**ANNAMALAI UNIVERSITY**

(Affiliated Colleges)

**207 - B.Sc. Environmental Management**

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Part** | **Course Code** | **Study Components & Course Title** | **Credit** | **Hours/ Week** | **Maximum Marks** |
| **CIA** | **ESE** | **Total** |
|  |  | **SEMESTER - I** |  |  |  |  |  |
| I | 23UTAMC11/23UHINL11/23UFREL11 | Language - I – **பொதுதமிழ்- I:** தமிழிலக்கிய வரலாறு-1/Hindi-I/French-I | 3 | 6 | 25 | 75 | 100 |
| II | 23UENGL12 | General English – I | 3 | 6 | 25 | 75 | 100 |
| III | 23UEVMC13 | Core – I: Environmental Ecology  | 5 | 5 | 25 | 75 | 100 |
| 23UEVMP14 | Core – II: Practical – I: Environmental Ecology  | 5 | 4 | 25 | 75 | 100 |
| 23UBOTE1523UBOTEP1 | Elective - I: Botany - IBotany Practical - 1 | 21 | 32 | 2525 | 7575 | 100100 |
| IV | 23UTAMB1623UTAMA16 | Skill Enhancement Course – I\*NME-I /Basic Tamil – I /Advanced Tamil - I | 2 | 2 | 25 | 75 | 100 |
| 23UEVMF17 | Foundation Course:Environmental Education and Awareness | 2 | 2 | 25 | 75 | 100 |
|  |  | Total | 23 | 30 |  |  | 800 |
|  |  | SEMESTER – II |  |  |  |  |  |
| I | 23UTAMC21/23UHINL21/23UFREL21 | Language – II: **பொதுதமிழ்- II:** தமிழிலக்கிய வரலாறு-**2**/Hindi-II/French-II | 3 | 6 | 25 | 75 | 100 |
| II | 23UENCL22 | General English – II | 3 | 6 | 25 | 75 | 100 |
| III | 23UEVMC23 | Core – III : Aquaculture and Environment | 5 | 5 | 25 | 75 | 100 |
| 23UEVMP24 | Core –IV : Practical – II: Aquarium Keeping and Management | 5 | 4 | 25 | 75 | 100 |
| 23UBOTE2523UBOTEP2 | Elective - II: Botany - IIBotany Practical – 1I | 21 | 32 | 2525 | 7575 | 100100 |
| IV | 23UTAMB2623UTAMA26 | Skill Enhancement Course – II\*NME-II/Basic Tamil – II /Advanced Tamil - II | 2 | 2 | 25 | 75 | 100 |
| 23USECG27 | Skill Enhancement Course – III:Internet and its Applications (Common Paper) | 2 | 2 | 25 | 75 | 100 |
| 23UNMSD01 | Language Proficiency for employability: Overview of English Communication\*\* | 2 | - | 25 | 75 | 100 |
|  |  | Total | 25 | 30 |  |  | 900 |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **SEMESTER - III** |  |  |  |  |  |
| I | 23UTAMC31/23UHINL31/23UFREL31 | Language - III – பொது தமிழ் – III: தமிழக வரலாறும், பண்பாடும்/Hindi-III/French-III | 3 | 6 | 25 | 75 | 100 |
| II | 23UENGL32 | English – III | 3 | 6 | 25 | 75 | 100 |
| III | 23UEVMC33 | Core – V : Natural Resources and Management | 5 | 5 | 25 | 75 | 100 |
| 23UEVMP34 | Core – VI : Practical –III: Natural Resources and Environmental Toxins | 5 | 4 | 25 | 75 | 100 |
| 23UCHEE3523UCHEEP3 | Elective - III: Chemistry -I for Biological SciencesChemistry Practical - I for Biological Sciences | 21 | 32 | 2525 | 7575 | 100100 |
| IV | 23UEVMS36 | Skill Enhancement Course – IV: (Entrepreneurial Skill):Vermicomposting  | 1 | 1 | 25 | 75 | 100 |
| 23UEVMS37 | Skill Enhancement Course – V: Environmental Toxicology  | 2 | 2 | 25 | 75 | 100 |
|  | Environmental Studies | - | 1 | - | - | - |
|  |  | Total | 22 | 30 |  |  | 800 |
|  |  | SEMESTER – IV |  |  |  |  |  |
| I | 23UTAMC41/23UHINL41/23UFREL41 | Language – IV: பொது தமிழ்–IV: தமிழும் அறிவியலும்/Hindi-IV/French-IV | 3 | 6 | 25 | 75 | 100 |
| II | 23UENCL42 | English – IV | 3 | 6 | 25 | 75 | 100 |
| III | 23UEVMC43 | Core – VII : Environmental Pollution and Control Measures | 5 | 4 | 25 | 75 | 100 |
| 23UEVMP44 | Core –VIII : Practical – IV: Pollution Management  | 5 | 4 | 25 | 75 | 100 |
| 23UCHEE4523UCHEEP4 | Elective - IV: Chemistry – II for Biological Sciences Chemistry Practical – II for Biological Sciences | 21 | 32 | 2525 | 7575 | 100100 |
| IV | 23UEVMS46 | Skill Enhancement Course – VI:Remote Sensing and GIS | 2 | 2 | 25 | 75 | 100 |
| 23UEVMS47 | Skill Enhancement Course – VII:Environmental Microbiology  | 2 | 2 | 25 | 75 | 100 |
| 23UEVSG48 | Environmental studies | 2 | 1 | 25 | 75 | 100 |
|  |  | Total | 25 | 30 |  |  | 900 |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | SEMESTER - V |  |  |  |  |  |
| III | 23UEVMC51 | Core – IX: Environmental Safety, Health and Management | 4 | 5 | 25 | 75 | 100 |
| 23UEVMC52 | Core – X: Computers in Environment | 4 | 5 | 25 | 75 | 100 |
| 23UEVMC53 | Core – XI : Solid Waste Management | 4 | 5 | 25 | 75 | 100 |
| 23UEVMD54 | Core – XII : Project with Viva-voce | 4 | 5 | 25 | 75 | 100 |
| 23UEVME55 | Elective-V: Forest Conservation and Management | 3 | 4 | 25 | 75 | 100 |
| 23UEVME56 | Elective VI : Conservation Biology and Management | 3 | 4 | 25 | 75 | 100 |
| IV | 23UVALG57 | Value Education | 2 | 2 | 25 | 75 | 100 |
| 23UEVMI58 | Summer Internship ++ | 2 |  | 25 | 75 | 100 |
|  |  | Total | 26 | 30 |  |  | 800 |
|  |  | SEMESTER – VI |  |  |  |  |  |
| III | 23UEVMC61 | Core – XIII: Environmental Impact Analysis | 4 | 6 | 25 | 75 | 100 |
| 23UEVMC62 | Core – XIV: Natural Hazard and Disaster Management | 4 | 6 | 25 | 75 | 100 |
| 23UEVMP63 | Core – XV : Practical – V: Waste Recycling Techniques &Environmental Impact Assessment  | 4 | 6 | 25 | 75 | 100 |
| 23UEVME64 | Elective-VII: Environmental Economics | 3 | 5 | 25 | 75 | 100 |
| 23UEVME65 | Elective-VIII: Environmental Laws , Policies and Treaties  | 3 | 5 | 25 | 75 | 100 |
| IV | 23UEVMF66 | Professional Competency Skill: Environmental Biotechnology and Herbal Science | 2 | 2 | 25 | 75 | 100 |
| V | 23UEVMX67 | Extension Activity | 1 | - | 100 |  | 100 |
|  |  | Total | 21 | 30 |  |  | 700 |
|  |  | Grand Total | 142 | 180 |  |  | 4900 |

**Non-Major Elective Courses (NME) to other Departments)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| IV | 23UEVMN16 | Global Environmental issues and Management | 2 | 2 | 25 | 75 | 100 |
| 23UEVMN26 | Occupational safety, health and management | 2 | 2 | 25 | 75 | 100 |

\* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

\*\* The course “23UNMSD01: Overview of English Communication” is to be taught by the experts from Naan Mudhalvan Scheme team. However, the faculty members of Department of English should coordinate with the Naan Mudhalvan Scheme team for smooth conduct of this course.

++Students should complete two weeks of internship before the commencement of V semester.

**Elective Courses offered to other Science Department in I and II Semesters**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| III | 23UEVME1523UEVMEP1 | Elective - I: Environmental Zoology - IEnvironmental Zoology Practical - 1 | 21 | 32 | 2525 | 7575 | 100100 |
| 23UEVME2523UEVMEP2 | Elective - II: Environmental Zoology - IIEnvironmental Zoology Practical - II | 21 | 32 | 2525 | 7575 | 100100 |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**

**for all UG courses including Lab Hours**

**First Year – Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part I | Language – Tamil  | 3 | 6 |
| Part II | English | 3 | 6 |
| Part III | Core Theory, Practical & Elective Courses  | 13 | 14 |
| Part IV | Skill Enhancement Course SEC-1 (NME-I) | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part I | Language – Tamil | 3 | 6 |
| Part II |  English | 3 | 6 |
| Part III | Core Theory, Practical & Elective Courses  | 13 | 14 |
| Part IV | Skill Enhancement Course -SEC-2 (NME-II) | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year – Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part I | Language - Tamil | 3 | 6 |
| Part II |  English | 3 | 6 |
| Part III | Core Theory, Practical & Elective Courses | 13 | 14 |
| Part IV | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part I | Language - Tamil | 3 | 6 |
| Part II |  English | 3 | 6 |
| Part III | Core Theory, Practical & Elective Courses | 13 | 13 |
| Part IV | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
|  E.V.S  | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part III | Core Theory, Practical, Project & Elective Courses | 22 | 28 |
| Part IV | Value Education  | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | - |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part III | Core Theory, Practical & Elective Courses | 18 | 28 |
| Part IV | Professional Competency Skill | 2 | 2 |
| Part V | Extension Activity | 1 | - |
|  |  | **21** | **30** |

**Consolidated Semester wise and Component wise Credit distribution**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parts**  | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Sem V** | **Sem VI** | **Total Credits** |
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV**  | 4 | 4 | 3 | 6 | 4 | 2 | 23 |
| **Part V** | - | - | - | - | - | 1 | 1 |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

**\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components Part IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

**CREDIT DISTRIBUTION FOR U.G. PROGRAMME**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part** | **Course Details** | **No. of Courses** | **Credit per course** | **Total****Credits** |
| **Part I** | Tamil | 4 | 3 | 12 |
| **Part II** | English | 4 | 3 | 12 |
| **Part III** | Core Courses  | 15 | 4/5 | 68 |
| Elective Courses: Generic / Discipline Specific (3 or 2+1 Credits) | 8 | 3 | 24 |
| **Part I, II and III Credits**  | 116 |
| **Part IV** | Skill Enhancement Courses / NME / Language Courses | 7 | 1/2 | 15 |
| Professional Competency Skill Course | 1 | 2 | 2 |
| Environmental Science (EVS) | 1 | 2 | 2 |
| Value Education  | 1 | 2 | 2 |
| Internship | 1 | 2 | 2 |
| **Part IV Credits** | **23** |
| **Part V** | Extension Activity (NSS / NCC / Physical Education) | 1 | 1 | 1 |
| **Total Credits for the UG Programme**  | **140** |

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| --- |
| **Methods of Evaluation** |
| **Internal Evaluation** | Continuous Internal Assessment Test | 25 Marks |
| Assignments |
| Seminars |
| Attendance and Class Participation |
| **External Evaluation** | End Semester Examination | 75 Marks |
|  | Total | 100 Marks |
| **Methods of Assessment** |
| **Recall (K1)** | Simple definitions, MCQ, Recall steps, Concept definitions |
| **Understand/Comprehend (K2)** | MCQ, True/False, Short essays, Concept explanations, Short summary or overview |
| **Application (K3)** | Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain |
| **Analyze(K4)** | Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge |
| **Evaluate(K5)** | Longer essay/Evaluation essay, Critique or justify with pros and cons |
| **Create(K6)** | Check knowledge in specific or off beat situations, Discussion, Debating or Presentations |

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| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study**PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.**PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.**PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation**PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team**PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.**PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.**PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.**PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.**PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling. |

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| **Programme Specific Outcomes:** | **PSO1 – Placement:** To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.**PSO 2 - Entrepreneur:**To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations**PSO3 – Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.**PSO4 – Contribution to Business World:**To produce employable, ethical and innovative professionals to sustain in the dynamic business world.**PSO 5 – Contribution to the Society:**To contribute to the development of the society by collaborating with stakeholders for mutual benefit |

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| --- | --- | --- | --- |
| **Semester** | **Core – I****COURSE CODE: 23UEVMC13****COURSE TITLE: Environmental Ecology** | **H/W** | **C** |
| **I** | **5** | **5** |

**Course Objectives**

1. To learn the concept, principles of ecology and ecosystem
2. To understand the structure and functions of ecosystem
3. To impart knowledge about population ecology
4. To understand the community ecology.
5. To study the ecological relationships among organism.

**UNIT I: Ecology**

Definition - Scope and importance of Ecology - Sub divisions of Ecology - Autecology- Synecology - Branches of Ecology - Environmental Factors- Abiotic - Water- Air - Soil – Temperature – Light - Biotic Factors.

**UNITI II: Ecosystem**

Structure of Ecosystem - Principle steps and components of an Ecosystem - Ecosystem Types- Aquatic Ecosystem - Pond Ecosystem - Functions of Ecosystem - Energy - Food Chain- Food Web- Ecological Pyramids - Pyramid of Number, Biomass and Pyramid of Energy- Inverted Pyramids.

**UNIT III: Population ecology**

Characteristics of Population - Natality - Mortality - Age Distribution - Age Pyramids - Survivorship Curves - Population Dispersal - Population Growth Forms - Carrying Capacity- Ecological Adaptations - Hydrophytes - Morphology and Anatomy - Mesophytes - Morphology and Anatomy - Xerophytes - Morphology and Anatomy - Halophyte.

**UNIT IV: Community Ecology**

Definition - Ecological Dominance - Ecotone and Edge Effect - Ecological Niche - Ecological Equivalence - Ecological Indicators - Ecological Succession - Types - Primary and Secondary Succession - Process of Succession- Nudation-Invasion – Establishment – Competition- Reaction – Stabilization .

**UNIT V: Animal Association**

Inter-Specific Relationship - Neutralism - Symbiosis - Mutualism- Commensalism Antagonism- Competition, Predation, Antibiosis, Exploitation, Parasitism- parasitic adaptations – Intra specific relationship.

**Expected Course Outcomes**

After completion of this course, students will be able to gain knowledge in

1. The scope and importance of ecology.

2. The structure and functions of Ecosystem.

3. The characteristics of population ecology.

4. The community ecology, ecological succession, ecotone and ecological niche.

5. The inter and intra specific relationship of animals.

**Text Books**

1. Verma, P.S., Agarwal, V.K. (1983) Principles of Ecology, S Chand & Company Limited, New Delhi.

2. Jeyaraj, Veerbalarastogi, (1988) Fundamentals of Ecology, S Chand and Company, New Delhi.

3. Smith, T.M., Smith, R.L. (2007) Elements of Ecology, Pearson Education.

**Supplementary Reading**

1. [https://www.environment-ecology.com](https://www.environment-ecology.com/).

2. [https://www.britannica.com](https://www.britannica.com/).

3. <https://esj.Journalsonlinelibrary.wiley.com>.

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Core – II: Practical - I****COURSE CODE: 23UEVMP14****COURSE TITLE: Environmental Ecology** | **H/W** | **C** |
| **I** | **4** | **5** |

**Course Objectives**

1. To know about the morphology and anatomical adaptations of hydrophytes.
2. To know morphological adaptations of Xerophytes. Mesophytes and Halophytes.
3. To identify the biodiversity hotspots in India
4. To learn about IUCN Red list categories.
5. To learn the Biosphere reserves.

**PRACTICAL**

1. Study on the morphology and anatomy of Hydrophytes
2. Study on the morphology and anatomy of Xerophytes.
3. Study on the morphology and anatomy of Mesophytes.
4. Study on the morphology and anatomy of.
5. Squash preparation of onion root tip for Mitosis.
6. Mapping of biodiversity hotspots in India.
7. IUCN Red list categories.
8. List of 10 most World endangered animals.
9. List of 10 most World endangered birds.
10. CITES
11. Location of Biosphere reserves of Tamilnadu.

**Expected Course Outcome:**

After completion of this course,

students will be able to gain knowledge

1. About the morphology and anatomical adaptations of hydrophytes.
2. On the morphological adaptations of Xerophytes. Mesophytes and Halophytes.
3. To identify the biodiversity hotspots in India
4. About the IUCN Red list categories.
5. In learn the Biosphere reserves.

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 2 |

\*3 - Strong; 2 - Medium; 1- Low

**ELECTIVE I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - i****Course Code : 23UBOTE15****Course Title: Botany - I** | **H/W** | **C** |
| **I** | **3** | **2** |

**Course Objective**

|  |  |
| --- | --- |
| **1** | To study morphological and anatomical adaptations of plants of various habitats. |
| **2** | To demonstrate techniques of plant tissue culture. |
| **3** | To familiarize with the structure of DNA, RNA.  |
| **4** | To carryout experiments related with plant physiology.  |
| **5** | To perform biochemistry experiments.  |

**Unit – 1: Algae:**

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.

**Unit – 2 : Fungi, Bacteria and Virus:**

General characters of fungi, structure, reproduction and life cycle of the following genera – *Penicillium* and *Agaricus* and economic importance of fungi.

Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.

**Unit – 3 : Bryophytes, Pteridophytes and Gymnosperms:**

General characters of Bryophytes, Structure and life cycle of *Funaria*.

General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.

General characters of Gymnosperms, Structure and life cycle of *Cycas*.

**Unit – 4: Cell Biology:**

Prokaryotic and Eukaryotic cell-structure/ organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.

**Unit – 5: Genetics and Plant Biotechnology:**

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods.Plant tissue culture and its application in biotechnology.

**Expected Course Outcomes (CO)**

At the end of the course, the student will be able to

|  |  |
| --- | --- |
| **1** | Increase the awareness and appreciation of human friendly algae and their economic importance.  |
| **2** | Develop an understanding of microbes and fungi and appreciate their adaptive strategies.  |
| **3** | Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.  |
| **4** | Compare the structure and function of cells and explain the development of cells.  |
| **5** | Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.  |

**Recommended Texts**

1. Singh,V., Pande,P.C and Jain,D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma,O.P.2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S.

 Viswanathan Pvt. Ltd., Madras.

**Reference books:**

1. Parihar, N.S. 2012. An introduction to Bryophyta –Pteridophytes- Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Bbryophyta –Bryophytes -, Surjeet Publications, Delhi.

7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II,

S.Chand and Co. New Delhi.

**Web Resources**

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. [http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html](http://www.freebookcentre.net/biology-books-download/Fungi-%28PDF-15P%29.html)
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>
8. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

**Mapping with Programmed Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | M | S | S | S | S | L | S | S | S | S |
| **CO4** | S | S | M | S | S | S | M | S | M | S |
| **CO5** | S | M | M | M | M | M | M | L | M | L |

**S – Strong; M – Medium; L-Low**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - i****Course Code : 23UBOTEP1****Course Title: Botany Practical - I** | **H/W** | **C** |
| **I** | **2** | **1** |

**Course Objectives**

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of cell biology.
4. Understanding of laws of inheritance, genetic basis of loci and alleles.
5. To learn about the principles and applications of Biotechnology

**EXPERIMENTS**

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms Cell biology and Biotechnology.

**Bonafide record of practical work done should be submitted for the practical examination**

**Course outcomes:**

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

1. To study the internal organization of algae .
2. To study the structure and organization of fungi, bacteria and viruses
3. Develop critical understanding on morphology, anatomy and reproduction of

Bryophytes, Pteridophytes and Gymnosperms.

1. To study the cell structure and function.
2. Understand the fundamental concepts of genetics and Biotechnology

**Recommended texts**

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.

2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.

3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.

4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.

5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference books**

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

**Web Resources**

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. [https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy](https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover) [mnosperms&printsec=frontcover](https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover)
3. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 2 | 3 | 1 | 3 | 2 |
| **CO2** | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 2 | 1 | 3 | 2 | 3 |
| **CO4** | 1 | 3 | 3 | 2 | 2 |
| **CO5** | 2 | 2 | 3 | 1 | 3 |

**BOTANY PRACTICAL I**

Time : 3 Hours Max. Marks : 75

**PRACTICAL QUESTION PAPER**

1. Make suitable micro preparations of the given specimens A, B and C.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Make suitable micro preparations of the given specimens D.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (08)

3. Identify the given electron micrograph –E, describe and draw diagrams

 (Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J, K and L.

(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65

Record = 10

 \_\_\_\_\_\_\_\_\_\_\_\_

Grand Total = 75

 \_\_\_\_\_\_\_\_\_\_\_\_

**BOTANY PRACTICAL I**

**KEY & SCHEME OF VALUATION**

1. A – Algae / Fungi : *Sargassum/Agaricus*

 B – Bryophytes : *Funaria*

 C – Pteridophytes : *Lycopodium*

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Gymnopserms - D : *Cycas* – rachis and leaflet

(Identification – 1, diagram – 2, Reasons – 2, Slide -3) (08)

3. Cell biology - E – Electron Micrograph of organelles- Chloroplast, Mitochondria, Nucleus, Mitosis, Giant Chromosomes

– (Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J and L(any seven of the following)

(Algae, Fungi, Bacteria, Virus, Bryophytes, Pteridophytes and Gymnosperms –permanent slides, book diagrams or wet preserved jar specimens, mentioned in the syllabus)

Cytology – photographs of cell organelles

Genetics – simple genetics problems

Plant biotechnology – tissue culture techniques : explants, callus, hardening

 (Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65

Record = 10

 \_\_\_\_\_\_\_\_\_\_\_\_

 Grand Total = 75

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|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Foundation Course**  **COURSE CODE: 23UEVMF17****COURSE TITLE: Environmental Education and Awareness**  | **H/W** | **C** |
| **I** | **2** | **2** |

**Course objectives:**

* + - 1. To understand the importance, need and methodologies of environmental education.
			2. To acquire skills to conduct environmental awareness programs.

**UNIT - I: Basics of Environmental Education**

Objectives and Concepts of Environmental Education; National and Global Environmental organizations (IUCN, UNEP, WII, CSE, and IPCC), Major Environmental Movements in India – Chipko, Bishnoi, and Silent Valley.

**UNIT - II: Methodology**

Forms of Environmental Education, Concepts of education for childhood, higher education and adult, Present methods in India.

**UNIT - III: Environmental Awareness for rural children**

Environmental Awareness for rural children, Planning, preparation and Implementation.

**UNIT - IV: Environmental Awareness for urban children**

Environmental Awareness for urban school / college community, Planning, preparation, Implementation.

**UNIT – V: Practice:** Environmental Awareness forgeneral public, Environmental Awareness for general public, Planning, preparation and Implementation

**Expected Course Outcomes**

After the completion of this course the students will be able to:

1. Recall the history of environmental education
2. Summarize the concept of environmental education
3. List and analyze the different environmental organizations
4. Categorize the different forms of education
5. Plan and design the environmental education programs for various target groups

**Text Books**

1. UNEP. Public Environmental Awareness and Education, 2007

2. MOEF. Ministry of Environment & Forests. Government of India Paryavaran Bhawan Cgo Complex Lodhi Road, New Delhi, 110003, National Environment Awareness Campaign.2011-2012.

**Reference Books**

1. Early Childhood Environmental Education Programs: Guidelines for Excellence, North American Association for Environmental Education, 2000, USA, www.naaee.org [www.eelink.net](http://www.eelink.net).
2. Joyce Meredith. A Project of Ohio. EE 2000: A Strategic Plan for Environmental Education in Ohio. Published by: Environmental Education Council of Ohio P.O. Box 2911 Akron, OH 44309-2911, 2000.
3. Non-formal Environmental Education Programs: Guidelines for Excellence. North American Association for Environmental Education. 2000 P Street, NW - Suite 540 Washington, DC 20036, USA.

#### OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Core - III****COURSE CODE: 23UEVMC23****COURSE TITLE: AQUACULTURE AND ENVIRONMENT** | **H/W** | **C** |
| **II** | **5** | **5** |

**Course Objectives**

1. To learn about culture system.

2. To impart knowledge of aquatic pollution.

3. Learn the impact of weeds and predators.

4. To Study about preservation.

5. To learn about Pearl culture.

**UNIT-1 CULTURE SYSTEM**

 Culture system- freshwater-. Brackish water-. Extensive- intensive -semi -. Intensive. Pokkali – Cage- Pen culture- mono –monosex culture, -Poly Paddy cum fish-. Fish cum dairy- fish cum pig. Fish cum duck-Fish ponds- breeding- nursery-rearing- stocking -dry and wet bundh- Construction and maintenance of fish farm.

**UNIT –2 AQUATIC POLLUTION**

 Aquatic pollution- definition- pollutants- marine pollution- causes- ecological effects effects of aquatic pollution on fishers- water quality management- physical, chemical, biological parameters- assessment of a water quality.

**UNIT –3 WEED & PREDATOR CONTROL**

 Weed control- harmful effects of weed control, aquatic weeds- control of aquatic weeds- predator control--definition- predatory insects - Predatory vertebrates.

**UNIT –4 PRESERVATION OF FISHES**

 Preservation of fishes- fish spoilage- chemical action- autolysis- microbial action- principles of fish preservation- cleaning-low temperature-high temperature- dehydration- salts.- methods of preservation- curing- drying - freezing- fish diseases- white spot disease- costiasis - whirling disease- knot disease- gill rot- pinhead- rickets.- Causes- symptoms- treatment.

**UNIT- 5 PEARL CULTURE**

 Pearl Culture-definition- Types -composition of pearl -Pearl producing animals- cultivable species- biology of Pearl oysters, Pearl formation, culture of pearls, freshwater Pearl culture.

**Expected Course outcome**

After completion of this course, students will be able to gain knowledge in

1. Different types of culture system.

2. Causes and effect of aquatic pollution.

3. Weed and Predator control.

4. Preservation of Fishes

5. Pearl culture.

**Text Books**

1. Jhingaran, C.G. 1981. Fish and Fisheries of India, Hindustan Publishing Corporation.

2. Talwar, P.K. and Jhingaram, A.G. 1991. Inland Fisheries of India and adjacent

countries, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

3. N. Arumugam. 2008. Aquaculture, Saras Publications, Nagercoil, Tamilnadu.

**Supplementary reading**

1. [Https://www.sciencedirect.com](https://www.sciencedirect.com/)

2. [https://www.fao.org](https://www.fao.org/)

3. [https://oceanservice.noaa.gov](https://oceanservice.noaa.gov/)

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Core – IV: PRACTICAL II:****COURSE CODE: 23UEVMP24****COURSE TITLE: AQUARIUM KEEPING AND MANAGEMENT PRACTICAL**  | **H/W** | **C** |
| **II** | **4** | **5** |

Course Objectives

1. To identify Freshwater and Marine aquarium fishes
2. To get knowledge on identification of fish diseases
3. To know the water salinity
4. To learn the LC50 and LD50
5. To know the method of fish transport

Practicals

1. Identification of Marine aquarium fishes.
2. Identification of common Aquarium fresh water fishes.
3. Identification and treatment of common ornamental fish diseases.
4. Estimation of oxygen consumption in fish by Winkler’s method.
5. Estimation of salinity.
6. Estimation of LC50 and LD50 with heavymetals using fish.
7. Effect of temperature and salinity on respiration of fish.
8. Demonstration of setting up of High-Tech aquarium tank.
9. Methods and transport of seeds and breeders.
10. Visit to aquaculture farm and submission of report.

Expected Course Outcome

After the completion of this practical course, the students are able to

1. Identify Freshwater and Marine water aquarium fishes
2. Identify and treat fish diseases
3. Know the water salinity and its impact
4. Estimate LC50 and LD50
5. Method of setting up of High-tech aquarium tank

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - ii** **Course Code: 23UBOTE25****course title: Botany - II** | **H/W** | **C** |
| **II** | **3** | **2** |

**Course Objective (LO):**

|  |  |
| --- | --- |
| **1** | To be familiar with the basic concepts and principles of plant systematics.  |
| **2** | Learn the importance of plant anatomy in plant production systems. |
| **3** | Understand the mechanism underling the shift from vegetative to reproductive phase. |
| **4** | To learn about the physiological processes that underlie plant metabolism.  |
| **5** | To know the energy production and its utilization in plants.  |

**Unit – 1: MORPHOLOGY OF FLOWERING PLANTS**

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

**Unit – 2 :TAXONOMY**

Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae

**Unit – 3: ANATOMY**

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

**Unit – 4: EMBRYOLOGY**

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

**Unit – 5: PLANT PHYSIOLOGY**

Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.

**Expected Course Outcomes (CO)**

At the end of the course, the student will be able to

|  |  |
| --- | --- |
| **1** | Understand the fundamental concepts of plant anatomy and embryology.  |
| **2** | Analyze and recognize the different organs of plants and secondary growth.  |
| **3** | Understand water relation of plants with respect to various physiological processes |
| **4** | Classify aerobic and anaerobic respiration.  |
| **5** | Classify plant systematics and recognize the importance of herbarium and virtual herbarium. |

**Recommended Texts**

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms

(6th revised and enlarged edition).Vikas Publishing House, New Delhi.

1. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc.

Plant Morphologists, New Delhi.

1. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
2. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

**Reference books**

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and

enlarged edition). Vikas Publishing House, New Delhi.

1. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
2. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
3. [Rajni Gupta](https://www.amazon.in/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=Rajni+Gupta&search-alias=stripbooks). 2012. Plant Taxonomy: Past, Present and Future.  [Vedams (P) Ltd. New Delhi.](https://www.abebooks.com/vedams-ebooks-p-ltd-new-delhi/573945/sf%22%20%5Co%20%22Vedams%20eBooks%20%28P%29%20Ltd)
4. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
5. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand& Co., New Delhi.

**Web Resources**

1. <https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y>
2. <https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y>

##### [https://archive.org/EXPERIMENTS/plantanatomy031773mbp](https://archive.org/details/plantanatomy031773mbp)

1. <https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG>
2. <https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692>

**MappingwithProgrammeOutcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | M | S | S | S | S | L | S | S | S | S |
| **CO4** | S | S | M | S | S | S | S | M | S | M |
| **CO5** | S | M | M | M | M | M | M | L | M | M |

**S – Strong; M – Medium; L – Low**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Course Code: 23UBOTEP2****course title: Botany Practical - II** | **H/W** | **C** |
| **II** | **2** | **1** |

**Course Objectives**

1. To enhance information on the identification of taxonomical plant
2. To be familiar with the basic concepts and principles of plant systematics.
3. Understanding of reproduction and development of angiosperms
4. To understand the internal organization of Angiopserms
5. To learn about the physiological processes that underlie plant metabolism.

**EXPERIMENTS**

1. To identify Angiosperm root, stem, leaf, flowers and fruits based on morphology
2. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
3. To dissect a flower, construct floral diagram and write floral formula.
4. Demonstration experiments
	1. Ganong’s Light screen
	2. Ganong’s respiroscope
5. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
6. Spotters - Angiosperm morphology, anatomy, Embryology and Physiology

**Bonafide record of practical work done should be submitted for the practical examination**

**Course outcomes:**

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

1. Understand external structure of angiosperms
2. To study the classical taxonomy with reference to different parameters.
3. Understand the fundamental concepts of plant anatomy and embryology
4. To study the effect of various physical factors on photosynthesis.
5. Understand simple experiments in plant Physiology

**Recommended texts**

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference books**

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

**Web Resources**

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. [https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy](https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover) [mnosperms&printsec=frontcover](https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover)
3. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 2 | 3 | 1 | 3 | 2 |
| **CO2** | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 2 | 1 | 3 | 2 | 3 |
| **CO4** | 1 | 3 | 3 | 2 | 2 |
| **CO5** | 2 | 2 | 3 | 1 | 3 |

**BOTANY PRACTICAL II**

Time : 3 Hours Max. Marks : 75

**PRACTICAL QUESTION PAPER**

1. Identify the given specimens –A to its respective family, draw MLS of the flower and describe it in technical terms.

 (Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Identify the given specimen –B, to its respective family, construct the floral diagram and write the floral formula.

 (Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3. Make suitable micro preparations of the given specimens C.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons. (Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Comment on the Physiology setup – D Write the aim, materials required , Procedure, Results and Inference

( Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

4. Spotters – E, F, G, H, I, J, K and L.

(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35) \_\_\_\_\_\_\_\_\_\_\_\_

 Total = 65

 Record = 10

 \_\_\_\_\_\_\_\_\_\_\_\_

 Grand Total = 75

 \_\_\_\_\_\_\_\_\_\_\_\_

BOTANY PRACTICAL II

KEY & SCHEME OF VALUATION

1. Taxonomy - A – MLS of the flower (from any one family mentioned in the syllabus)

(Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Taxonomy - B – Floral diagram and floral formula (from any one family mentioned in the syllabus) (Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3.. Anatomy - C : Dicot and monocot – stem, root and leaf.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Physiology Set up D - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong’s light screen and Ganong’s respire scope

 ( Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

5. Spotters –E, F, G, H, I, J , and K (any seven of the following) (08)

Morphology – vegetative and reproductive morphological parts

Anatomy – simple and complex tissues, dicot, monocot root and leaf

Embryology – ovules, anther T.S.

Physiology - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong’s light screen and Ganong’s respire scope experimental setup.

(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35)

 \_\_\_\_\_\_\_\_\_\_

 Total = 65

 Record = 10

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 Grand Total = 75

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**Elective Courses offered to other Science Department in I and II Semesters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Elective – I** **COURSE CODE: 23UEVME15****COURSE TITLE: ENVIRONMENTAL ZOOLOGY – I** | **H/W** | **C** |
| **I** | **3** | **2** |

**Course Objectives**

1. To know about the distribution of animals in the universe

2. To understand the evolutionary history of animals

3. To learn about economic importance of animals

4. To understand the breeding phenomenon in fishes

5. To learn about ornamental fish culture

**UNIT - I: ZOO GEOGRAPHY**

 Animal Distribution – Definition - Classification of Animal Distribution - Patterns of Distribution - Cosmopolitan Distribution - Discontinuous Distribution - Bipolar Distribution - Isolated Distribution - With Examples - Factors Affecting Distribution - Factors Influencing Distribution.

**UNIT - II: EVOLUTION**

 Origin of Life - Theories of Evolution - Lamarck - Theory of Use and Disuse - Theory of Inheritance of Acquired Characters - Neo-Lamarckism - Darwin’s Theory of Natural Selection – Variation - Geometric Ratio of Increase in Production - Struggle for Existence - Survival of the Fittest - Sexual Selection - Neo-Darwinism.

**UNIT - III: ECONOMIC ZOOLOGY**

 Productive Insects - Honey bee Culture - Production of Honey - Economic Importance of Honey - Silkworm Culture - Production of Silk - Economic Importance of Silk, Lac Insect – Culture - Production of Lac - Economic Importance of Lac.

**UNIT - IV: INDUCED BREEDING IN FISHES**

 Hypophysation - Principles of Hypophysation - Procedure - Collection, Preparation and Injection of Pituitary extract - Mechanism of Pituitary Action - Advantages - Seed Collection - Collection from Natural Habitat - Bundh Breeding - Transport of Fish Seeds - Open System - Closed System.

**UNIT - V: ORNAMENTAL FISH CULTURE**

 Aquarium Culture - Aims of Aquarium Culture - Types of Aquariums - Requirements for Aquarium making - Setting of Aquarium - Aquarium maintenance - Aquarium Fishes - Gold Fish - Angel Fish - Fighter Fish - Koi - Molly - Sword Tail - Zebra Fish - Guppy - Fish Marketing - Definition - Marketing Channels - Types of Fish Marketing - Risk of Fish Marketing.

**Expected Course Outcomes**

After completion of this course, students will be able to gain knowledge in

 1. Animal distribution.

 2. The evolutionary significance of animal kingdom.

 3. The economic importance of animals.

 4. Breeding pattern of fishes.

 5. Ornamental fish culture.

**Textbooks**

 1. Sharma, P.D. (2018). *Fundamentals of ecology*, Rastogi publication.

 2. Arumugam N, (2001). *Organic Evolution*, Saras Publication.

 3. Ravindranath K.R. (2005). *Economic Zoology*, Dominant Publishers, New Delhi.

 4. Srinivasalu Reddy, M & Sambasivarao K.R.S, (2004). *A Text Book of Aquaculture*, Discovery Publishing House, New Delhi.

5. Pradip V Jabde (2016). *Text Book of Applied Zoology*, Discovery Publishing House, New Delhi.

**Reference Books**

1. Pillay T.V.R. (1990). Aquaculture. Principles & Practices, Black Well Publication, Oxford.

2. Jhingaran V.G. (1981). *Fish & Fisheries of India,* Hindustan Publishing Corporation.

**Supplementary reading:**

 1. [https://www.researchgate.net](https://www.researchgate.net/)

 2. [https://www.aquaculturealliance.orgs](https://www.aquaculturealliance.orgs/)

3. [https://www.iaszoology.com](https://www.iaszoology.com/)

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| --- | --- | --- | --- |
| **Semester** | **Elective – I****COURSE CODE: 23UEVMEP1****COURSE TITLE: ENVIRONMENTAL ZOOLOGY PRACTICAL–I**  | **H/W** | **C** |
| **I** | **2** | **1** |

Course Objectives

1. To identify Freshwater and Marine fishes
2. To get knowledge on identification of fish diseases
3. To know the water salinity
4. To learn the LC50 and LD50
5. To know the method of fish seed and fish transport

 Practicals

1. Identification of Cultivable Marine fishes.
2. Identification of Cultivable fresh water fishes.
3. Identification and treatment of common fish diseases.
4. Estimation of oxygen consumption in fish by Winkler’s method.
5. Estimation of salinity.
6. Estimation of LC50 and LD50 with heavy metals using fish.
7. Effect of temperature and salinity on respiration of fish.
8. Demonstration of setting up of High-Tech aquarium tank.
9. Methods and transport of seeds and breeders.
10. Visit to aquaculture farm and submission of report.

Expected Course Outcome

After the completion of this practical course , the students are able to

1. Identify Cultivable Freshwater and Marine water fishes
2. Identify and treat fish diseases
3. Know the water salinity and its impact
4. Estimate LC50 and LD50
5. Transport of fishes

Text Books

1. Sharma, P.D. (2018). *Fundamentals of ecology*, Rastogi publication.

 2. Arumugam N, (2001). *Organic Evolution*, Saras Publication.

 3. Ravindranath K.R. (2005). *Economic Zoology*, Dominant Publishers, New Delhi.

 4. Srinivasalu Reddy, M & Sambasivarao K.R.S, (2004). *A Text Book of Aquaculture*, Discovery Publishing House, New Delhi.

5. Pradip V Jabde (2016). *Text Book of Applied Zoology*, Discovery Publishing House, New Delhi.

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Elective – I****COURSE CODE: 23UEVME25****COURSE TITLE: ENVIRONMENTAL ZOOLOGY -II** | **H/W** | **C** |
| **II** | **3** | **2** |

**Course Objectives**

1. To know about the classification of animals in the universe

2. To understand the physiology of animals

3. To learn about genetics of animals

4. To understand the causes of diseases in human

5. To learn the methods of analysis of parasitic diseases.

UNIT-I

Classification of Animals - Practical, artificial, Natural system of classification - Binomi nomenclature - Modern classification of living organisms - Branches of science related to zoology- Discoverers.

UNIT-II

Physiology-definition - brief history - fields of Physiology - Branches of Physiology- embryology - Program of development - Historical thoughts - Concepts - Branches of embryology-Scope of Embryology -Branches of Genetics.

UNIT-III

Gene theories: Definition - History - Vapour theory - fluid theory - epigenic theory - particulate theory- Performation theory-Pangenic theory-germ plasm theory.

UNIT IV

Medical Microbiology: Bacterial diseases: Cholera, typhoid, tuberculosis- Viral diseases: Small pox, measles, rabies, encephalitis, AIDS

UNIT V

Methods of diagnosing Parasitic diseases:

Examination of stools: Direct examination- sedimentation technique, floatation technique, Examination of blood-thick smear and thin smear method

Bacterial examination: Gram Positive and Gram Negative staining method

**Expected Course Outcomes**

After completion of this course, students will be able to gain knowledge in

1. The classification of animals in the universe

2. The physiology of animals

3. The genetics of animals

4. The causes of diseases in human

5. The methods of analysis of parasitic diseases.

**Textbooks**

1. Jordon, E.L. and P.S Verma, (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
2. Adam Sedgwick, (1960). *A student’s text book of Zoology, Vol. I & III*, General Book Depot, Allahabad.
3. Sharma, P.D. (2018). *Fundamentals of ecology*, Rastogi publication.
4. Ravindranath K.R. (2005). *Economic Zoology*, Dominant Publishers, New Delhi.

 5. Srinivasalu Reddy, M & Sambasivarao K.R.S, (2004). *A Text Book of Aquaculture*, Discovery Publishing House, New Delhi.

6. Pradip V Jabde (2016). *Text Book of Applied Zoology*, Discovery Publishing House, New Delhi.

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Elective – I****COURSE CODE: 23UEVMEP2****COURSE TITLE: ENVIRONMENTAL ZOOLOGY PRACTICAL – II** | **H/W** | **C** |
| **II** | **2** | **1** |

**Course Objectives**

1. To learn the principles of microscope.

2. To know the method of identification of blood groups.

3. To learn the method of blood smearing

4. To identify the viral diseases

5. To know the bacterial diseases

**Practicals**

1. Compound microscope.
2. PTC test.
3. Identification of ABO Blood Group
4. Preparation of thick and thin smear of blood.
5. Examination of Blood – thick and thin smear method.
6. Bacterial Examination – gram positive and gram negative method.
7. Water borne disease – Bacterial disease – Typhoid.
8. Viral disease – Hepatitis and Rabies.
9. Gram staining of Bacteria.
10. Examination of stool.

**Expected Course Outcomes**

After the completion of this course, students will be able to

1. Know the principles of microscope.

2. Identify human blood groups.

3. Make the blood smearing

4. Identify the viral diseases

5. Understand the bacterial diseases

**Textbooks**

1. Jordon, E.L. and P.S Verma, (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
2. Adam Sedgwick, (1960). *A student’s text book of Zoology, Vol. I & III*, General Book Depot, Allahabad.
3. Sharma, P.D. (2018). *Fundamentals of ecology*, Rastogi publication.
4. Ravindranath K.R. (2005). *Economic Zoology*, Dominant Publishers, New Delhi.

 5. Srinivasalu Reddy, M & Sambasivarao K.R.S, (2004). *A Text Book of Aquaculture*, Discovery Publishing House, New Delhi.

6. Pradip V Jabde (2016). *Text Book of Applied Zoology*, Discovery Publishing House, New Delhi.

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

**Non-Major Elective Courses (NME)** to other Departments)

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| --- | --- | --- | --- |
| **Semester** | NME-I: **COURSE CODE: 23UEVMN16****COURSE TITLE:**GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT | **H/W** | **C** |
| **I** | **2** | **2** |

# Course Objectives

1. To learn about the major global environmental issues.
2. To know about global atmospheric changes like global warming.
3. To study the over exploitation of natural resources.
4. To know about global disaster like forest fire &oil spills.
5. To know about sustainable environmental management goal.

# UNIT – I: HUMAN POPULATION AND MANAGEMENT

Basic demographic concepts: Growth, fertility, mortality and migration -Population distribution and Urbanization - Poverty, food security and environmental degradation.

# UNIT – II: GLOBAL ATMOSPHERIC CHANGES

Regional and global Air Quality and CO2 emission - Air pollutants and climate change - Sources of greenhouse gases - Ozone depleting substances - Global warming - El Niño and La Niña

# UNIT – III: OVER EXPLOITATION OF NATURAL RESOURCES

Overexploitation of natural resources: Ecological footprint - Earth Overshoot Day - Water resources: Status of groundwater quality in India - Soil Resources: Global threats for soil quality - Loss of organic carbon. Biodiversity Resources: Deforestation, Biodiversity Loss.

# UNIT – IV: GOBAL DISASTER

Geological Disasters: Earthquake, Effects of earthquake; Volcanoes: Types of volcanic eruptions - Active volcanic belts in the world; Hydrological hazards: Flash flood - Flood management strategies - Oil spills - Forest fire.

# UNIT – V: SUSTAINABLE ENVIRONMENTAL ANAGEMENT

Sustainable utilization of renewable energy resources - Solar, Wind, Hydroelectric and Biomass energy resources. Sustainable agricultural practices: Biofertilizers and Biopesticides - National Action Plan on Climate Change - UNDP Sustainable Development Goals 2030 Agenda

# Expected Course Outcome

After completing this course, students will be able to gain knowledge in

1. Clearly identifying important global, national, and local issues relating to population, food, and the environment.
2. Recognizig the values of global atmospheric changes.
3. The consequences of over exploitation of natural resources.
4. The basic knowledge of global disaster.
5. Sustainable environmental management strategies.

# Text Books

1. Frances Harris (2012) Global Environmental Issues, 2nd edition, John Wiley & Sons Ltd., UK.
2. Stavros G. Poulopoulos and Vassilis J. Inglezakis (2016) Environment and Development: Basic Principles, Human Activities, and Environmental Implications. Elsevier, Netherlands.
3. John V. Walther (2014) Earth’s Natural Resources, Jones & Bartlett Learning, USA.

**Supplementary Readings:**

1. <https://www.stateofglobalair.org/sites/default/files/soga-2018-report.pdf>

2. <https://unfccc.int/>

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| --- | --- | --- | --- |
| **Semester** | NME-2 **COURSE CODE: 23UEVMN26****COURSE TITLE:** OCCUPATIONAL SAFETY, HEALTH AND MANAGEMENT | **H/W** | **C** |
| **II** | **2** | **2** |

# Course Objectives

1. To impart knowledge about Occupational hazards and deficiency diseases.

2. To learn about the health problems due to air and water pollution.

3. To study the occupational diseases and their preventive measures.

4. To learn the industrial safety standards

5. To understand the environmental management system.

# UNIT - I: OCCUPATIONAL HAZARD

Types of Occupational Hazards – Health – Definition – Need for Good Health – Factors Affecting Health – Malnutrition – Deficiency Diseases-Balanced diet-Food adulterants-Personal Hygiene.

# UNIT - II: HEALTH PROBLEMS DUE TO AIR AND WATER POLLUTION

Communicable Disease - Mode of transmission (Epidemic and Endemic diseases)-Water borne - Air borne - Food borne Diseases.

# UNIT – III: OCCUPATIONAL HEALTH HAZARDS

Physical-Chemical and Biological hazards-Occupational diseases –Silicosis-Asbestosis- Byssinosis-Hearing loss-Prevention and Control of Occupational diseases.

# UNIT – IV: INDUSTRIAL SAFETY STANDARDS

Causes of Accidents-Definition-Accident Reporting System-First aid-Frequency rate- Prevention and Control-Health education-Safety awareness.

# UNIT – V: ENVIRONMENTAL MANAGEMENT SYSTEM

ISO14000 and ISO14001-OSHA-The Public Liability Insurance Rules, 1991.

Compensation Act.

# Expected Course Outcome

After the completion of course students will able to gain knowledge in

1. The types of occupational hazards

2. The health impacts of air and water pollution.

3. Different types of health hazards.

1. The importance of industrial safety.
2. The ISO certification procedure.

# Text books

1. Scoot, R, M, 1997 concepts of industrial hygine, lewis publisher, New York.
2. Diberardins L.J., 1998. Hand Book of Occupational safety and health, john Willey,

New York.

1. Park J.E, and Park Preventive and social medicine.

# Supplementary readings

* 1. <https://dgfasli.gov.in/sites/default/files/service_file/Nat-OSH-India-Draft%281%29.pdf>
	2. [www.ehs.ucsb.edu](http://www.ehs.ucsb.edu/)
	3. <http://safety.ucanr.edu/Safety_Notes/>

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| --- | --- | --- | --- |
| **Semester** | **Core – V**: **COURSE CODE:23UEVMC33****COURSE TITLE: NATURAL RESOURCES AND MANAGEMENT** | **H/W** | **C** |
| **III** | **5** | **5** |

**Course objectives**

1. To learn about natural resources and their importance.

2. To study the forest resources and management tools.

3. To study water resources and its management.

4. To know about the soil degradation and their conservation strategies.

5. To study the world food problems and minerals resources.

**UNIT – I: INTRODUCTION TO NATURAL RESOURCES**

Natural resources- Classification- Renewable resources – Non renewable resources- Demand on natural resources - Impacts of poor natural resources management- Role of individuals in conservation of natural resources.

**UNIT – II: RESOURCE MANAGEMENT**

 Commercial, Ecological, Aesthetic benefits of forests - Dams - Uses - Impacts of dams on forest- Deforestation- Causes- Impacts - Prevention- Forest management tools: social forestry, agro forestry & urban forestry- Eco development committees - Eco tourism - Climate change reduction- Carbon trading

**UNIT – III: WATER RESOURCE MANAGEMENT**

 Water resources – Hydrological cycle- Surface water – Ground water – Over utilization of surface & ground water and their effects – Drought – Causes- Effects – Drought management - Rain water harvesting - Need – Methods of rain water harvesting – Water resource management – Coastal zone management strategies.

**UNIT – IV: LAND AND SOIL RESOURCES MANAGEMENT**

Role of agriculture practices in soil degradation – Soil erosion – Types – Causes – Effects – Prevention – Soil fertility and nutrient management – Soil conservation – methods – Green manuring – Animal manure and restoration of degraded and waste lands.

**UNIT – V: FOOD AND MINERAL RESOURCES MANAGEMENT**

 Food resources – Causes for world food problems - Impacts remedy – World food summit- Mineral resources – Types, sources, distribution and extraction of minerals – Impact of extraction of minerals on environment – Conservation strategies.

**Expected Course outcome:**

After completion of this course, students will be able to gain knowledge in

1. To knowledge the types significance of natural resources.

2. Recognize the values of forest resources.

3. Integrate the knowledge and strategies of social water conversation.

4. Analyze and recognize the importance of soil fertility & nutrient management.

5. Food and mineral resources.

**TEXT BOOKS:**

1. Jha L.K (1997) Natural resource management, APH Publishing Corporation New Delhi.

2. Alagappa Moses. A, Vasanthy M. Kumaraswamy Adeline Nikeita . A, (2021) A comprehensive text book for environmental studies new century book house (p) ltd., Chennai.

3. Sarah fehly (2011) Natural resource management oriental enterprises Dehradun, India.

**Supplementary readings:**

1. [https://www.indiagov.in](https://www.indiagov.in/) /topics environment- forest/ natural resources.

2. <https://www.forest/natural> resources

3. [https://www.greenfacts.org](https://www.greenfacts.org/)

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – VI**: **COURSE CODE: 23UEVMP34** **PRACTICAL –III****COURSE TITLE: NATURAL RESOURCES AND ENVIRONMENTAL TOXINS** | **H/W** | **C** |
| **III** | **4** | **5** |

**Practical’s**

1. Distribution of mineral resources in India.

2. Demonstration of solar energy as a renewable energy resource.

3. Rain water harvesting – demonstration.

4. Demonstration of Bio Gas plant.

5. Distribution of coal resources in India.

6. Estimation of chlorophyll ‘a’ in polluted and non-polluted leaves.

7. Estimation of Aflatoxin production.

8. Estimation of LC50 and LD50 with a heavy metal using a suitable Organism.

9. Impact of toxin on plants.

10. Biomagnifications of pesticide.

11. Biochemical effects of Mercury.

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| **Semester** | ELECTIVE - III:**COURSE CODE: 23UCHEE35****COURSE TITLE: CHEMISTRY – I** **FOR BIOLOGICAL SCIENCES** | **H/W** | **C** |
| **III** | **3** | **2** |

**Course objectives**

This course aims to providing knowledge on

* + basics of atomic orbitals, chemical bonds, hybridization
* fundamentals of organic chemistry
* nuclear chemistry and industrial chemistry
* importance of speciality drugs and
* separation and purification techniques.

**UNIT –I: Chemical Bonding and Nuclear Chemistry**

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon

dating, rock dating and medicinal applications.

**Unit – II: Industrial Chemistry**

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.

**UNIT – III: Fundamental Concepts in Organic Chemistry**

Hybridization: Orbital overlap hybridization and geometry of CH4, C2H4, C2H2 and C6H6. Polar effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft’s alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

**UNIT – IV: Drugs and Speciality Chemicals**

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

**UNIT - V: Analytical Chemistry**

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

**Expected Course outcome:**

**On completion of the course the students should be able to**

1. State the theories of chemical bonding, nuclear reactions and its applications.
2. Evaluate the efficiencies and uses of various fuels and fertilizers.
3. Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
4. Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.
5. Analyse various methods to identify an appropriate method for the separation of chemical components.

**Text Books**

**1.** V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.

2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.

3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.

4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

**Reference Books**

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.

2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | ELECTIVE - III:**COURSE CODE: 23UCHEEP-I****COURSE TITLE: CHEMISTRY – Practical - I** **FOR BIOLOGICAL SCIENCES** | **H/W** | **C** |
| **III** | **2** | **1** |

**Course objectives**

This course aims to provide knowledge on the

• basics of preparation of solutions.

• principles and practical experience of volumetric analysis.

**VOLUMETRIC ANALYSIS**

1. Estimation of sodium hydroxide using standard sodium carbonate.

2. Estimation of hydrochloric acid using standard oxalic acid.

3. Estimation of ferrous sulphate using standard Mohr's salt.

4. Estimation of oxalic acid using standard ferrous sulphate.

5. Estimation of potassium permanganate using standard sodium hydroxide.

6. Estimation of magnesium using EDTA.

7. Estimation of ferrous ion using diphenyl amine as indicator.

Reference Book

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **SKILL ENHANCEMENT COURSE – VII** **COURSE CODE:23UEVMS36****COURSE TITLE: VERMICOMPOSTING** | **H/W** | **C** |
| **III** | **1** | **1** |

**COURSE OBJECTIVES:**

1. To Maintain Vermicomposting unit in college in order to maintain eco-friendly college campus.

2. To improve the entrepreneurship development skills in students.

3. To utilize waste of campus plants and garden by using earthworms and get vermicompost as a Black Gold

4. To aware the students to use chemical free Vermicompost as an organic fertilizer for agriculture.

5. To provide own Vermicompost to college horticulture and gardens in free of cost.

**Unit I: INTRODUCTION**

Earthworm– Structures, Geographical distribution, Classification based on habitat, (i) epigeics, (ii) anecics and (iii) endogeics.

**Unit II: FACTORS RESPONSIBLE FOR EARTHWORM**

Distribution– I) Soil Acidity, ii) Soil Moisture, iii) Temperature, iv) Cycles of Activity, Burrowing, Feeding, Casting.

**Unit III: SPECIES SUITABLE FOR VERMICOMPOSTING**

Identification of earthworm species, suitable species for Vermicomposting, popular Ssecies used in India.

**Unit IV: METHODS OF VERMICOMPOSTING AND MANAGEMENT**

Pit method, Bin method, Steps of vermicomposting set up, Vermibed preparation, Management of vermiculture.

**Unit V: MARKETING VALUE OF VERMICAST**

Practical –and harvesting techniques of vermicast, Marketing of vermicompost.

**EXPECTED COURSE OUTCOME:**

After completion of the course students will be able to gain knowledge in

1. The structure of earthworm
2. The distribution of earthworm.
3. Suitable species for vermicomposting
4. Methods of vermicomposting techniques
5. Vermicast.

**TEXT BOOKS:**

1. Clive A. Edwards (2004). Earthworm ecology. Taylor and Francis.
2. Ganesh kumar**,**T**.**(2013). Sustainable vermicomposting of Salviniamolesta, Mitchell Lambert Academic Publishing House Germany.
3. Ganesh kumar, T. (2015). Utilization of two of the worlds worst weeds Salviniamolesta Mitchell and Lantana camara Linnaeus by vermicomposting,

**Reference Books**

1. Gajalakshmi, S. and Abbasi, S.A. (2004). Earthworms and vermicomposting. Indian Journal of Biotechnology,3:486-494.

2. Ganesh kumar, T., (2014). Vermicomposting of the pernicious weed Salviniamolesta, Mitchell. Lambert Academic Publishing HouseGermany.

3. Ganeshkumar, T., Gajalakshmi, S., and SA Abbasi (2014). A new process for the rapid and direct vermicomposting of the aquatic weed Salvinia (*Salviniamolest*a). Bioresources and Bioprocessing, 2014, 1:26.

**SUPPLEMENTARY READINGS**

1. <http://hdl.handle.net/10603/284437>, 2015.

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 2 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **SKILL ENHANCEMENT COURSE –SEC-V** **COURSE CODE: 23UEVMS37****COURSE TITLE: ENVIRONMENTAL TOXICOLOGY** | **H/W** | **C** |
| **III** | **2** | **2** |

**Course Objectives:**

1. To focus on understanding the role of pollutants,

2. To know the presence of Xenobiotics in the natural environment

3. To understand the basics of environmental toxicology

4. To know about the risk assessment.

5. To learn about the Pesticide toxicity.

**UNIT - I: BASICS OF TOXICOLOGY**

Introduction to toxicology, scope and types - Classification of toxic agents. Routes of exposure, duration and frequency of exposure, Dose response relationship - LC50, LD50.

**UNIT - II: TOXICITY**

Acute toxicity - Chronic toxicity - Toxicants - Toxicokinetics and Toxicodynamics -Applications of toxicology - Toxicity of chromium - Cadmium and Arsenic.

**Unit - III: ENVIRONMENTAL RISK ASSESSMENT**

Environmental Risk - Definition, Risk Characterization - Hazard Identification, Exposure Assessment Methods, Risk Assessment - National and International guidelines. Environmental Risk - Mitigation measures.

**UNIT - IV: XENOBIOTICS**

Xenobiotics - Bioaccumulation and Biomagnifications - mechanisms of toxicity. - food toxicity, genotoxicity, Molecular neurotoxicity.

**UNIT - V: PESTICIDE TOXICOLOGY**

Bioaccumulation and Biomagnifications of toxic materials in food chain, Types, mechanism and Toxicology of major pesticides - Environmental impacts of pesticides, biotransformation, biomonitoring, concept of bioindicator groups and examples.

**Expected Course Outcomes:**

After completion of the course the students will able to gain knowledge in

1. The types of toxicants in the environment.

2. Various fields of toxicology.

3. The values of xenobiotics.

4. Risk assessment.

5. Pesticide toxicity.

**Textbooks**

1. Alberts, B., Bray, D., Hopkin, K. et al. (2009). *Essential Cell Biology*, 3rd edition,

2. Buchanan, B.B., Gruissem, W. and Jones, R.L. (2002). *Biochemistry and Molecular Biology of Plants*, ASPB, USA.

3. David L. Nelson, and Michael M. Cox (2004). *Lehninger Principles of Biochemistry* (1970) by Albert L. Lehninger Published April 23rd 2004 by W. H. Freeman (first published).

**Supplementary readings:**

1. <https://dgfasli.gov.in/sites/default/files/service_file/Nat-OSH-India-Draft%281%29.pdf>

1. [www.ehs.ucsb.edu](http://www.ehs.ucsb.edu/)
2. <http://safety.ucanr.edu/Safety_Notes/>

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – VII**: **COURSE CODE:23UEVMC43****COURSE TITLE: ENVIRONMENTAL POLLUTION AND CONTROL MEASURES** | **H/W** | **C** |
| **IV** | **5** | **5** |

**Course objectives**

1. To study the sources and effects of air pollution.

2. To know about the water pollution impacts and treatment of waste water.

3. To understand the hazards of plastic pollution and preventive measures.

4. To acquire knowledge of Noise pollution , rules and regulations.

5. To understand various forms of soil and radioactive pollution.

**UNIT - I: AIR POLLUTION**

 Natural and anthropogenic sources of air pollution - Primary pollutants – Hydrocarbons, CO, SO2, lead, aerosols - Secondary pollutants - PAN & Ozone. Effects of air pollution- Acid rain - Green House effect - Global warming - Ozone depletion - Air pollution control and management.

**UNIT - II: WATER POLLUTION**

 Physical, chemical biological characteristics of waste water – Sources and Effects of water pollution – Water borne diseases – Eutrophication - Wastewater treatment - primary - Secondary – Tertiary treatment - Pollution in river Ganga – River cleaning - Namami Gange programme.

**UNIT - III: PLASTIC POLLUTION**

Definition - Categories of plastics - Roots of plastic pollution - Plastic poisoning the Earth - Effects – Hazards of plastics on Marine environment - Havoc of plastic on Human life -Control measures - Ecofriendly biodegradable Green alternatives of plastics - Legislative control of plastic pollution.

**UNIT – IV: NOISE POLLUTION**

 Natural and man-made- Sources of noise pollution – Types of noise - Transport noise - Industrial noise - Domestic noise - Effects of noise pollution on human health - Noise exposure levels and standards - Prevention and control measures-Noise pollution rules and regulations 2000 .

**UNIT - V: SOIL AND RADIOACTIVE POLLUTION**

Soil pollution - Biodegradable - Non biodegradable - Causes of soil pollution- Pesticides in soil environment - Biomagnification - Effects of soil pollution - Soil degradation - Soil conservation - Radioactive pollution - Sources - Impacts of radiation on environment - Nuclear explosion episode - Chernobyl disaster - Hiroshima and Nagasaki.

**Expected Course outcome:**

After the completion of this course the students will be able to gain knowledge in

1. Categorize various forms of pollution.

2. Analyzing the impact of water pollution and explain the waste water treatment process.

3. Recognise the Sources, types of plastic pollution , its havoc of plastic pollution and green alternatives.

4. Noise pollution Rules and regulations.

5. Inspect the various sources and effects of soil and radioactive pollution.

**Text books.**

1. Rao MN and Rao HVN, Air pollution (1989) Tata Mc graw hill publishing co.Ltd , New Delhi.

2. Sharma Bk and kaur H soil and noise pollution (1994) Goel publishing house meerut.

3. Kannan K. Fundamentals of environmental pollution S. Chand and co delhi 1991.

**Supplementary readings**

**1.** [https://www.nrdc.org](https://www.nrdc.org/)

2. [https://www.hsph.hardvard.edu](https://www.hsph.hardvard.edu/)

3.. [https://www.downtpearth.org](https://www.downtpearth.org/)

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 2 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – VIII**: **COURSE CODE:23UEVMP44****COURSE TITLE: PRACTICAL – IV: POLLUTION MANAGEMENT AND WASTE RECYCLING** | **H/W** | **C** |
| **IV** | **3** | **5** |

Practical’s

1. Estimation of Dissolved Oxygen
2. Estimation of Chloride
3. Estimation of Phosphate.
4. Estimation of Turbidity.
5. Estimation of pH.
6. Pollution Indicators.
7. Identification of different types of solid wastes.
8. Segregation of municipal waste.
9. Demonstration of waste collection methods.
10. Demonstration of waste disposal – landfills.
11. Demonstration of waste recycling methods.
12. Preparation of vermin compost kitchen waste.

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| **Semester** | ELECTIVE - IV:**COURSE CODE: 23UCHEE45****COURSE TITLE: CHEMISTRY – II** **FOR BIOLOGICAL SCIENCES** | **H/W** | **C** |
| **IV** | **3** | **2** |

**Course objectives**

This course aims to providing knowledge on

This course aims to provide knowledge on

• nomenclature of coordination compounds and carbohydrates.

• Amino Acids and Essential elements of biosystem

• understand the concepts of kinetics and catalysis

• provide fundamentals of electrochemistry and photochemistry

**UNIT - I: Co-ordination Chemistry and Water Technology**

Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner’stheory - EAN rule - Pauling’s theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques – BOD and COD.

**Unit - II: Carbohydrates**

Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.

**UNIT - III: Amino Acids and Essential elements of biosystem**

Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

**UNIT – IV: Electrochemistry**

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome

plating – Types of cells -fuel cells-corrosion and its prevention.

**UNIT- V: Photochemistry**

Grothus - Drapper’s law and Stark-Einstein’s law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and

photosensitization and photosynthesis (definition with examples).

**Expected Course outcome:**

On completion of the course the students should be able to

1. Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.
2. Explain the preparation and property of carbohydrate.
3. Enlighten the biological role of transition metals, amino acids and nucleic acids.
4. Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
5. Outline the various type of photochemical process.

**Text Books**

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.

2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.

3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.

4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

**Reference Books**

1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.

2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.

4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

#### Outcome Mapping

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 2 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | ELECTIVE - IV:**COURSE CODE: 23UCHEEP-II****COURSE TITLE: CHEMISTRY – Practical - II** **FOR BIOLOGICAL SCIENCES** | **H/W** | **C** |
| **IV** | **2** | **1** |

**Course Objectives**

This course aims to provide knowledge on

• identification of organic functional groups

• different types of organic compounds with respect to their properties.

• determination of elements in organic compounds.

**SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS**

The analysis must be carried out as follows:

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].

(b) Detection of elements (N, S, Halogens).

(c) To distinguish between aliphatic and aromatic compounds.

(d) To distinguish – Saturated and unsaturated compounds.

**Reference Book**

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

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| **Semester** | **SKILL ENHANCEMENT COURSE – VI** **COURSE CODE:23UEVMS46****COURSE TITLE: REMOTE SENSING AND GIS** | **H/W** | **C** |
| **IV** | **2** | **2** |

**Course Objectives**

1. To know about the remote sensing process

2. To facilitate to gain the basic knowledge of distantly sensing devises.

3. To give insight on mapping technology

4. To grasp the basic principles and applications of RS &GIS

5. To gain knowledge image processing.

**UNIT - I: INTRODUCTION TO REMOTE SENSING**

Key concepts and components of Remote sensing (RS), electromagnetic radiation, spectrum and divisions, image characteristics, RS system - Aerial photography - Types - Geometry of aerial photographs.

**UNIT - II: DIGITAL DATA AND IMAGE PROCESSING**

Digital Data, data formats, image structure, processing overview, components, and software, image interpretation mage resolution: variables, operating conditions, measurement of resolution.

**UNIT - III: SATELLITE REMOTE SENSING**

Landsat - SPOT - Indian remote sensing satellite - ERS - 1 - JERS - 1 Radasat - 1 - Satellite data products.

**UNIT - IV: GEOGRAPHIC INFORMATION SYSTEM(GIS)**

Basics of GIS, terminologies, concepts and components for GIS,GIS software, data and data entry, spatial query, buffer analysis Mobile GIS - GIS applications.

**UNIT - V: APPLIACTION OF RS**

Forestry - Agriculture - Water resources - Geology and Mineral resources - Monitering of environmental hazards.

**Course Outcomes**

After completion of the course student will able to gain knowledge in

1. Interpreting the remotedly sensed images

2. Basic knowledge of how can RS &GIS be used for environmental management.

3. The values of remote sensing applications.

4. The importance of GIS.

5. The benefits of remote sensing.

**Textbooks**

1. Lillesand ,T.M. and Kiefer, R.W.(2015). *Remote Sensing and Image Interpretation* (7th ed.), John Wiley & Sons New York.

2. Kumar,S. (2016). *Basics of Remote Sensing and GIS*. Laxmi Publications (P)Ltd.

3. Chandra, A. M. and Ghosh, S. K. (2016). *Remote Sensing and Geographic Information*, (2nd ed.), Himalaya Publishing House.

**Reference Books**

* + - 1. Longley, P.A. Goodchild, M.F., Manguire,D.J., and Rhino, D.W.(eds). (2005) *Geographical Information System, Volume I: Principal and Technical Issues*, (2nd ed.), John Wiley & Sons.
			2. Richards, J. A. & Jia, X. 1999. *Remote Sensing and Digital Image Processing*. Springer.

**Supplementary Readings:**

<https://dayinterpreting.com/?gclid=EAIaIQobChMI1MSCodKo6AIV2BwrCh3OQAOBEAAYAyAAEgLEC_D_BwE>.

2 .<http://rsgislearn.blogspot.com/2007/06/digitization-basics-and-right-methods.html>

3.<https://www.geospatialworld.net/>

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **SKILL ENHANCEMENT COURSE – VII** **COURSE CODE:** **23UEVMS47****COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY**  | **H/W** | **C** |
| **IV** | **2** | **2** |

**COURSE OBJECTIVES:**

1. To impart knowledge about microorganism and their discovery.
2. To understand the structure of microbes and their reproduction.
3. To learn about the role of microorganism in industry.
4. To study the existence and the role of microorganisms and their interaction with the biogeochemical cycles.
5. To Study the role of microbes in food and sanitation.

**Unit – I: INTRODUCTION TO MICROBIOLOGY**

 History and discovery of microorganisms. – Louise Pasteur’s contribution and Discoveries and Koch Postulates – Immunity- various types – chemotherapy- mode of action of chemotherapeutic agents.

**Unit – II: STRUCTURE OF MICROBES**

 Prokaryotic and eukaryotic cells, structure of bacteria – structure- external to cell wall and internal to cell wall, virus Growth and reproduction of Bacteria and Virus, Bacteriophage.

**Unit – III: MICROBES- CULTIVATION AND ROLE IN INDUSTRY**

 Sterilization- Physical and Chemical methods. Culture techniques. – Types of Media, Microorganisms in industry- Production of lactic acid. Amino Acid, Alcohol fermentation, Penicillin production.

**Unit – IV: MICROBES and BIOGEOCHEMICAL CYCLE**

 Microorganisms in soil, air and water- Rhizosphere and non-rhizosphere microorganisms- role of microorganism in carbon, nitrogen and sulphur cycle.

**Unit – V: FOOD MICROBIOLOGY**

 Microorganisms in food: milk, fruits, egg and fish- principles of food spoilage and food preservation, microorganisms in sanitation.

**Course Outcomes**

After completion of this course, students will be able to gain knowledge in

1. The history and contribution of microbes.
2. The structure and reproduction of microbes.
3. The production of Various Acid and culture of media.
4. The role of microbes in carbon, sulphur and nitrogen cycle.
5. Developing microbial interaction in soil and food preservation.

**Textbooks**

1. Micheal J. Pelczar, J.R., E.C.S. Chan and Noel R. Krieg (1993).Microbiology, Tata McGraw Hill Edition, New Delhi.
2. Alexander, M. (1961). Introduction to Soil Microbiology. John Wiley and sons, Inc., New Delhi.
3. James M. Jay, Martin J. Loessner, and David A. Golden (2005). Modern food Microbiology, (7th ed.). CBS publishers.
4. Sharma,P.D. (2005). EnvironmentalMicrobiology,AlphaScienceInternational, Ltd.
5. Dubey, R,C. and D.K. Maheshwari, (2013). A Textbook of Microbiology, (5th ed.) S. Chand and Co., New Delhi.
6. Mohapatra, P. K. (2013). Textbook of EnvironmentalMicrobiology, IK International PublishingHouse Limited.

**Reference Books**

1. Subba Rao, N. S. (2004). Soil Microbiology. 4th Edition, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
2. Subba Rao, N. S. (1995).Biofertilizers in Agriculture and Forestry. 3rd Edition, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
3. Singh, D. P. and S. K. Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.
4. Brock, T.D., Madigan, M.T., Martinko, J.M. and Parker, J. (1994).Biology of Microorganisms, (7th ed.), Prentice-Hall, USA.
5. Ronald M. Atlas, and Richard Bartha, (1997). Microbial Ecology, (4th ed.), Benjamin Cummings Publishing Company, USA.

**Supplementary** **Reading**

1. <https://microbenotes.com/category/environmental-microbiology/>
2. <https://microbewiki.kenyon.edu/index.php/MicrobeWiki>
3. <https://www.onlinebiologynotes.com/sewage-treatment-process-of-wastewatertreatment/>

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 2 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – IX: COURSE CODE:23UEVMC51****COURSE TITLE: ENVIRONMENTAL SAFETY, HEALTH AND MANAGEMENT** | **H/W** | **C** |
| **V** | **5** | **4** |

**Course Objectives**

1. To know the concept and importance of environmental safety and health

2. To study and understand about communicable diseases

3. To understand the occupational diseases and their causes

4. To know the safety measures to be taken at occupation sites

5. To impart knowledge in environmental management system

**UNIT – I: ENVIRONMENTAL HEALTH**

Environmental Health- Concept and Scope - Need for good health - Factors affecting health – Malnutrition - Deficiency diseases – Kwashiorkor - Marasmus - Balanced diet - Food adulterants.

**UNIT – II: PUBLIC HEALTH**

Public Health - Communicable diseases - Mode of transmission (Epidemic and Endemic diseases) Bacterial diseases - Tuberculosis - Typhoid- Filariasis -Viral diseases - Hepatitis - AIDS - Rabies - Waterborne and Airborne diseases.

**UNIT – III: OCCUPATIONAL HAZARDS**

Occupational Health Hazard - Concepts and Scope - Occupational Hazard - Physical- Chemical and Biological hazards - Occupational Diseases - Pneumoconiosis - Silicosis - Anthracosis - Byssinosis - Farmer’s lungs - Lead poisoning-Skin Diseases - Prevention and Control of Occupational Diseases.

**UNIT – IV: OCCUPATIONAL SAFETY**

Industrial Safety and Management Techniques - Accidents - Causes - First aid - Prevention and Control - Risk analysis , assessment and Management- Health education - Safety Measures in Industry.

**UNIT – V: ENVIRONMENT MANAGEMENT SYSTEM**

Environment Management System (EMS) - ISO 14000 and ISO 14001 - Compensation Act - Public Liability Insurance Act - Health Organization - NIOH (National Institute of Occupational Health) WTO (World Trade Organization) OSHA (Occupational Safety and Health Administration) - Standards.

**Expected Course Outcome**

After completion of the course the students will able to gain knowledge in

1. The concept and scope of Environmental Health.

2. Different types of public health issues.

3. Occupational health hazards, and take steps to control measures.

4. The suitable safety measures to prevent industrial occupational hazards.

5. Utilize the environmental management system.

**Text Books**

1. Shaw, J. Chadwick (1998) Principles of Environmental Toxicology, Taylor& Francis Ltd.

2. Annalee Yassi, Tord Kjellstr"om, Theo de Kok, Tee Guidotti (2001). Basic Environmental Health, Oxford University Press.

3. Gurjar, B.R., Molina, L.T., Ojha C.S.P. (2010). Air Pollution: Health and Environmental Impacts. CRC Press, Taylor & Francis.

**Supplementary readings:**

1. <https://dgfasli.gov.in/sites/default/files/service_file/Nat-OSH-India-Draft%281%29.pdf>

2. [www.ehs.ucsb.edu](http://www.ehs.ucsb.edu/)

3. http://safety.ucanr.edu/Safety\_Notes/

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – X: COURSE CODE:23UEVMC52****COURSE TITLE: COMPUTERS IN ENVIRONMENT** | **H/W** | **C** |
| **V** | **5** | **4** |

**Course Objectives :**

1. To provide fundamental knowledge about data and the ways of collecting and representing data.
2. To Provides the knowledge of condensing the data by means of a single figure and Discuss how the different observations scatter about an average
3. To Provide hands-on use of Microsoft Excel
4. To Provides basic introduction to HTML
5. To impart knowledge on application of computers in Environmental Science

**UNIT - I: Collection of Data**

Data - methods of Collection - primary data, secondary data - Classification of data - Tabulation - types of tables. Diagrammatic and graphical representation of data - One dimensional Diagrams, Two dimensional Diagrams, Three dimensional Diagrams, Pictograms and cartograms, Graphs - histogram, frequency polygon, smoothed frequency curve and olives.

**UNIT - II: Measures of central tendency and dispersion**

Measures of central tendency - Calculation of Mean - Arithmetic Mean, Geometric Mean, Harmonic mean, Median and Mode. Measures of dispersion - range, Interquartile range, Mean deviation, Standard deviation

**UNIT - III: MS Excel**

Introduction to MS Excel - Building a work sheet, formatting cells - rows - columns - functions in Excel - statistical measures in Excel - Conditional Formatting - Data Sorting and Filtering in Excel - Pivot Tables - Chart Templates

**UNIT - IV : HTML Basics**

Introduction to HTML - Advantages - HTML Components - Header section - Body Section - BG Color, color, Text, Link colors, Comment lines - Working with text - Images - Ordered and unordered lists - nested list - tables - frames - URL - Fundamental tags of HTML.

**UNIT - V : Application of Computers in Environmental Science**

Environmental information system - Methods in EIS - Applications of Computer in Environmental Science - Role of programming in Environmental Science.

**Expected Course Outcome:**

After completion of this course, students will be able to gain knowledge in

1. What is data and the methods of collecting and classifying data

2. Calculating Mean, Median, mode, Range, Mean deviation and standard deviation for any type of distribution.

3. Solving statistical problems with MS Excel.

4. Creating simple web pages by using HTML tags.

5. The applications of computer in Environmental Science.

**Textbooks**

1. Palanisamy. M. (1989). *A Text book of statistics*, Paramount publication, Palani.

2. Vittal, R.R. (1986). *Business Mathematics and Statistics*, Murugan Publications.

3. Sanjay saxena (2003). A First Course in computers, Vikas publishing house Pvt.

Ltd, New Delhi.

**Reference Books**

1. Arumugam. N. (2015). *Basic concepts of Biostatistics*, Saras Publication.

2. Gurumani. N. (2010). *An Introduction to Biostatistics*, M. J. Publishers.

3. Zar, J. H. (1998). *Biostatistical Analysis*. Prentice Hall, N.J.

**Supplementary Readings:**

1. www.stat.cmu.edu/~brian/701/notes/paper-structure.pdf

2. www.cengage.com/resource\_uploads/downloads/1133629601\_397200.pdf

3. <https://www.scribd.com/document/.../Statistical-Analysis-of-Data-with-report-writing>

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – XI: COURSE CODE:23UEVMC53****COURSE TITLE: SOLID WASTE MANAGEMENT** | **H/W** | **C** |
| **V** | **5** | **4** |

**Course Objectives**

1. To learn about different types of solid wastes

2. To impart knowledge about collection and disposal

3. To learn the processes of treatment and recycling

4. To study about the hazardous waste management

5. To learn about biomedical waste and handling.

**UNIT – 1: INTRODUCTION**

Definition of Solid Waste - Types and sources of solid waste - Domestic, Municipal, Agricultural, Industrial, and Mining - Physico-Chemical Characteristics of Solid Waste - Solid Waste Generation - Problem and Impact of Municipal Solid Waste - Methane Gas Emission due to MSW.

**UNIT – II: DISPOSAL OF SOLID WASTE**

Disposal of Solid Waste – Collection- Process of Collection - Segregation of Waste - The Role of Rag Pickers - Biodegradable - Non- biodegradable - Reusable - Recyclable- Non-Recyclable-Combustible- Noncombustible-Hazardous.

**UNIT – III: SOLID WASTE PROCESSING**

 Solid Waste Processing Technologies - Open Dumping - Incineration - Types of Incinerators – Waste to Energy - Sewage Sludge Onsite Incinerators – Pyrolysis - Landfill-Landfill Regulation-Emission, Leachate and Monitoring - Composting-Aerobic Composting - Anaerobic Composting – Vermicomposting – Solid waste rule (2016).

**UNIT – IV: HAZARDOUS WASTE**

 ` Hazardous Waste- Definition- Waste Dumping Site, Storage, Transport - Handling of Wastes- grant of authorization for handling hazardous waste – Packing, Labelling and Transport, Disposal site - Import and Export of Hazardous Waste- Hazardous Waste (management and handling) Rule 2016.

 **UNIT – V: BIOMEDICAL WASTE**

Biomedical Waste: Definition - Collection, Packing, Transportation and Storage - Categories of Biomedical waste - Colour Coding and Types of Containers for Disposal of Biomedical Waste (Management and Handling) Rule 2020.

**Expected Course Outcome**

After completion of this course, students will be able to gain knowledge in

1. Different types of solid wastes.

2. Waste collection, transport and the proper disposal methods.

3. Various waste recycling methods.

4. To distinguish hazardous wastes.

5. Biomedical waste handling techniques.

**Text Books**

1. Asnani, P.U.2006. Solid waste management. India Infrastructure Report 570.

2. Bagchi, A .2004. Design of landfills and Integrated solid waste management. JOHN WILY & Sons.

3. N. Arumugam, V. Kumaresan, Applied Plant Biotechnology. 2016, saras Publication, Nagarcoil.

**Supplementary Reading**

1. <http://mohua.gov.in/>

2. [https://globalrec.org](https://globalrec.org/)

3. http://www.hp.gov.in/

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester: V** | **23UEVMD54****PROJECT WITH VIVA-VOCE** | **H/W** | **C** |
| **Core – XII** | **5** | **4** |

**(Refer to the Regulations)**

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| **Semester** | **ELECTIVE COURSE – V** **COURSE CODE: 23UEVME55****COURSE TITLE: FOREST CONSERVATION AND MANAGEMENT** | **H/W** | **C** |
| **V** | **4** | **3** |

**COURSE OBJECTIVES**

1. To impart knowledge about the various types of forest.

2. To understand the importance of sacred Groves.

3. To learn about the various forest movement to protect the forest.

4. Study the Existence of social Forestry and its role in conserving the forest.

5. To learn about the conservation forest and the laws concerned.

**Unit - 1: FOREST TYPES**

 Forest - types - moist deciduous. - Dry Deciduous, Evergreen, semi green - Grassland - Thorny Forest, mangrove forest - Utilization of forest products - Timber, Firewood, Fodder and Medicinal plants.

**Unit - II: SACRED GROVES AND CONSERVATION**

Sacred Groves: Values - sacred grooves in Tamil Nadu - shrines of symbols - character of deities - Festivals - believes - taboos associated with the sacred grooves- keystone species - ethical dilemma in sacred groups - conservation.

**Unit - III: FOREST MOVEMENT**

Forest movement and people’s participation - Tribal Community symbiotic relationship between Tribal and Forest, Community participation - Chipko movement, Apiko movement. India’s bishnoi community and their conservation practices.

**Unit - IV: AFFORESTRY**

Social forestry, Afforestation, Ecological Significance of Forests , Plant Indicators, Forests as carbon sinks.

**Unit - V: FOREST CONSERVATION**

 Forest conservation - Protection from fire, Prevention of fire, Protection from wild animals - Raise of awareness, through tourism, Role of Government in forest conservation, Forest Conservation Act 1980.

**Expected Course Outcomes**

After completion of this course, students will be able to gain knowledge in

1. The various types of forest and its economic value.

2. The values of sacred grooves in conserving the forest.

3. The various people's movement to protect the forest.

4. The importance of social forestry.

5. The conservation of forest and the Forest Conservation Act 1980.

**Textbooks**

1. Kormondy, E.J. (2005). *Concept of Ecology*. Prentice hall of India Pvt Ltd. New Delhi.

2. Calrke, G.L (1954). *Elements ecology*. John Wiley and sons, New York.

**Reference Books**

1. Champman, R.N. (1928). *The quantitative analysis of environmental factors,* Ecology, Vol. 9 (2) :111-122.

2. Champion, H.G. and S.K.Seth, (2005). A revised survey of the forest types of India, Manager of publicatios, New Delhi.

3. Karthikeyan, S. and A.C. Thangavelou (2011). *Journey through Sacred Grooves*. Bio- Science Research Foundation, Pondicherry, India.

**Supplementary Reading**

1. [www.google.com/conservation\_of\_forest.html](http://www.google.com/conservation_of_forest.html).

2. [www.edugreen.teri.res.in/explore/forestry/groves.html](http://www.edugreen.teri.res.in/explore/forestry/groves.html)

3. [www.nature.org](http://www.nature.org/)

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **ELECTIVE COURSE – VI** **COURSE CODE: 23UEVME56****COURSE TITLE:** **CONSERVATION BIOLOGY AND MANAGEMENT** | **H/W** | **C** |
| **V** | **4** | **3** |

**Course objectives:**

1. To understand the concept, types, values and threats of biodiversity.

2. To know the In-situ conservation methods.

3. To understand the Ex-situ conservation strategies of biodiversity.

4. To learn about wildlife protection act 1972 and IUCN.

5. To propose measures for conservation.

**UNIT – I BIODIVERSITY**

Definition - Types of Bio-diversity - Genetic diversity - Species diversity - Ecosystem diversity - Values of biodiversity – Consumptive, productive, social, scientific, religious, recreational, ethical and aesthetic values - Hot spots of biodiversity- Threats to biodiversity- habitat loss - over exploitation - Poaching – Fire – Deforestation- Pollution - Illegal trade.

**UNIT – II BIODIVERSITY CONSERVATION**

Insitu conservation - Wildlife sanctuaries - Mudumalai - KMTR - Kalakad Mundanthurai Tiger reserve - Point calimere Bird santuary - Vedanthangal - National parks - Guindy- Silent valley –Kaziranga- Biosphere reserves- Nilgiri - Gulf of Mannar.

**UNIT – III EXSITU CONSERVATION**

Botanical gardens - Zoological park- Gene Bank-Seed Bank- Arboreta – Germplasm Bank - Ova Bank - Semen bank - Project for conservation- Project Tiger- Project crocodile- Project Elephant-Project Turtle.

**UNIT – IV WILDLIFE PROTECTION ACT 1972**

Wildlife protection amendment act 2002- Forest management – Afforestation -social forestry - Chipko movement - IUCN threatened Species- Red Data Book - Endangered- endemic- Extinct - biodiversity act 2002.

**UNIT-V**

**ROLE OF GOVERNMENT AND NON-GOVERNMENTAL ORGANIZATION**

In conservation of biodiversity - MOEF & CC Ministry of Environment Forest and Climate Change - BNHS - Bombay Natural History and Society - IUCN International Union for Conservation of Nature and Natural Resources - WWF - World Wide Fund for nature – CITES - Convention on International Trade in Endangered Species of Flora and fauna - Role of Media in Conservation of Biodiversity

**Course outcome:**

After completion of this course, students will be able to gain knowledge in

1. Recognize the values of biodiversity.

2. Explain the In-situ conservation strategies.

3. Specify the Ex situ conservation methods.

4. Relate the laws pertainting to conservation.

5. The role of government and non-governmental organizations in conservation of biodiversity.

**Text books:**

1. Krishnamoorthy ,KV, An advanced textbook of biodiversity principles and practices (2004) Oxford and IBH.Publ. Co., New delhi.

2. Odum, EP, Fundamentals of ecology 1971. WB Soundere co. Philadelphia and London.

3. Melchiar G. Biodiversity and conservation.(2001) Oxford IBH New Delhi.

**Supplementary readings:**

1. <https://www.worldwildlife.org>
2. <https://www.nationalgeographic.org>
3. <https://www.sciencedirect.co>.

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 2 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **SEMESTER V** | **23UEVMI58****SUMMER INTERNSHIP** | **H/W** | **C** |
| **PART IV** | **-** | **2** |

**(Refer to the Regulations)**

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| **Semester** | **Core – XIII: COURSE CODE: 23UEVMC61****COURSE TITLE:** **ENVIRONMENTAL IMPACT ANALYSIS** | **H/W** | **C** |
| **VI** | **6** | **4** |

**Course Objectives:**

1. To impart knowledge about Environmental Impact Assessment

2. To identify methods and parameters to be included to EIA

3. To learn about the methods and steps involved in EIA

4. To report the EIA study report and post EIN management system

5. To access the case studies of major developmental projects

**UNIT- I: INTRODUCTION TO EIA**

EIA - Introduction - Concept of EIA- Scope and objectives of EIA - EMP - Historical perspectives of EIA - Organization responsible for EIA - Pre-project analysis - Site selection and Area classification - Sitting and Setting Criteria for EIA Projects.

**UNIT- II: EIA ASSESSMENT PARAMETERS**

Environmental Indicators - Abiotic and Biotic factors - Socio and Economic aspects -

Environmental quality - Air, Water, Soil, Flora and Fauna - Field survey and data

Collection - Environmental auditing.

**UNIT - III: EIA METHODLOGIES**

Various Steps of EIA - Content of EIA - Analytical and Integrated Approach Assessment Methodology - Adhoc, Overlay Network, Matrix and Checklist - Environmental Values and Technique - Cost benefit Analysis - Environmental Clearance.

**UNIT- IV: ENVIRONMENTAL IMPACT STATEMENT**

Environmental Impact Statement (EIS) and Environmental Management Plan (EMP)

Environmental Management System Standards (ISO14000 series). EIA Notification, 2006 and 2020 amendments. Eco-labeling schemes.

**UNIT- V EIA CASE STUDIES**

Case Studies for Major Developmental Projects: Hydro-electric and Thermal Power Plants, Mining, Highway Roads, Airport, Cement Industries.

**Course outcome**

After completion of this course, students will be able to gain knowledge in

1. The importance and principles of EIA processes.

2. The parameter to be evaluated in EIA.

3. The methods of EIA .

4. The EIA report and appropriate environmental management plan.

5. Analyze EIA cases studies.

**Textbooks**

1. EIA Manual (2001). *Ministry of Environment, Forest and Climate Change,* New Delhi.

2. Barthwal, R.R. (2012). *Environmental Impact Assessment*, New Age International

Publishers.

3. Khandeshwar, S.R.,Raman,N.S. and Gajbhiye,A.R. (2019). *Environmental Impact*

*Assessment*, I.K.International Publishing House Pvt.

**Supplementary reading**

1. <http://environmentclearance.nic.in/>

2. http://environmentclearance.nic.in/writereaddata/Draft\_EIA\_2020

3. http://www.moef.nic.in/division/eia-manual

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – XIV: COURSE CODE: 23UEVMC62****COURSE TITLE: NATURAL HAZARD AND DISASTER MANAGEMENT** | **H/W** | **C** |
| **VI** | **6** | **4** |

**Course objectives**

1. To learn about hazard.

2. To impart knowledge of natural hazard.

3. To learn the impact of anthropogenic hazard.

4. To study about emergency management of disaster.

5. To learn about medical management of hazard.

**UNIT-1: HAZARD**

Definition of Hazard, Natural. Technological hazard - concept of risk and vulnerability- Reason for vulnerability - rapid population growth- urban expansion, environmental pollution- Epidemics, industrial accidents- two components of risk: Likelihood and consequences, qualitative likelihood measurement index (LMI)- categories of (direct losses, indirect losses, tangible losses and intangible losses) - application of Geo informatics in hazard risk and vulnerability assessment.

**UNIT-2: NATURAL HAZARD**

Natural hazard- types of natural hazard- hydrological-Atmospheric- geological hazard- earthquake- causes, impacts on environment- control measures- tsunami- cyclones- landslides- causes., impact on environment. -Preventive measures

**UNIT-3: ANTHROPOGENIC HAZARD**

Anthropogenic hazard. Impact of anthropogenic activities- Rapid Urbanization –injudious ground water extraction-. sand Mining from riverbank. - Deforestation- Mangroves destruction- Warfare- Chemical weapons- biological weapons- Major accident from industries. - eg:bhopal disaster- Iov canal disaster-London smog.

**UNIT-4: EMERGENCY MANAGENMENT OF DISASTER**

Emergency Management of disaster. - Phases and professional activities- mitigation. - Preparedness- response- recovery- phase- personal activity. - mitigation. - structural mitigation- nonstructural mitigation- preparedness- response- recovery as a profession- immediate steps to be taken after a disaster.

**UNIT-5: MEDICAL MANAGEMENT OF DISASTER**

Medical management of disaster- disaster impact and response- Identification of dead.-Search rescue- first aid- relief phase- vaccination, basic sanitation and personal hygiene- environmental disaster assessment, planning, resettlement, rehabilitation. Role of NGOs, NGOs, (relief camp, psychotherapy. - simplified yoga and meditation stress management).

**Expected Course Outcome**

After completion of this course, students will be able to gain knowledge in

1. Vulnerability, risk and hazard.

2. The different types of Natural Disasters.

3. Anthropogenic hazard & its impact on environment.

4. The national, international agencies, NGOs for major role in disaster

management.

5. Disaster management program.

**Text Books**

1. Natural hazards, Edwards B (2005), Cambridge University Press, UK.

2. Natural Disaster, Sharma R.K& amp; Sharma G. (2005), A.P.H Publishing Corporation, New Delhi.

3. Disaster Management: A Disaster Manager’s Hand book, Carter, N.W. (1992), Asian

Development Bank, Manila.

**Supplementary reading:**

1. <https://www.GIS.Development.net>

2. https://iirs.nrsa.org

3. [https://quake.usgs.gov](https://quake.usgs.gov/)

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **Core – XV: Practical – V****23UEVMP63****WASTE RECYCLING TECHNIQUES & ENVIRONMENTAL IMPACT ASSESSMENT**  | **H/W** | **C** |
| **VI** | **6** | **4** |

Practical’s

1. Pre project analysis.
2. Analyze the project categories A, B & C.
3. Effective intervention in EIA process- public hearing.
4. EIA Report – EIS.
5. EIA-2020.
6. Case study.
7. Identification of different types of solid wastes
8. Segregation of municipal wastes
9. Demonstration of waste collection methods
10. Demonstration of waste disposal – landfills
11. Demonstration of waste recycling methods
12. Preparation of vermicompost kitchen waste

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| **Semester** | **ELECTIVE COURSE – VII** **COURSE CODE: 23UEVME64****COURSE TITLE:** **ENVIRONMENTAL ECONOMICS** | **H/W** | **C** |
| **VI** | **5** | **3** |

**Course Objectives**

 1. To gain knowledge in ecological and economic system.

 2. Impart principles of ecological economics.

 3. To understand root cause of environmental issues and economic solution.

 4. To understand economic instruments of Environmental Protection.

 5. To understand economic planning and sustainable development.

**Unit - I: INTRODUCTION TO ENVIRONMENTAL ECONOMICS**

 Environmental Economics - Environmental Policy **–** Ecological Economics - Resource Economics - Positive and Normative Economics - Important issues in Environmental Economics**.**

**Unit - II: ENVIRONMENT AND ECONOMIC DEVELOPMENT**

Important Issues in the Environment - Pollution - Depletion of Non - Renewable - Degradation of Natural Resources - Climate Changes - Outbreak of New Diseases - Degraded Ecosystem**.**

**Unit - III: ENVIRONMENTAL REGULATION**

 Regulatory Approach and Economic Incentives ( USA , European Union, Russian Federation) - Choices for Environmental Protection and cost Biocentrism - Anthropocentrism and sustainability.

**Unit - IV: BASIC REGULATORY INSTRUMENTS**

Command - control - incentives - Economic Instruments of Environmental Protection - Direct Instruments - Pollution Charges - Tradable Pollution Permits - Permits charges – Other Direct Economic Instruments - Indirect Instruments - Taxes, Charges, price reforms.

**Unit - V: ECONOMIC PLANNING AND SUSTAINABLE DEVELOPMENT**

Market - efficiency, market - externalities - The Coase Theorem - Single Polluter - The Multiple Polluters - The Equi marginal principle - Benefit cost analysis - Eco efficiency and New Technologies - Valuing Environmental Resources - Option Value and Willingness to Pay Economic.

**Course Outcomes**

After completion of this course the students will be able to gain knowledge in

1. The linkage between economic activities and Environmental Quality.

2. Impacts of economic activities on Earth‘s resources.

3. Importance of economic instruments in environmental regulation.

4. Significance of Environmental Protection.

5. Significance of sustainable development.

**Textbooks**

1. Tom Tietenberg and Lewis (2010). *Environmental Economics and policy*, Pearson, (6th ed.).

2. Field, B.C. and Field, M.K. (2006). *Environmental Economics : an introduction*. McGraw- Hill Series.

3. Charles D. Kolstad (2004). *Environmental Economics*, New York, Oxford University press.

**Reference Books**

1. Ulaganathan Sankar (2001). *Development and the Environment. In: Environmental Economics,* Oxford India, 333-446 pp.

2. Nayudu, G.S. (2008). *Economic planning and sustainable Development. In: Environmental Economics*, Adhyayan Publishers and Distributers, New Delhi.

**Supplementary Readings**

1. https://ashraffeps.yolasite.com

2. https://ironically.com

3. https://www.researchgate.net.

#### Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| **Semester** | **ELECTIVE COURSE – VIII** **COURSE CODE: 23UEVME65****COURSE TITLE: ENVIRONMENTAL LAWS, POLICIES AND TREATIES** | **H/W** | **C** |
| **VI** | **5** | **3** |

**Course Objectives**

1. To impart knowledge about Environmental Laws,

2. To learn about indian environmental protection laws

3. To know about the waste management and recycling rules.

4. To know about the policies and treaties of International.

5. To impart knowledge about environmental conservation.

**UNIT-I: INTRODUCTION TO ENVIRONMENTAL LAW**

Fundamental Rights-Evolution and Development of Environment Laws with Reference to Stockholm Conference 1972 – Environmental Legislation – Legal Definition \_Article 48A –Article 51G-National Green Tribunal- Environmental Ethics- Principle -Importance.

**UNIT**-**II: LEGISLATION FOR ENVIRONMENTAL PROTECTION**

The Wildlife (Protection) Act,1972 – The Water (Prevention and Control of Pollution) Act ,1974 -The Air (Prevention and Control of Pollution) Act, 1981-The Environment (Protection) Act, 1986 - The Forest (Conservation) Act, 1980 –The Noise pollution (Regulation and Control) Rules2000-The Biological Diversity Act, 2002 -Solid Waste(Management and Handling) Rules, 2000 –Biomedical Waste (Management and Handling) Rules1998.

**UNIT-III: RULES FOR ENVIRONMENTAL PROTECTION IN INDIA**

Bio-Medical Waste (Management & Handling) Rules,1998; Recycled Plastics Manufacture and Usage Rules, 1999; Noise Pollution (Regulation and Control) Rules,2000 ;Municipal Solid Waste (Management and Handling Rules)2000; The Hazardous Wastes(Management, Handling and Transboundary Movement) Rules,2008.

**UNIT-IV: ENVIRONMENTAL POLICY**

Definition –Benefits of developing an Environmental Policy- International Agreements-Montreal Protocol 1987 –Kyoto Protocol 1997- Copenhagen –Pairssummits Conventionon Climate Change –Carbon Credit and Carbon Trading .The National Forest Policy,1998.

**UNIT-V: ENVIRONMENTAL TREATIES**

United Nations Conference of Environment and Development 1992- Rio-de-Janerio (RioDeclaration,Agenda21) Scheme and Labelling of Environment Friendly Products-Indus Water Treaty- Ganges Water treaty -Vienna Convention for the Protection of Ozone Layer1985.

**Expected Course Outcome:**

After completion of this course, students will be able to gain knowledge in

1. The constitution of India environmental legislation and Environmental ethics.

2. Legislation for environmental protections.

3. The National Green Tribunal Act and bio medical waste management rules.

4. The environmental policies and International agreements.

5. Environmental treaties.

**Text Books**

1. TNPCB Pollution Control Legislation – TNPCB, Vol-1&2 , Chennai, 1999.

2. Agarwal VK 2005, Environmental Laws in India, Challenges for Enforcement, Bulletin of The National Institute of Ecology.

3. JadhavH&BhosaleY.M, 1995 ,Environmental Protection & Laws ,Himalayan Publications, New Delhi.

.**Supplementary Readings:**

* + - 1. <https://www.sciencedirect.com>
			2. <https://www.epd.gov.hk>.
			3. https://www.gsa.gov.

**Outcome Mapping**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **PROFESSIONAL COMPETENCY SKILL** **COURSE CODE: 23UEVMF66****COURSE TITLE:** **ENVIRONMENTAL BIOTECHNOLOGY AND HERBAL SCIENCE** | **H/W** | **C** |
| **VI** | **2** | **2** |

**COURSE OBJECTIVES**

1. To impart the knowledge about biotechnology and its use in environment.

2. To understand the knowledge about agricultural biotechnology.

3. To Learn about the techniques of mushroom cultivation.

4. To impart knowledge about the herbal science and traditional system of medicine.

5. To Study the role of Medicinal plants under conservation.

**Unit -1: SCOPE OF ENVIRONMENTAL BIOTCHNOLOGY**

Environmental Biotechnology: Basic concept, Aim and Scope. Pollution Monitoring- Biotechnological Methods- Biosensors- Biological Treatment of Wastewater.

 **Unit – I: I AGRICULTURAL BIOTECHNOLOGY**

Agricultural Biotechnology- Micropropagation- Techniques - Applications- Biofertilizers- Mass cultivation techniques of rhizobium , Azolla and Phospho bacteria, bio pesticides, petroleum plants**.**

**Unit – I: II TECHNOLOGY OF MUSHROOM CULTURE**

Mushrooms Technology - Nutritive value of Edible mushrooms- Medicinal value of mushrooms- Advantages of mushroom cultivation- Cultivation of oyster mushrooms.

**Unit – IV: HERBAL SCIENCE**

Herbal science- traditional system of medicine – Siddha- Ayurveda – Homeopathy- common medicinal plant – Zingiber officinale – Aloe vera - Ocimum sanctum – Asafoetida – Honey.

**Unit – V: CONSERVATION OF MEDICINAL PLANTS**

Conservation methods for Herbal plants.- Insitu and Exsitu conservation- Biotechnology in conservation of medicinal plants- Adulteration of herbal products - Reason- Types-Disadvantages.

**Expected Course Outcome:**

After completion of this course, students will be able to gain knowledge in

1. The environmental biotechnology and its value.

2. The agricultural biotechnology and bio pesticide.

3. The cultivation of mushroom and its value.

4. The value of herbal science and traditional system of medicine.

5. The conservation of medicinal plants and herbal products.

**TEXTBOOKS**

1. N. Arumugam, V. Kumaresan, Applied Plant Biotechnology. 2016, saras Publication, Nagarcoil.

2. V.kumaresan , Herbal biotechnology & pharmacography, 2015., Saras Publication Nagarcoil.

3. Gupta B.K. Elements of Biotechnology ,1997, Tata McCraw Hill publication. New Delhi.

**SUPPLEMENTARY READING**

* + - 1. https://www.researchgate.net/publication/341157139\_Environmental\_Biotechnology\_For\_Sustainable\_Future
			2. <https://www.mushroomoffice.com/mushroom-cultivation/>
			3. <https://medcraveonline.com/APAR/bio-diversity-and-conservation-of-medicinal-and-aromatic-plants.html>

#### Outcome Mapping

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

\*3 - Strong; 2 - Medium; 1- Low

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| --- | --- | --- | --- |
| **SEMESTER VI** | **23UEVMA67****EXTENSION ACTIVITY**  | **H/W** | **C** |
| **PART V** | **-** | **1** |

**(Refer to the Regulations)**