, Lawn, Shrubbery, Rockery, Topiary; Famous Gardens in India.

Unit IV

9 hrs

Scope and importance of commercial floriculture in India. Production techniques of commercial flower crops -rose, chrysanthemum. Postharvest management of flower crops. Flower arrangement. Bonsai culture and maintenance.

Unit V

9 hrs

Harvesting, handling, curing, grading and pre-cooling of horticulture produce, Packaging, Transportation and modes of transport. Marketing of fresh produce; Pre- and post-harvest treatments for extending storage life. Principles and methods of storage. Agripreneurship, Factors affecting entrepreneurial growth, Women entrepreneurship.

Text Books

| S.No | Authors | Title of the book | Publishers | Year of publication & Edition |
|------|--------------------|------------------------------|--|-------------------------------|
| 1 | Kumaresan, V | Horticulture | Saras Publications, Nagercoil. | 2014 |
| 2 | Kumar.N | Introduction to Horticulture | Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi. | 2010 |
| 3 | Bansil, P.C. | Horticulture in India. | CBS Publishers and Distributors, New Delhi. | 2008. |
| 4 | Manibhushan Rao.K. | Text Book of Horticulture | Macmillan India Ltd, New Delhi | 1991. |
| 5 | K.L.Chadda, | Advances in Horticulture | Malhotra Publishing House, New Delhi. | 2009 |
| 6 | Dhillon, W.S. | Fruit Production in | Narendra Publishing House. | 2013 |

| | | | | |
|--|--|-------|-----------|--|
| | | India | New Delhi | |
|--|--|-------|-----------|--|

Reference Books

| S.No | Authors | Title of the book | Publishers | Year of publication |
|------|--|---|-----------------------------|---------------------|
| 1 | Rajan,S. and B.L.Markose, | Propagation of horticultural crops. | Pitam Pura, NewDelhi | 2007 |
| 2 | Bhattacharjee.S.K. | Horticulture, Biotechnology and post-harvest technology, | Pointer publishers, Jaipur. | 2006 |
| 3 | Christopher, E.P, | Introductory Horticulture | Biotech Books, NewDelhi. | 2001 |
| 4 | Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I. | Introduction to spices, Plantation crops and Aromatic plants. | Oxford & IBH, New Delhi. | 1997 |

Course Designer

Dr. K. S. Tamil Selvi, Dr.B. S. Chithra Devi, Dr. Sarah Jaison

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-----------------------------------|----------|----|---|---|--------|
| PL23C07 | Plant Physiology and Biochemistry | Theory | 73 | 2 | - | 4 |

Preamble

- To study the interactions in aqueous systems
- To obtain knowledge on plant-water relationships
- To understand the various aspects of plant metabolism
- To understand the structure and functions of biomolecules

Course Learning outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Explain the principles of water relations, translocation, transpiration, and mineral uptake in plants, and their importance in maintaining plant homeostasis. | K2 |
| CLO2 | Analyze the mechanisms of photosynthesis, respiration, and nitrogen metabolism, including pathways such as C3, C4, CAM, and glycolysis, and their roles in plant energy and nutrient cycles. | K3 |
| CLO3 | Understand the functions of plant growth regulators, photoperiodism, and vernalization, and their influence on plant development, movements, and flowering. | K4 |
| CLO4 | Classify the structure, properties, and biological significance of biomolecules, including carbohydrates, proteins, lipids, and enzymes, in plant systems. | K4 |
| CLO5 | Assess the biochemical processes underlying enzyme activity, factors affecting enzymatic reactions, and the role of biomolecules in plant physiology and metabolism | K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | M | M | M |
| CLO2 | S | M | M | S | M |
| CLO3 | M | S | S | M | S |
| CLO4 | M | S | M | M | S |
| CLO5 | S | M | M | S | S |

S- Strong; M-Medium

Syllabus

Unit I

14 Hrs

Plant Physiology- Water as a molecule, Properties of water, aqueous solutions, colloids. Water

relations – Diffusion and Osmosis, water potential, plasmolysis. significance of Osmosis in plants. Absorption of water- Active and Passive absorption; Factors affecting absorption of water. Translocation of water. Transpiration –Types (lenticular, cuticular and stomatal), Mechanism of stomatal movement, Factors affecting transpiration. Guttation.

Unit II

14 Hrs

Phloem transport- bidirectional transport, source-sink concept, translocation of solutes. Mineral uptake. role of Macronutrients and micronutrients.

Photosynthesis: Pigment systems, Light reactions, Calvin- Bensen (C3) cycle, Hatch and Slack (C4) pathway, photorespiration, glycolate metabolism and CAM pathways.

Unit III

15 Hrs

Respiration- Glycolysis (EMP pathway), Tricarboxylic acid cycle (Citric acid or Krebs cycle)- electron transport system and oxidative phosphorylation. Respiration quotient. Nitrogen metabolism– Biological nitrogen fixation, Transamination and reductive amination.

Unit IV

15 Hrs

Plant growth and development: Growth Regulators– Chemical nature, Physiological effect of Auxins, Gibberellins, Kinetins, Ethylene and ABA. Plant movements– Types of movements. Physiology of flowering: Photoperiodism and Phytochrome. Vernalisation. Seed dormancy.

Unit V

15 Hrs

Biochemistry- Biomolecules: Carbohydrates: General Structure and properties of Monosaccharides, Oligosaccharides and Polysaccharides. Amino acids – structure, types-peptides - protein structure and properties. Enzymes: Nomenclature and Classification– Mechanism of Enzyme action. Factors affecting enzyme action. Lipids: General Structure, Classification, Properties of Fats and Oils.

Text Book

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|--|-------------------------------------|--|------------------|
| 1. | Jain. J.L. | Fundamentals of Biochemistry | S. Chand & Company. New Delhi | 2007, VI Edn. |
| 2. | Rastogi, S.C. | Biochemistry | Tata McGraw Hill Education Private Limited, New Delhi. | 2011, III Edn. |
| 3. | Albert L. Lehninger, David L. Nelson, and Michael M. Cox | Leninger Principles of Biochemistry | H Freeman and Company, United States | 2018, VIII Edn. |

Reference Book

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|-------------------------------|-----------------------|---|------------------|
| 1. | Salisbury, F.B and Ross, C.W. | Plant Physiology | Prentice Hall of India. New Delhi | 1992, I Edn. |
| 2. | Day, P.M., and Harborne, J.B. | Plant Biochemistry | Harcourt Asia (P) Ltd., India & Academic Press, Singapore | 2000, I Edn. |
| 3. | Jain. V.K. | Fundamentals of Plant | Chand & Company. New | 2017, XIX Edn. |

| | | | | |
|--|--|------------|-------|--|
| | | Physiology | Delhi | |
|--|--|------------|-------|--|

Pedagogy

- Power point presentation, Group Discussion, Seminar, Quiz, Assignment and Experience discussion

Course Designers

1. Dr.K.S.Tamil Selvi
2. Dr.R.Sumathi

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|--------------------------|----------|----|---|---|--------|
| PL23C08 | Basics of Bioinformatics | Theory | 73 | 2 | - | 4 |

Preamble

- To understand the fundamental concepts of biology, computing, and data analysis.
- To apply the knowledge of various types of databases and sequence alignment methods in diverse fields of biology.
- To gain insights into the method of gene identification and genome annotation.
- To construct evolutionary relationships between species using bioinformatics approaches.

Course Learning Outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Understand the basic knowledge of DNA, proteins and biological databases | K1 |
| CLO2 | Classify the databases and sequence alignment methods in various fields | K2 |
| CLO3 | Differentiate the pattern of sequence analysis | K3 |
| CLO4 | Evaluate the different methods of gene identification and genome annotation | K3 |
| CLO5 | Create the evolutionary relationship between species | K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | S | S | S |
| CLO2 | S | M | S | S | M |
| CLO3 | M | M | M | M | S |
| CLO4 | S | S | S | M | S |
| CLO5 | S | M | S | S | M |

S- Strong; M-Medium

Syllabus

Unit I

13 Hrs

Bioinformatics:- History, Scope, importance, Challenges and opportunities. Gene structure-prokaryotes and Eukaryotes. DNA sequencing: - N-terminal sequencing- Sanger's Method and Edman's degradation method; C-terminal sequencing:- Mass spectrometry, X-ray diffraction method.

Unit II

15 Hrs

Biological Databases:- Sequence database – nucleic acids database (NCBI, DDBJ & EMBL), protein database (PDB, SwissProt). Metabolic pathway database (MetaCyc). Chemical database

(Pubchem).Structure database (CATH, SCOP), literature database (Pubmed); file formats of GenBank, Swiss-Prot, PDB; data retrieval- *Entrez*.

Unit III

15 Hrs

Heuristic method of sequence alignment-FASTA and BLAST algorithm, Amino acid substitution matrices – Gaps and gap penalties; Scoring schemes- PAM and BLOSUM, Comparison of PAM and BLOSUM and its limitations.

Sequence analysis types and methods: Pair wise alignment - Global, local, Multiple sequence alignment (MSA) and its applications.

Unit IV

15 Hrs

Genomics- Gene identification methods- *Ab initio* method, consensus method, Web-based method-microarray. Gene prediction tools- GRAIL, Glimmer, Genscan, GeneMark. Protein prediction- methods and tools- Secondary structure (GOR, Chou-Fasman), Tertiary structure prediction - Homology Modeling, Threading and fold recognition.

Unit V

15 Hrs

Phylogeny- Introduction, Characteristics, types of trees, terminologies, Steps involved in the construction of cladogram, approaches used in phylogenetic analysis, methods (outline only), Applications.

Text Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|---|--------------------------------------|--|------------------|
| 1. | Arthur.M.Lesk | Introduction to Bioinformatics | Oxford University Press, USA | 2003, I Edn. |
| 2. | Mani. K and Vijayaraj. N | Bioinformatics A Practical Approach. | Aparnaa Publication. Tamil Nadu, India | 2004, I Edn. |
| 3. | Alam Khan. I | Elementary Bioinformatics. | Pharma Book Syndicate, Adithya Art Printers, | 2005, I Edn. |
| 4. | Vinay Sharma. Ashok Munjal, Asheesh Shankar | A text book of Bioinformatics. | Rastogi Publications, Meerut, | 2008, I Edn. |
| 5. | Ignacimuthu SJ | Basic Bioinformatics | Narosa Publishing House, New Delhi. | 2013, II Edn. |

Reference Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|--|--|--|------------------|
| 1. | Pennington.S. R., M. J. Dunn | Proteomics from Protein sequence to function | Viva Books Pvt.Ltd. New Delhi | 2002, III Edn. |
| 2. | Mehrotra.P, Kumund Sarin, Swapna.K.Srivastava. | The New hand Book of Bioinformatics | Vikas Publishing House Pvt. Ltd. Noida, Uttar Pradesh. India | 2005, I Edn. |
| 3. | Rastogi,R.C. Mendiratta,N. Rastogi,P | Bioinformatics-Methods and applications Genomics, proteomics and Drug discovery, | PHI learning private ltd, New Delhi. | 2010, III Edn. |

| | |
|----|---|
| 4. | List of e-sources - http://www.freebookcentre.net/Biology/BioInformatics- Books.html Bioinformatics - Shomu's Biology (shomusbiology.com) |
|----|---|

Pedagogy

Power point presentation, Seminar, Quiz, Assignment and Group Discussion, Experience Discussion.

Course Designers

1. Dr. H. Rehana Banu
2. Dr. K. Kiruthika

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|----------------------------------|----------|----|---|---|--------|
| PL23C09 | Plant Ecology and Phytogeography | Theory | 58 | 2 | - | 4 |

Preamble

- To understand the basic principle of ecology.
- To study about the interrelationships among the organisms.
- To gain knowledge on the aspects of ecology like population, community and ecosystem.
- To know about the environmental pollution and its effects.
- To acquire knowledge on the conceptual foundations of biodiversity conservation.

Course Learning Outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge level |
|------------|---|-----------------|
| CLO1 | Identify specific factors that influence an ecosystem | K1 |
| CLO2 | Understanding interrelationships among the organisms | K2 |
| CLO3 | Apply the dynamics of ecosystem | K3 |
| CLO4 | Identify the causes and effects of environmental pollution | K3 |
| CLO5 | Analyze the importance of regional biodiversity and its conservation measures | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | S | S | S |
| CLO2 | S | S | S | S | S |
| CLO3 | S | S | M | S | S |
| CLO4 | S | S | S | M | S |
| CLO5 | S | M | M | S | M |

S-Strong; M- Medium

Syllabus

Unit I

12 Hrs

Introduction to Ecology: Definition, scope and importance of Ecology. Abiotic components - Climatic factors - rain, humidity of air, atmosphere, light, wind, Edaphic factors - soil (formation, profile, classification, organic matters) pH, minerals, topographic - latitude, altitude, and steepness of the slope.

Unit II

11 Hrs

Ecosystem concept: Structure - biotic components - Producers, Consumers – primary, secondary, tertiary, quaternary and decomposers. Functions- Trophic levels, food chains, food

webs, ecological pyramids. Ecosystem types – Marine, forest, desert. Biogeochemical cycles– Gaseous cycles (carbon and nitrogen); Sedimentary cycles (phosphorus and sulphur).

Unit III

11 Hrs

Population and Community Ecology: Ecads, ecotypes - characteristics, formation, ecotone, edge effect, ecoclines, ecospecies and cenospecies. Methods of community studies – quadrat method (Procedure, purpose and uses)**Plant adaptations** - morphological, anatomical and physiological adaptations - hydrophytes, xerophytes, mesophytes, epiphytes, halophytes - mangrove vegetation.

Unit IV

12 Hrs

Environmental Pollution: Sources, Effects and Control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution and Radiation pollution.

Solid waste management: Causes, effects and control measures of e-waste, urban and industrial wastes.

Unit V

12 Hrs

Biodiversity and its Conservation: Definition. Levels of biodiversity. Major terrestrial biomes - tundra, temperate and tropical. Threats to Biodiversity-Endangered species; Vulnerable species, Red Data Book and Monotypic endemic genera of India. *Ex-situ* and *In-situ* conservation.

Phytogeography: Definition and types of phytogeography, Phytogeographical regions of India, Application of GIS and remote sensing in plant ecology.

Text Books

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|-------------|---|---|------------------|
| 1 | Sharma,P.D. | Ecology and Environment | Rastogi Publications, Meerut | 2017, XIII Edn |
| 2 | ManjuYadav. | Ecology | Discovery Publishing House, New Delhi. | 2003, I Edn |
| 3 | Rana,S.V.S | Essentials of Ecology and Environmental Science | Prentice Hal India Learning Private Limited,India | 2013, V Edn |
| 4 | Verma,V | Plant Ecology | AneBooksPvt. Ltd,NewDelhi | 2011, I Edn |

Reference Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|-------------------------------------|---|--|------------------|
| 1 | Singh, J.S., S.P.SinghandS. R.Gupta | Ecology, Environmental Science and Conservation | S.Chand Publications, New Delhi | 2014, I Edn |
| 2 | Odum,E. | Fundamentals of Ecology | Cengage Publications, Saunders publication, Philadelphia | 2005, V Edn |
| 3 | Purohit,S.S.Agrawal Ashok K | Ecology and Environmental Biology | Agrobios (India). | 2014, I Edn |

Pedagogy

Power point presentation, Group discussion, Seminar, Assignment, quiz and Experience discussion

Course Designers

1. Dr. K. Gajalakshmi
2. Dr. S. Subhashini

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|---------------------|----------|----|---|---|--------|
| PL23E04 | Plant Biotechnology | Theory | 73 | 2 | - | 5 |

Preamble

- To appreciate the basics of tissue culture techniques.
- To study the biological tools of recombinant DNA technology.
- To appreciate the construction of recombinant DNA and genetic engineering of plants.

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Understand the basic principles, history, nutritional requirements and pathways of plant tissue culture. | K2 |
| CLO2 | Apply plant tissue culture techniques such as meristem, shoot tip, organ, and anther culture for propagation and germplasm conservation. | K2 |
| CLO3 | Classify DNA manipulative enzymes, cloning vectors, and host systems used in recombinant DNA technology. | K2 |
| CLO4 | Analyze the processes of gene cloning, construction of DNA libraries, and selection of recombinant organisms. | K3 |
| CLO5 | Evaluate the applications of recombinant DNA technology in agriculture, medicine, and environment. | K4 |

Mapping with Programme Learning Outcomes

| COs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | S | M | S |
| CLO2 | S | S | S | M | S |
| CLO3 | S | S | S | M | M |
| CLO4 | S | S | S | S | S |
| CLO5 | S | S | S | S | M |

S-Strong; M-Medium

Syllabus

Unit I: Basis of Plant Tissue Culture

14 Hrs

Introduction-Concepts and principles. History of plant tissue culture. Sterilization techniques. Nutritional requirements for plant tissue culture - Factors affecting plant tissue culture. Pathways of plant regeneration morphogenesis – direct and indirect, organogenesis and somatic embryogenesis. Callus initiation - establishment and maintenance. Establishment of suspension culture. Synthetic seeds and applications.

Unit II: Plant Tissue Culture Techniques for Propagation

15 Hrs

Meristem culture and virus elimination - virus indexing methods. Shoot tip culture and *in vitro*

clonal multiplication and its applications. Micropropagation techniques in roses, banana, and advantages. Organ culture: Embryo culture and embryo rescue and its applications. *In vitro* fertilization techniques. Ovule, ovary, and endosperm culture. Anther and microspore culture - production of haploids. Applications - In vitro germplasm conservation – Secondary metabolites production through cell culture -bioreactors. Somaclonal variation - applications.

Unit III: Major Tools in rDNA Technology

15 Hrs

DNA manipulative enzymes-Restriction endonucleases, DNA polymerase, Reverse transcriptase, Polynucleotide kinase, DNA ligase, Terminal deoxynucleotidyl transferase, Alkaline phosphatase, Gene of Interest, Cloning vectors for *E. coli* - based on plasmids, phage DNA, cosmids and other sophisticated vectors – BAC and PAC, Host organism-*E.coli*-DH5 α , Linkers and adaptors.

Unit IV: Major techniques and events in rDNA Technology

15 Hrs

Selection and isolation of DNA insert-construction of genomic DNA library and cDNA library. Ligation of DNA fragments with vectors (cloning and expression), homopolymer tailing, construction of recombinant DNA. Introduction of rDNA into bacterial cells. Selection of transformants and recombinants – lac selection.

Unit V: Application of Recombinant DNA Technology

14 Hrs

Agriculture - Engineering plants for resistance to pest and disease, tolerance to herbicides and abiotic factors. Medicine –production of pharmaceuticals, growth hormones, vaccines, gene therapy. Environmental applications – bioremediation.

Text Book

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|----------------------------------|--|---|------------------|
| 1. | Satyanarayana, U. | Biotechnology | Books and Allied Pvt. Ltd., Kolkata. | 2005, I Edn. |
| 2. | Rastogi, S.C. | Biotechnology Principals & Applications | Narosa Publishing House, New Delhi. | 2009, I Edn. |
| 3. | Kalyan Kumar, De. | An Introduction to Plant Tissue Culture | New Central Book Agency. Pvt.Ltd. Howrah. | 2017, I Edn. |
| 4. | Kumaresan, V. | Biotechnology | Saras Publication, Nagercoil, TamilNadu. | 2014, VI Edn. |
| 5. | Brown, T.A. | Gene cloning and DNA analysis-An Introduction. | Blackwell publishing | 2010, VI Edn |
| 6. | Singh, B.D. | Plant Biotechnology | Kalyani publishers, Ludhiana | 2015, IV Edn. |
| 7. | Primrose, S. B and Twyman. R. M. | Principles of gene manipulation and genomics. | Blackwell Publishing. | 2006, VII Edn. |

Reference Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|--|--|--|------------------|
| 1. | Buchanan, Gruissem and Jones. | Biochemistry and Molecular Biology of Plants. | I. K. International Pvt. Ltd. New Delhi. | 2004, III Edn. |
| 2. | Glick and Pasternak | Molecular Biotechnology | ASM Press. Washington | 2017, V Edn. |
| 3. | Ashwani Kumar and Sudhir K. Sopory. | Recent Advances in plant biotech & its Applications | I.K. International Publishing house, New Delhi. | 2008, I Edn. |
| 4. | Thieman J. William and Palladino. A Michael | Introduction to Biotechnology. | Dorling Kindersly, PVT. Ltd. Delhi. | 2009, II Edn. |
| 5. | Bhojwani, S.S and Dantu, P. | Plant Tissue Culture – An Introductory Text | Springer Publications, London | 2013, I Edn. |
| 6. | Karl-Hermann Neumann, Ashwani Kumar and JafargholiImani. | Plant Cell and Tissue Culture- A Tool in Biotechnology- Basics and Application | Springer-Verlag, Berlin Heidelberg | 2009, I Edn. |
| 7. | Acram Taji, Prakash P. Kumar, Prakash Lakshmanan | In vitro plant breeding | The Haworth Press Inc., New York. | 2002, I Edn. |
| 8. | Cassells, A. C and Peter B. Gahan | Dictionary of plant tissue culture | Food Products Press, an Imprint of the Haworth Press, Inc., New York-London-Oxford | 2006, I Edn. |
| 9. | Gamborg, O.L and G.C.Philips | Plant Cell, Tissue and Organ culture-Lab Manual | Springer Science & Business media. | 2013, I Edn. |
| 10. | Razdan, M.K. | Introduction to Plant Tissue Culture. | Science Publishers Inc, Enfield (NH) U.S.A | 2003, II Edn. |
| 11. | Roberta H. Smith | Plant tissue culture: Techniques and Experiments | Gulf Professional Publishing. | 2012, III Edn. |
| 12. | Glick, Pasternak and Patten. | Molecular Biotechnology: Principles and applications of recombinant DNA | American Society of Microbiology | 2010, IV Edn. |

- e-resourc 1. PTC Information exchange - www.aggie-horticulture.tamu.edu/tisscult/tcintro.html
- 2. Applications of Biotech.in Crop Improvement - <http://nptel.ac.in/courses/102103016/13>

- e-book: Recent Advances in Plant in vitro Culture - <http://www.intechopen.com/books/recent-advances-in-plant-in-vitro-culture> 4. e-book: Plant Propagation by Tissue Culture. Vol. I-3rdEdn – pp.504. Springer publications. ISBN 978-1-4020-5005-3 (e-book)
 - e-resources1. <http://www.rpi.edu/dept/chem-eng/Biotech-Environ/Projects00/rdna/rdna.html>
2. <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/R/RecombinantDNA.html>

Pedagogy

- Power point presentation, Seminar, Quiz, Group Discussion and Experience discussion
Video/ Animation

Course Designers

1. Dr. M. Kanchana
2. Dr. B. S. Chithra Devi

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|------------------------|----------|----|---|---|--------|
| PL23E05 | Bioinoculants Paper II | Theory | 73 | 2 | - | 5 |

Preamble

- To study the symbiotic association of nitrogen fixing bacteria and the plants.
- To study the distribution, occurrence, morphological variation and characteristics features of algal and bacterial biofertilizers.
- To appreciate the applications of Azolla as bioinoculants.
- To understand the problems associated with the mass production of bioinoculants and its economical condition in the society.

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Understanding the symbiotic association of nitrogen fixing bacteria and the plants | K2 |
| CLO2 | Categorize the distribution, occurrence, morphological variation and characteristics features of algal and bacterial bioinoculants | K2 |
| CLO3 | <i>Composing Azolla</i> as bioinoculants for crop improvement | K3 |
| CLO4 | Develop the methods involved in the production of bioinoculants | K3 |
| CLO5 | Analyze mass production of biofertilizers and its economical condition in the society | K4 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | S | M | S |
| CLO2 | S | S | S | M | S |
| CLO3 | S | S | M | M | M |
| CLO4 | S | S | M | M | M |
| CLO5 | S | S | S | S | S |

S- Strong; M-Medium

Syllabus

Unit -1

14 Hrs

The organisms that fix atmospheric nitrogen- free - living, aerobic, symbiotic bacteria and Frankia. *Rhizobium* classification- cross inoculation groups- characteristics- Infection - root

nodule formation- leghaemoglobin- factors affecting nodulation. Nitrogen fixation- Nitrogen assimilation. Associative symbiosis-Biochemistry of Nitrogen fixation- nitrogenase- mechanism of nitrogenase- hydrogenase - Assay of nitrogen fixation.

Unit-II

14 Hrs

Distribution - occurrence - Morphological variation – characteristics of bacterial biofertilizers: *Azotobacter*, *Azospirillum*, *Acetobacter*. Algal bioinoculants: distribution- occurrence- Morphological variation – characteristics of *Anabaena* and *Nostoc*.

Unit-III

15 Hrs

Azolla – Importance, *Azolla* - *Anabaena* symbiosis- growth behaviour– sporulation. Principles of Mass production- growth characteristics- Fermentation- Principles and techniques - inoculum preparation.

Unit-IV

15 Hrs

Carrier materials- Types and quality characteristics of an ideal carrier- preparation of inoculant packets Field performance of bioinoculants - method of application.

Unit- V

15 Hrs

Large-scale production of bacterial bioinoculants, *Azolla* and Cyanobacteria, Arbuscular Mycorrhizal (AM) fungi and Ectomycorrhiza. Problems and prospects of bioinoculants. Storage Shelf life - Quality control of bioinoculants - BSI standards of bioinoculants - Economics of bioinoculants.

Text Book

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|-------------------|------------------------------|---|------------------|
| 1 | Kumaraesan, V. | Biotechnology | Saras Publication, Nagercoil. | 2001, I Edn. |
| 2 | Dubey, R.C. | A Text book of Biotechnology | S. Chand & Co, New Delhi | 2004, IV Edn. |
| 3 | Satyanarayana, U. | Biotechnology. | Books and Allied Publishers. Ltd. Kolkatta. | 2005, I Edn. |

Reference Book

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|-----------------|--|-------------------------------------|------------------|
| 1 | Subba Rao, N.S. | Advances in Agricultural Microbiology | Oxford and IBH Publ. Co. New Delhi. | 1982, I Edn. |
| 2 | Subba Rao, N.S. | Biofertilizers in Agriculture and Forestry | Oxford and IBH Publ. Co., New Delhi | 1993, III Edn. |

Pedagogy

- Power point presentation, Seminar, Assignment, Quiz, Group Discussion and Video/ Animation

Course Designer

Dr. K. Sunitha Kumari

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|---------------|----------|----|---|---|--------|
| PL23E06 | Pharmacognosy | Theory | 73 | 2 | - | 5 |

Preamble

- To study the importance of traditional system of medicine
- To understand the characters of crude drugs

Course Learning Outcomes

On the successful completion of the course, students will be able to understand the following:

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Understand the Traditional systems of Indian medicine | K1 |
| CLO2 | Identify the crude drugs | K2 |
| CLO3 | Appreciate the Processing of crude drugs | K2 |
| CLO4 | Detect the adulteration of the crude drug | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | S | M | S |
| CLO2 | S | M | S | S | M |
| CLO3 | M | M | M | M | S |
| CLO4 | S | S | S | M | S |

S- Strong; M-Medium

Syllabus

Unit I

14 Hrs

General account of Indian Systems of medicine- Ayurveda, Siddha, Unani and Homeopathy (AYUSH). Various systems of classification of natural drugs- Alphabetical, Morphological and taxonomical classification.

Unit II

14 Hrs

Crude drugs. Identification based on morphological and anatomical characters. Collection of medicinal plants – Aerial and underground drug collection. Drying of drugs. Packing and marketing of plant drugs. Factors affecting the yield of plant drugs.

Unit III

15 Hrs

Pharmacological grouping of plant drugs. Secondary metabolites in plants. Therapeutical and pharmaceutical applications of secondary metabolites like – alkaloids, steroids, tannins and terpenoids.

Unit IV

15 Hrs

Origin, distribution and uses of herbal drugs- bark (*Cinchona officinalis* L.), leaves (*Adhatodavastica* Nees), rhizome (*Alpinia galanga* (L.) Willd.), and flower (*Eugenia caryophyllata* L.). Effect of herbal drugs on Central Nervous system- *Datura metal* L., *Withaniasomnifera* (L.) Dunaland *Papaver somniferum* L. Cardiovascular system – *Digitalis purpurea* L.

Unit V**15 Hrs**

Drug adulteration– types of adulteration. A brief account of biological testing of crude drugs. phytochemical investigation- qualitative testing of crude drugs – Alkaloids, tannins and terpenoids, glycosides and saponins.

Text Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|--|-----------------------------|------------------------------|------------------|
| 1 | Saharan, Moond, Chouhan and Gupta. | Principles of Pharmacognosy | Agrobios, Jodhpur India. | 1982, I Edn. |
| 2 | Kokate C.K., Purohit, A.P and Gokhale, S.B | Pharmacognosy | Nirali Publications, Mumbai. | 1993, III Edn. |

Books for Reference

| S.No. | Authors | Title | Publishers | Year and Edition |
|-------|--|---------------------------------|---|------------------|
| 1 | Warrier, P.K, Nambiar, V.P.K and Ramakutty, (eds). | Indian Medicinal Plants | Orient Longman Ltd, Chennai. | 1982, I Edn. |
| 2 | Evans, W.C. | Trease and Evans- Pharmacognosy | Saunders- An imprint of Elsevier, Philadelphia. | 1993, III Edn. |

Pedagogy

- Power point presentation, Lecture, seminar, quiz and discussion

Course Designer

Dr. M. Kamalam

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-------------------|-----------|---|---|-----|--------|
| PL23CP4 | Core Practical IV | Practical | - | - | 120 | 6 |

Preamble

- To study the physiological movements and biochemical estimation of plants.
- To acquire the knowledge of pharmacological aspects of medicinal plants
- To understand the biotic interactions of organisms and their applications.
- To acquire knowledge in basic tissue culture techniques and plant genetic engineering.

Course Learning Outcomes

On the successful completion of the course, students will be able to:

| CLO Number | CLO Statement | Knowledge Level |
|------------|---|-----------------|
| CLO1 | Determine the movement of plants | K3 |
| CLO2 | Examine the morphological, anatomical and chemical constituents of medicinal plants | K3 |
| CLO3 | Demonstrate the interactions, adaptations and the distribution of organisms | K3 |
| CLO4 | Utilize the knowledge of plant tissue culture for crop improvement | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | M | S | S | M | S |
| CLO2 | S | M | M | S | S |
| CLO3 | M | S | S | S | M |
| CLO4 | S | M | S | S | S |

S- Strong; M-Medium

Syllabus

Plant Physiology and Biochemistry (45 hrs)

Individual Experiments

1. Determination of Osmotic potential by plasmolytic method.
2. Separation of leaf pigments by Paper chromatography.
3. Measurement of rate of photosynthesis under various CO₂ concentration.
4. Effect of light intensity on O₂ evolution during photosynthesis.
5. Estimation of carbohydrates.
6. Estimation of proteins

Demonstration experiments

1. Simple respiroscope.
2. Ganong's photometer.
3. Transpiration pull apparatus.
4. Determination of water absorption and transpiration ratio.

Plant Ecology and Phytogeography (30 hrs)

1. To determine the soil texture, temperature, moisture and pH of different soil.
2. Study of local vegetation in the college campus by quadrat method.
3. Determination of dissolved O₂ of water samples from polluted and unpolluted sources.
4. Determination of dissolved CO₂ of water samples from polluted and unpolluted sources.
5. Estimation of Biological Oxygen Demand of water samples from polluted and unpolluted sources.
6. To locate the hotspots and phytogeographical regions in the map of India.

Spotters

Biotic interactions: Mutualism-Lichens,

Parasitism-Stem parasite *Cuscuta*,

Root parasite- *Orobanche*,

Epiphytes – *Vanda*,

Predation- *Nepenthes*

Plant adaptations: Hydrophytes (*Hydrilla*, *Eichhornia*, *Pistia*),

Xerophytes (*Nerium*, *Opuntia*, *Asparagus*),

Halophytes (*Rhizophora*) and Mesophytes (*Hibiscus*).

Basics of Bioinformatics and Plant Biotechnology (45hrs)

i) Basics of Bioinformatics

Individual Experiments

1. Retrieving protein and DNA sequences using Entrez at NCBI
2. Visit to Biological database-nucleic acid database-GenBank; Protein database-Swiss Prot
3. Pairwise Alignment Tool-BLAST
4. Multiple sequence alignment- CLUSTAL W & Phylogenetic analysis

ii) Plant Biotechnology

Demonstration: Design of a Plant Tissue Culture lab

Experiments: Sterilization methods-stock and medium preparation

Initiation of callus from different explants

Meristem tip culture-Micropropagation in rose and banana

Embryo Culture-Sub culturing. Anther culture

Establishment of suspensions and viability assay

Rooting and hardening of Tissue culture plants.

Synthetic seed preparation.

1.Isolation of plasmid DNA and Quantification

2.Restriction analysis of plasmid DNA.

Demonstration:

1. Restriction digestion and recovery of DNA fragments from gel
2. Preparation of E. coli competent cells – bacterial transformation – recombinant selection.

3. DNA amplification by PCR.

Spotters: Agarose Gel Electrophoresis,
Golden rice,
Bt cotton,
Bt Brinjal.

Or

Bioinoculants- Paper II

Mass multiplication of bacterial bioinoculants - Fermentor
Carrier material - preparation of inoculant packets
Quality control - assessment of shelf life and storage methods
Methods of application of bacterial bioinoculants- seed coating, soil application.
Isolation, enumeration and identification of cyanobacteria
Cyanobacteria - large scale production and method of application.
Azolla - large scale production and inoculation methods.
Different genera of AM and Mass multiplication - application methods

or

Pharmacognosy

Morphology and uses of leaf drug *Adathoda vasica* Nees;
bark- *Cinchona officinalis* L.,
rhizome -*Alpinia galanga* Nees;
root- *Withania somnifera* (L.) Dunal;
Latex-*Papaver somniferum* L.;
Flower bud- *Eugenia caryophyllata* L.

Course Designers

1. Dr. M. Kanchana,
2. Dr. H. Rehanabanu,
3. Dr. E. Uma,
4. Dr. K. Sunithakumari
5. Dr. Sarah Jaison

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|-------------------------------|----------|---|---|---|--------|
| PL22AC3 | ALC- Industrial Biotechnology | Theory | - | - | - | 5 |

Preamble

- To know about the processes in industrial production of primary, secondary metabolites and their bioproducts.
- To understand the concept of the waste water treatment and bioremediation.
- To know about the applications of industrial biotechnology in health care.

Syllabus

Unit –I

Introduction to Industrial Biotechnology - Objectives and Scope: Historical overview of industrial fermentation process -traditional and modern Biotechnology. Industrial Fermentation-up stream and down stream processing (pictorial representation).

Unit II

Industrial production of primary metabolites: aminoacid- L-lysine, Organic acid- Vinegar and citric acid, Biomass - bakers yeast and alcohol (ethanol & butanol).

Unit-III

Industrial production of secondary metabolites: antibiotics- streptomycin, penicillin and erythromycin. Vitamins -Vit B12 and Vit B2. Industrial production of enzymes and other bioproducts: enzymes-amylase, biopreservative -Nisin, biopolymers -xanthan gum.

Unit-IV

Biotechnology in health care: production of human growth hormone and Insulin, recombinant vaccine production -Hepatitis B vaccine and cholera vaccine. Patenting biotechnology inventions. Environmental risks of genetically engineered organisms.

Unit- V

Waste water treatment for dairies, dye industries, distilleries, tanneries and sugar industries. Water recycling. Bioremediation

Text Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|-------------------|-----------------------------|---|------------------|
| 1 | Satyanarayana, U. | Biotechnology | Books and Allied Publishers, Ltd. Kolkatta. | 2005, I Edn. |
| 2 | Dubey, R.C. | A Textbook of Biotechnology | S.Chand& Co. Ltd, New Delhi. | 2014, V Edn. |

Reference Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|------------------------------------|--|-------------------------------|------------------|
| 1 | Michael L.Shuler and Fikret Kargi. | Bioprocess Engineering Basic concepts, | Prentice Hall, United States. | 1992, I Edn. |
| 2 | Presscott and Dunn. | Industrial Microbiology | AVI publishing Co. USA. | 1983, IV Edn. |

Course Designers

1. Dr. H. Rehana banu
2. Dr. E.Uma

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|---------------------------------|----------|---|---|---|--------|
| PL22AC4 | ALC-Mushroom Culture Techniques | Theory | - | - | - | 5 |

Preamble

- To know about the morphology, classification, life cycle and cultivation of common edible mushrooms.
- To understand the medicinal properties and diseases of mushrooms.

Syllabus

Unit –I

Introduction, history of mushroom cultivation; Morphology and classification of mushrooms. Poisonous mushrooms. Distinctive features and symptoms of mushroom poisoning. Key to differentiate Edible from non-edible mushroom.

Unit-II

Distinguishing characteristics, germination and life cycle of commonly cultivated mushrooms – Indian Oyster mushroom (*Pleurotus* sp.), button mushroom (*Agaricus* sp.), and paddy straw mushroom (*Volvariella* sp.) and medicinal mushrooms (*Ganoderma* sp.).

Unit-III

Nutritional profiling and medicinal properties of mushrooms. Value added products of mushrooms- powders and sauces. Mushroom research centers/farms: National and regional level.

Unit IV

Mushroom Cultivation– Infrastructure, equipments, substrates, isolation; spawn production, growth media, maintenance, harvesting and storage of mushrooms.

Unit- V

Post harvest technology – blanching, steeping, pickling, canning and freezing drying. Disease prevention and control measures. Marketing strategies of mushrooms.

Text Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|-----------------------------|-----------------------------|---|------------------|
| 1 | Satyanarayana, U. | Biotechnology | Books and Allied Publishers, Ltd. Kolkatta. | 2005, I Edn. |
| 2 | Dubey, R.C. | A Textbook of Biotechnology | S.Chand& Co. Ltd, New Delhi. | 2014, V Edn. |
| 3 | Reeti Singh and U.C. Singh. | Modern Mushroom Cultivation | Agrobios (India). | 2011, I Edn. |

Reference Book

| S.No | Authors | Title | Publishers | Year and Edition |
|------|--------------------|---|--|------------------|
| 1 | Tripathi, D.P | Mushroom Cultivation | Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi. | 2017, I Edn. |
| 2 | Pathak Yadav Gour. | Mushroom Production and Processing Technology | Published by Agrobios (India). | 2011, I Edn. |

Course Designers

- Dr. H. Rehana banu
- Dr.E.Uma

| COURSE CODE | COURSE TITLE | CATEGORY | L | T | P | CREDIT |
|-------------|--|-----------|---|---|----|--------|
| PL23SBP1 | Essentials of Horticulture and Agripreneurship Practical | Practical | - | - | 45 | 3 |

Preamble

- To understand the preparation of vermicompost to grow various horticultural crops
- To get skilled in various horticultural techniques

Course Learning Outcomes

On the successful completion of the course, students will be able to

| CLO Number | CLO Statement | Knowledge Level |
|------------|--|-----------------|
| CLO1 | Gain knowledge on the various tools used in horticulture | K1 |
| CLO2 | Prepare vermicompost and to construct vegetable garden | K2 |
| CLO3 | Practice cut flower techniques | K2 |
| CLO4 | Propagate various horticultural crops | K3 |

Mapping with Programme Learning Outcomes

| CLOs | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 |
|------|------|------|------|------|------|
| CLO1 | S | S | M | M | M |
| CLO2 | S | S | M | M | M |
| CLO3 | S | S | M | M | S |
| CLO4 | S | S | M | M | S |

S- Strong; M-Medium

Syllabus

Practicals

1. Study of tools used in horticulture
2. Preparation of vermicompost
3. Build a vegetable garden
4. Cutting-leaf, root and stem cutting
5. Layering-simple and air layering
6. Grafting-splice and cleft grafting
7. Budding-T-patch and H-chip budding
8. Flower arrangement-Fresh and Dry Flowers
9. Bonsai technique
10. Hydroponics
11. Microgreens
12. Visit to nursery and gardens to get a detailed understanding on nursery management

Course Designer

1. Dr. K.S.TamilSelvi,
2. Dr. B.S. Chithra Devi
3. Dr. Sarah Jaison