ANNAMALAI UNIVERSITY

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

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted in Affiliated Colleges

in the academic year 2022 -2023 ONLY)

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| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Part** | **Study Components & Course Title** | **Hours/Week** | **Credit** | **Maximum Marks** |
| **CIA** | **ESE** | **Total** |
|  |  | **SEMESTER – I** |  |  |  |  |  |
| **22UTAML11** | I | **Language Course - I : Tamil-I** | 5 | 3 | 25 | 75 | 100 |
| **22UENGL12** | II | **English Course - I : Communicative English I** | 5 | 3 | 25 | 75 | 100 |
| 22UEVMC13 | III | Core Course - I : Environmental Ecology | 4 | 4 | 25 | 75 | 100 |
| 22UEVMC14 | Core Course - II : Environmental Botany  | 4 | 4 | 25 | 75 | 100 |
|  | Core Practical - I : Environmental Eco - Botany | 3 | - | - | - | - |
| 22UEVMA01 | Allied - I : Paper - 1 : Environment and Ecotourism  | 4 | 4 | 25 | 75 | 100 |
|  | Allied Practical - I : Ecotourism  | 3 | - | - | - | - |
| **22UENVS18** | IV | **Environmental Studies** | 2 | 2 | 25 | 75 | 100 |
|  | **Total** | **30** | **20** |  |  | **600** |
|  |  | **SEMESTER – II** |  |  |  |  |  |
| **22UTAML21** | I | **Language Course - II : Tamil-II** | 5 | 3 | 25 | 75 | 100 |
| **22UENGL22** | II | **English Course - II : Communicative English II** | 5 | 3 | 25 | 75 | 100 |
| 22UEVMC23 | III | Core Course - III : Environmental Zoology  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMP24 | Core Practical - I : Environmental Eco - Botany and Zoology | 3 | 3 | 40 | 60 | 100 |
| 22UEVMA02 | Allied - I : Paper -2 : Basics of Computer  | 4 | 4 | 25 | 75 | 100 |
| **22UEVM P02** | Allied Practical - I : Ecotourism and Basics of computer | 2 | 3 | 40 | 60 | 100 |
| 22UEVME26 |  | Internal Elective - I | 3 | 3 | 25 | 75 | 100 |
| **22UVALE27** | IV | **Value Education** | 2 | 1 | 25 | 75 | 100 |
| **22USOFS28** | **Soft Skill** | 2 | 1 | 25 | 75 | 100 |
| 22UNMSD01 |  | **Skill Development Course I: Effective English** | **30** | **2** | 25 | 75 | 100 |
|  | **Total** | **30** |  **27** |  |  | **1000** |
|  |  | **SEMESTER – III** |  |  |  |  |  |
| **22UTAML31** | I | **Language Course - III : Tamil-III** | 5 | 3 | 25 | 75 | 100 |
| 22UENGL32 | I | English Course - III : English Through Literature-I | 5 | 3 | 25 | 75 | 100 |
| 22UEVMC33 | III | Core Course - IV : Natural Resources Management | 4 | 4 | 25 | 75 | 100 |
| 22UEVMP34 | Core Practical - II : Natural Resources  | 3 | - | - | - | - |
| 22UEVMA03 | Allied - II : Paper -1 Environmental Chemistry  | 4 | 4 | 25 | 75 | 100 |
|  | Allied Practical - II : Environmental Toxins | 2 | - | - | - | - |
| 22UEVME36 | Internal Elective -II : | 3 | 3 | 25 | 75 | 100 |
| 22UEVMN37 | IV | Non-Major Elective - I :  | 2 | 2 | 25 | 75 | 100 |
| 22UEVMS38 | Skill Based Subject - I : Vermicomposting  | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total** | **30** | **21** |  |  | **700** |

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|  |  | **SEMESTER – IV** |  |  |  |  |  |
| **22UTAML41** | I | **Language Course IV: Tamil-IV** | 5 | 3 | 25 | 75 | 100 |
| 22UENGL42 | I | English Course - IV : English Through Literature-II | 5 | 3 | 25 | 75 | 100 |
| 22UEVMC43 | III | Core Course - V : Environmental Pollution and Control Measures  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMP44 | Core Practical - II : Pollution Monitoring Techniques and Natural Resources  | 4 | 3 | 40 | 60 | 100 |
| 22UEVMA04 | Allied - II : Paper - 2 : Environmental Microbiology | 3 | 4 | 40 | 60 | 100 |
| 22UEVMPO4 | Allied Practical - II : Environmental Microbiology and Environmental Toxins  | 3 | 3 | 40 | 60 | 100 |
| 22UEVMN47 | IV | Non-Major Elective - II :  | 2 | 2 | 25 | 75 | 100 |
| 22UEVMS48 | Skill Based Subject - II : Environmental Toxicology  | 2 | 2 | 25 | 75 | 100 |
| 22UNMSD02 |  | **MS-Office Essentials** | **2** | **2** | 25 | 75 | 100 |
|  |  | **Total** | **30** | **26** |  |  | **900** |
|  |  | **SEMESTER – V** |  |  |  |  |  |
| 22UEVMC51 | IIIIII | Core Course - VI : Environmental Safety, Health and Management  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMC52 | Core Course - VII : Environmental Impact Analysis  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMC53 | Core Course - VIII : Computers in Environment  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMC54 | Core Course - IX : Solid Waste Management  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMP55 | Core Practical - III : Computers in Environment  | 3 | - | - | - | - |
| 22UEVMP56 | Core Practical - IV : Waste Handling and Recycling Techniques  | 3 | - | - | - | - |
| 22UEVME58 | Internal Elective -III : | 4 | 3 | 25 | 75 | 100 |
| 22UEVMS59 | IVIV | Skill Based Subject - III : Remote Sensing and GIS | 2 | 2 | 25 | 75 | 100 |
| **22UGENS57** | **Gender Studies** | 2 | 1 | 25 | 75 | 100 |
|  |  | **Total** | **30** | **22** |  |  | **700** |
|  |  | **SEMESTER – VI** |  |  |  |  |  |
| 22UEVMC61 | III | Core Course - X : Wild Life Conservation Biology and Management  | 5 | 4 | 25 | 75 | 100 |
| 22UEVMC62 | Core Course - XI : Natural Hazard and Disaster Management  | 5 | 4 | 25 | 75 | 100 |
| 22UEVMC63 | Core Course - XII : Environmental Laws and Policies  | 4 | 4 | 25 | 75 | 100 |
| 22UEVMP64 | Core Practical – III : Environmental Impact Assessment and Computers in Environment | 4 | 3 | 40 | 60 | 100 |
| 22UEVMP65 | Core Practical - IV: Pollution Management and Waste Handling and Recycling Techniques.  | 4 | 3 | 40 | 60 | 100 |
| 22UEVME66 | Internal Elective - IV: | 4 | 3 | 25 | 75 | 100 |
| 22UEVMS68 | IV | Skill Based Subject - IV : Environmental Biotechnology and Herbal Science  | 2 | 2 | 25 | 75 | 100 |
| **22UEXTA67** | V | **Extension Activities** | 2 | 1 | 100 | - | 100 |
| 22UNMSD03 |  | **Employability Readiness**(NAANDI/UNNATI/SKILLS BUILD) |  | **0** |  |  |  |
|  |  | **Total** | **30** | **24** |  |  | **800** |
|  |  | **Grand Total** | **180** | **140** |  |  | **4500** |

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**Internal Elective Courses**

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| 22UEVME26-1 | Internal Elective - I  | 1. Principles of Sustainable Development and Management
2. Forest Management
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| 22UEVME26-2 |
| 22UEVME36-1 | Internal Elective - II  | 1. Aquaculture and Environment
2. Energy resources
 |
| 22UEVME36-2 |
| 22UEVME58-1 | Internal Elective - III  | 1. Forest Conservation and Management
2. Environmental education and awareness
 |
| 22UEVME58-2 |
| 22UEVME66-1 | Internal Elective - IV | 1. Environmental Economics
2. Waste handling management
 |
| 22UEVME66-2 |

**Allied Courses**

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| --- | --- | --- |
| 22UEVMA01 | Theory | Environment and Ecotourism  |
| 22UEVMA02 | Theory | Basics of Computer |
| 22UEVM P02 | Practical | Ecotourism and Basics of Computer |
| 22UEVMA03 | Theory | Environmental Chemistry  |
| 22UEVMA04 | Theory | Environmental Microbiology |
| 22UEVMPO4 | Practical | Environmental Microbiology & Environmental Toxins  |

**Non-Major Elective Courses (NME)**

(Department of Environmental Management offers the following NME to other Departments)

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| --- | --- |
| 22UEVMN37 | Global Environmental Issues and Management  |
| 22UEVMN47 | Occupational Safety, Health and Management  |

**Credit Distribution**

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| **Part** | **Study Components** | **Papers** | **Credits** | **Total Credits** | **Marks** | **Total Marks** |
| Part I | Languages | 4 | 3 | 12 | 100 | 400 |
| Part II | Communicative English & English | 4 | 3 | 12 | 100 | 400 |
| Part III | Core Courses | 12 | 4 | 48 | 100 | 1200 |
|  | Core Practical | 4 | 3 | 12 | 100 | 400 |
|  | Allied Courses | 4 | 4 | 16 | 100 | 400 |
|  | Allied Practical | 2 | 3 | 6 | 100 | 200 |
|  | Internal Electives | 4 | 3 | 12 | 100 | 400 |
| Part IV | Environmental Studies | 1 | 2 | 2 | 100 | 100 |
|  | Value Education | 1 | 1 | 1 | 100 | 100 |
|  | Soft Skill | 1 | 1 | 1 | 100 | 100 |
|  | Gender Studies | 1 | 1 | 1 | 100 | 100 |
|  | Non Major Electives | 2 | 2 | 4 | 100 | 200 |
|  | Skill Based Courses | 4 | 2 | 8 | 100 | 400 |
| Part V | Extension Activities | 1 | 1 | 1 | 100 | 100 |
|  |  | **45** |  | **136** |  | **4500** |

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| SEMESTER: IPART:IIICORE: I | 22UEVMC13: ENVIRONMENTAL ECOLOGY | CREDIT:4HOURS:4 |

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 - Subdivisions of Ecology - Autecology- Synecology - Branches of Ecology - Environmental Factors – Abiotic: Water- Air - Soil - Temperature – Light - Biotic Factors.

UNIT - 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 - Stablization .

UNIT - V: Animal Association

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

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. Bhatia,A.L. (2010). *Textbook of Environmental Biology*, I.K. International Publishing House Pvt. Ltd., New Delhi, India.
2. Verma, P.S. and Agarwal, V.K. (2000). *Environmental Biology (Principles of Ecology)*, S Chand and Company Limited, New Delhi.
3. Rastogi V.B, and M.S. Jayaraj, (1989). *Animal Ecology and Distribution of animals*, Kedarnath, Ram Nath Meerut – 250 001.
4. Smith, T.M. and Smith, R.L. (2015). *Elements of Ecology*, (9thed.).Pearson Education.
5. Singh,J.S.,Singh,S.P.&Gupta,S.R.(2006).*Ecology,EnvironmentandResourceConservation.*AnamayaPublications.

Supplementry Readings

1. Champman,J.L. andReiss,M.J.(1998). *Ecology, Principles and Applications*, Cambridge University Press.
2. Kotpal. R.L, and N.P. Bali, (1986). *Concepts of Ecology*, Vishal Publications, New Delhi – 7.
3. Ananthakrishnan, T. N. and Viswanathan, T. R., *General Animal Ecology*, Macmillan India, New Delhi, 1976
4. Eugene P. Odum, 1971. *Fundamentals of ecology*, Saunders International Student Edition,W.B.Saunders Company, Philadelphia London, Toront.
5. Clark, G.L. (1954). *Elements of Eology*, John wiley and Sons Inc., New York, London.

Supplementary Readings

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

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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 |

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| SEMESTER: IPART: IIICORE: II | 22UEVMC14: ENVIRONMENTAL BOTANY | CREDITS: 4HOURS: 4 |

COURSE OBJECTIVES

1. To impart knowledge about classification of plants.
2. To understand the basics of cell and its structure.
3. To learn about the anatomy of various plant types.
4. To study the existence and role of Mendel's law.
5. To study the economic importance of plants.

Unit - I: FUNDAMENTALS OF CLASSIFICATION

Fundamental of classification, Basic unit of classification - classification of plants - Taxonomic hierarchy - Artificial and Natural classification- Merits and Demerits.

Unit - II: CELL DIVISION AND TYPES

Prokaryotic and Eukaryotic cells - cell organelles - Mitochondria, chloroplast and nucleus, cell division - mitosis - its significance.

Unit- III: ANATOMY OF PLANTS

Anatomy of dicot stem, root - Monocot stem, root - Structure and life History of Gracilaria, Agaricus, Lycopodium and Cycas - Economic importance of Gracilaria and Agaricus.

Unit-IV: GENETICS AND LAWS

 Mendel- Reason for Mendel’s success- Characters selected by Mendel -Monohybrid Experiment - Homozygous, Phenotype, genotype - Back cross and Test cross - Dihybrid Experiment - Mendel's Laws, Law of Dominance, Law of Segregation and Law of Independent Assortment.

UNIT-V: ECONOMIC BOTANY

 Economic Botany - Medicinal Plants, Edible oil Seeds, Pulses, Vegetables, Fruits, Mushroom, Single Cell Protein, Spirulina.

COURSE OUTCOMES

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

1. The various types of classification of plants.
2. The cell division and various cell organelles.
3. The anatomical features of plants.
4. Mendel's law of inheritance.
5. The economic importance of various plants.

Text Books

1. Jeffery, C. (1982). *An introduction of plants Taxonomy*, Cambridge University Press.
2. Smith Gilbert, M (1995). *Cryptogrammic Botany*, VOL. 1&2, McGraw Hill, New York.
3. Verma, P. S and V.K. Agarwal, (1989). *Principles of Ecology*, S. Chand and company, New Delhi.
4. Singh,V., P.C. Pandey and D.K. Jain (2017). *A Text Book of Botany*. (5thed.), Rastogi.
5. Pandey S.N. and Trivedi, P.S. (2015).*A text Book of Botany*, Vol 1 (11thed.), Vikas Publishing House, Pvt., Ltd., UP.
6. Mathawat, G.S.P., Sharma, D. and R.K. Sahni (1996).A text book of Botany, Ramesh Book depot, Jaipur.
7. Verma, V. (2009). *Text book of Economic Botany*, Ane Books Pvt Ltd, Chennai.

Supplementary Readings

1. Mehrothra, R.S. (1991).*Plant Pathology*, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Muneeswaran, A. (2004). *Allied Botany*, Titan Nooks, Madurai, India.
3. Pandey, B.P. (1991). *Economic Botany*, S. Chand and Co., New Delhi.
4. Verma, P.S and V.K. Agarwal, (1989). *Principles of Ecology*, S. Chand and Company, New Delhi.
5. Hill, A.W. (1951). *Economic Botany*, McGraw Hill Publications.
6. Dash, M.C. (1995). *Fundamentals of Ecology*, McGraw Hill, Publications.

Supplementary Readings

1. <http://www.thecompleteuniversityguide.co.uk/courses/options/botany/>
2. <https://botany.org/home/careers-jobs/careers-in-botany/what-is-botany.html>
3. <http://www.livescience.com/14016-natural-products-nih.html>

OUTCOME MAPPING

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

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| SEMESTER:1PART:III | 22UEVMA01: ENVIRONMENT AND ECOTOURISM | CREDIT:4HOURS:4/W |

COURSE OBJECTIVES

1. To understand ill effects of tourism on environment
2. To give insight on ecological tourism.
3. To highlight the areas of employment opportunities in ecotourism
4. To evoke ecological tourism
5. To understand the Guidelines of the ministry of tourism

 Unit - I: INTRODUCTION TO TOURISM

Tourism**:** Meaning - Etymology - History - Types of Tourism in India - Socio Economic and Environmental Tourism - Benefits and Drawbacks of Tourism industry in India - Need for eco friendly tourism.

Unit - II: ECOTOURISM

Ecotourism **-** Definition - History - principles (as per world wide fund for Nature) , Elements and Goals -Importance of Ecotourism - Positive Impact of Eco-Development projects on Ecotourism.

Unit - III: ECOTOURISM RESOURCES

Biosphere Reserves - National Park - Sanctuaries,Wetlands - Coastal - Freshwater - Mangroves,Coral Reefs, Desserts, Mountains and Forests - Including unique flora and Fauna.

Unit - IV : ECOTOURISM PLACES IN INDIA

Major Ecotourism Places in India: Kerala - Sundarbans,Goa, Himalayas , Andaman, Coorg, Sikkim, Shimla, Kodaikanal - States Promoting Ecotourism in India.

Unit - V: PROMOTION OF ECOTOURISM

Ecotourism in India - Some major Issues and Challenges - India’s Initiatives National Ecotourism policy - Guidelines of the Ministry of Tourism - Government of India - Nature Conservation Foundation - Centre for Responsible Travel (CREST) - Equitable Tourism options (EQUATIONS) - Responsible Travel Awards**.**

COURSE OUTCOMES

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

1. Socio - economic and environmental benefits of tourism.
2. The Elements and Goals of Ecotourism.
3. Ecotourism Resources like coastal, freshwater and mangroves.
4. Ecotourism places in India
5. National ecotourism policy.

Text Books

1. Biju Abraham, K Nagarajan and Alex K Thottunkel (2016). *Ecotourism Economics and Environment*,Educreation Publishing.
2. Stephen Wearing and John Neil (2009). *Ecotourism: Impacts,Potentials and Possibilities* – (2nd Ed.), Butterworth-Heinemann.
3. Honey, M.(1998). *Ecotourism and sustainable development: Who Owns Paradise?*Island Press.
4. Bhatia,A.K.(1995).*TourismDevelopment-PrinciplesandPractices.*SterlingPublishersPrivateLtd.,NewDelhi.
5. Bharadwaj, D.S. and Kandari, O.P. (1999). *Domestic Tourism in India*, Indus Publishing Company, Delhi.
6. Singh, L.K. (2008). *Indian Cultural Heritage Perspective for Tourism.*Isha Books, Delhi.

Reference Books

1. Ratandeep Singh (2000). *Handbook of Environmental Guidelines for IndianTourism*. Kanishka PublishersandDistributors, NewDelhi.
2. Larkin,T.andK.N.Kähler(2011)."*Ecotourism."EncyclopediaofEnvironmentalIssues.*Rev.Ed.Pasadena:SalemPress.

Supplementary Readings

1. https://www.sciencedirect.com.
2. https://www.academia.edu
3. <https://www.cabi.org>.
4. <https://traveltriangle.com/blog/ecotourism-in-india/>
5. [www.indiawildlifeportal.com](http://www.indiawildlifeportal.com/)
6. [www.ecotourismindia.com](http://www.ecotourismindia.com/)

OUTCOME MAPPING

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

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| SEMESTER: IPART: IV | 22UENVS 18: ENVIRONMENTAL STUDIES | CREDIT: 2HOURS: 2/W |

COURSE OBJECTIVES

1. To gain knowledge about the importance of environmental sciences and natural resources.
2. To learn the concept, structure and function of ecosystem and the importance of biodiversity.
3. To understand and gain knowledge about environmental pollution and management.
4. To impart knowledge about social issues and human population.
5. To acquire the skills for identifying and solving pollution problem.

UNIT - I: INTRODUCTION TO ENVIRONMENTAL SCIENCES: NATURAL RESOURCES:

Environmental Sciences – Relevance – Significance – Public awareness – Forest resources – Water resources – Mineral resources – Food resources – conflicts over resource sharing - Exploitation - Land use pattern - Environmental impact - fertilizer -PesticideProblems-casestudies.

UNIT - II:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION:

Ecosystem – concept – structure and function producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow - Forest, Grassland, desert and aquaticeco system.

Biodiversity - Definition - genetic, species and ecosystem diversity - Values and uses ofbiodiversity - biodiversity at global, national (India) and local levels - Hotspots, threatstobiodiversity-conservationofbiodiversity-Insitu &Exsitu.

UNIT - III:ENVIRONMENTALPOLLUTIONANDMANAGEMENT

Environmental Pollution – Causes – Effects and control measures of Air, Water, Marine, soil, solidwaste, Thermal, Nuclear pollution and Disaster Management - Floods, Earth quake, Cyclone and Land slides.Role of individuals in prevention ofpollution-pollutioncasestudies.

UNIT - IV:SOCIALISSUES-HUMANPOPULATION

Urban issues - Energy - water conservation - Environmental Ethics - Global warming -Resettlement and Rehabilitation issues - Environmental legislations - Environmentalproduction Act. 1986 - Air, Water, Wildlife and forest conservation Act – Population growth and Explosion – Human rights and Value Education – Environmental Health- HIV/AIDS – Role of IT in Environment and Human Health – Women and child welfare – Public awareness – Case studies.

UNIT-V:FIELDWORK

Visittoalocalarea/localpollutedsite/localsimpleecosystem-Reportsubmission

COURSE OUTCOMES

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

1. The scope and importance of environmental science and natural resources.
2. The structure and functions of Ecosystem and biodiversity and its conservation.
3. The problem of environmental pollution and its management.
4. The social issues and human population.
5. They will identify and solve the pollution problem.

Text Books

1. Agarwal,K.C. (2008). *EnvironmentalBiology*, NidiPubl.Ltd.Bikaner.
2. Bharucha Erach, (2004). *Textbook for Environmental Studies,* UGC.
3. Odum, E.P., Odum, H.T. & Andrews, J. (1971). *Fundamentals of Ecology*. Philadelphia: Saunders.
4. Brusseau, M.L., Pepper, I.L., and Gerba, C. (2019). *Environmental and Pollution Science*. Academic Press, USA.
5. Primack R.B. (2014). *Essentials of Conservation Biology*, Oxford University Press, USA.
6. Raven, P.H, Hassenzahl, D.M., Hager M.C, Gift N.Y, and Berg L.R. (2015). *Environment*, (9th Ed.), Wiley Publishing, USA.
7. Rosencranz, A., Divan, S., and Noble M.L. 2002. Environmental Law and Policy in India: Cases, Material & Statutes. Oxford University Press.
8. Schmidtz, D., Shahar, D.C. 2018. Environmental Ethics: What Really Matters, What Really Works 3rd Edition, Oxford University Press, USA.
9. Sengupta,R.(Ed.) 2013. Ecological Limits and Economic Development. Oxford University Press, New Delhi, India.
10. Singh, J.S., Singh, S.P. and Gupta, S.R. 2017. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
11. Stuetz R.M., and Stephenson T. (Eds.) (2009). *Principles of Water and Wastewater Treatment Processes (Water and Wastewater Process Technologies).* IWA Publishing, London, UK.
12. Sodhi, N.S., Gibson, L. and Raven, P.H. (Eds). (2013). *Conservation Biology: Voices from the Tropic*s. John Wiley & Sons.
13. Thapar, V. (1998). *Land of the Tiger: A Natural History of the Indian Subcontinent*. University of California Press, USA.
14. Warren, C.E. (1971). *Biology and Water Pollution Control*. WB Saunders.
15. Wilson, E.O. (2006). *The Creation: An Appeal to Save Life on Earth*. W.W. Norton & Company, NewYork, USA.
16. World Commission on Environment and Development. (1987). *Our Common Future*. Oxford University Press, USA.

Supplementary Readings

1. Kumarasamy,K.,A. Alagappa Moses and M.Vasanthy, (2004). *Environmental Studies*, Bharathidsan University Pub,1, Trichy.
2. Rajamannar, (2004). *Environemntal Studies*, EVR College Pub, Trichy.
3. Kalavathy,S. (ED.) (2004). *Environmental Studies*, Bishop Heber College Pub., Trichy.

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 |

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| SEMESTER: IIPART: IIICORE: III | 22UEVMC23: ENVIRONMENTAL ZOOLOGY | CREDITS: 4HOURS: 4/W |

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- Honeybee Culture- Production of Honey- Economic Importance of Honey- SilkwormCulture- 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 Injectionof 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

AquariumCulture - Aims of AquariumCulture - 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.

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.

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.

Supplementary Readings

1. Pillay T.V.R. (1990). Aquaculture. Princilples & Practices, Black Well Publication, Oxford.
2. Jhingaran V.G. (1981). *Fish & Fisheries of India,*Hindustan Publishing Corporation.

Supplementary Readings

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

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| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
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| SEMESTER: IIPART: IIICORE PRACTICAL | 22UEVMP 15 AND 24: ENVIRONMENTAL ECO - BOTANY AND ZOOLOGY | CREDITS:3HOURS:3/W |

CORE PRACTICAL

1. Micro preparation and anatomy of dicot stem.
2. Micro preparation and anatomy of dicot root.
3. Squash preparation of onion root tip for Mitosis.
4. Identification of Museum and Live specimen-Gracilaria,Agaricus.
5. Identification and micro preparation of Lycopodium stem T.S., Strobilus L.S.
6. Study on the Morphology and Anatomy of Hydrophytes.
7. Study on Morphology and Anatomy of Mesophytes- stem.
8. Study on Morphology and Anatomy of Xerophytes. - Stem
9. Study on Morphology and Anatomy of Halophytes. Museum specimens and slides.
10. Demonstration of honeybee culture and Silkworm culture.
11. Identification of invertebrates in Local habitat.
12. Identification of vertebrates in your local habitat.

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| SEMESTER: IIPART: III | 22UEVMA02: BASICS OF COMPUTER | CREDIT : 4HOURS : 4/W |

COURSE OBJECTIVES

1. To understand the fundamentals of computers and the use of computer hardware and software.
2. To provide fundamental knowledge about the types of number system and the types of number Representations used in computers
3. To provide handson use of Microsoft Word and PowerPoint.
4. To understand and describe the types of Networks, its topology and protocols used to support communications in networks.
5. To discuss elementary Internet concepts, history, working and applications of Internet.

UNIT – I: Fundamentals of Computers

Introduction: History of Computer - Generation of computers- Classification of computers- Parts of Computer System -CPU, Memory, Input device and output device - Hardware Devices - Software - Types of Software, System Software, Application Software - Operating System - Basics of Operating systems - LINUX - WINDOWS

UNIT–II: Number System

Number System - Types of Number System - Binary system - Decimal number system - Octal Number System - Hexa-Decimal Number System - Number base conversions - Number Representations - BCD - Gray code - Excess 3 code - ASCII Code - EBCDIC Code- CPU and memory- RAM, DRAM, SRAM , Registers - Input devices - output devices.

UNIT–III: MS Office

Introduction to MS Office, Components and Features - **MS Word: Menus -** Creating Letter, Table, Fonts, Page Layout Document, Formatting, Spell Check, Print Preview, Template, Color, Mail Merge, Auto Text, Inserting Picture, Word Art. - MS **PowerPoint: I**ntroduction to PowerPoint, Creation of Slides, Inserting Pictures, Preparing Slide Show with Animation.

UNIT–IV: Computer Networks

Networks - communication media - Types of Networks - LAN, MAN, WAN - Network topology - Star Topology, Ring, Tree Topology, Linear bus topology - Network protocols - Network Architecture - peer-to-peer architecture, client server architecture

UNIT–V: Internet

Introduction to Internet - History of Internet - Internet Access - Working of Internet- Internet Services - Internet Addressing - IP Address, Domain names, URL, Email Basics - World Wide Web- Web browsers - Search engines

COURSE OUTCOMES

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

1. The fundamentals of computers and the components of a computer.
2. Number system and the types of number Representations used in computers
3. MS Word and MS PowerPoint
4. Networks and how it works
5. The working of Internet and www.

Textbooks

1. Sanjay Saxsena, (2000). “*A First Course in Computer*”, Vikas Publishing House.
2. Ron Mansfield, (1997). “*Working in Microsoft Office*”, Tata McGraw Hill.
3. Alexis Leon and Mathews Leon (2009). “*Fundamentals of Information Technology”*, (2nded.), Vijay Nicole, Chennai.

Supplementary Readings

1. Computer Fundamentals Concepts, Systems & Applications – P.K Sinha
2. <http://en.wikipedia.org>,
3. <http://learning-unix.blogspot.in>,

OUTCOME MAPPING

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| CO3 | 2 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 3 |

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| SEMESTER: IIPART: IIIPRACTICAL: I | 22UEVMP02: ECOTOURISM ANDBASICS OF COMPUTER | CREDIT : 3HOURS : 2/W |

Practicals

1. Ecotourism- a boon for Indian Economy.
2. A visit to pristine natural environment.

i. Sacred groves.

ii. Temples

iii. Pitchavaram

1. Ecological threats during ecotourism
2. Never ever buy wild life products.
3. Build cultural and environmental awareness.
4. Organizations that encourage sustainability.
5. Applying menus and formatting in MS Word
6. Creation of tables, bullets and numbering in MS Word
7. Inserting headers and footers and mail merge in MS Word
8. Creating, saving, closing presentation in MS PowerPoint
9. Changing slide layout and Inserting Clip art in MS PowerPoint
10. Applying Transition and animation effects, in MS PowerPoint.

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| SEMESTER:IIPART:III | 22UEVME26-1: PRINCIPLES OF SUSTAINABLE DEVELOPMENT AND MANAGEMENT | CREDIT:3HOURS:3/W |

COURSE OBJECTIVES

1. To understand the principles of management and how to acquire skill to become a good manager.
2. To apply the concept of planning and decisionmaking.
3. To provide the basic knowledge of organization and span of control.
4. To enable the students to understand the delegation of authority.
5. To enable students to be aware of coordination and control process.

UNIT- I:INTRODUCTION OF MANAGEMENT

Function of management- planning, organizing and controlling - systems approach to management - Patterns of analysis - Economic, social, political and ethical factors - Affecting management practice.

UNIT - II: PLANNING PROCESS MANAGEMENT

Steps in the planning process management - By objectives - programme budgeting - capital budgeting - economic analysis - marginal analysis - benefits / cost analysis etc. Decision analysis - risk and uncertainty - decision trees, strategy and policy analysis - Limitation of planning.

UNIT- III : ORGANIZATIONAL STRUCTURE

Organizational structure - Formal and Informal organization - Line and staff relations - Relations with the public - Principles of Delegation - Performance Appraisal - Motivation - Communication and Leadership Aspect - Theories of organization.

UNIT- IV: IMPORTANCE OF GREEN BUILDING

Green buildings - History of green buildings - Need and Relevance of Green Buildings - Associated Cost and Benefits - Outlined Examples of Green Buildings - LEED Certified Building - Eco - Mark Certification - Establishment of Eco - mark in India - Its Importance and Implementation.

UNIT- V: SUSTAINABLE DEVELOPMENT

Public Transportation for Sustainable Development - Green Belts - Green Banking- Setting Environmental Goals - Resource Mobilization - Use of Natural Resources and Environmental Indicators - Output Building - Monitoring and Evaluating Environmental Programme.

COURSE OUTCOMES

After completion of this course Students will be able to gain Knowledge in.

1. Management Functions and Factors affecting the management practice.
2. Planning process, programme budgeting and capital budgeting.
3. Organizational structure.
4. Importance of green Building
5. Natural Resources and Environmental Indicators.

Text Books

1. Sharma, R.D. (1976 ). *Organizational management*, Light and life publishers, New Delhi.
2. Chakraborty, S.L. (1976). *Management by objectives*, MacMillan Publishers Ltd., New York.
3. Varma, P.S. and V.K. Agarwal (1992).*Theory and practice of management*, Forward Book Depot, New Delhi.

Supplementary Readings

1. https://www.eolss.net
2. https://www.scribd.com
3. <https://www.kobo.com>

OUTCOME MAPPING

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| SEMESTER: IIPART: III | 22UEVME26-2: FOREST MANAGEMENT | CREDIT: 3HOURS: 3/W |

COURSE OBJECTIVES

1. To learn about the forest ecology, types of forests and its resources.
2. To know the economy of forest.
3. To know the threats to forest and management of it.
4. To know the conservation measuresthrough policy and legislation
5. To know the forest management strategies.

UNIT 1: Concept of forest Ecology

Forest ecosystem - Forest types; forest productivity: nutrient cycling, natural stress to forest (drought, water logging).

UNIT 2: Forest Economics

Forest Resources, Non – Timber forest Products (NTFPs) definition and scope; (medicinal plants, gums, oil seeds nuts). Forest economics –estimation of demand and supply.

UNIT 3: Threats and Protective Measures offorest biodiversity

Forest Fire, Encroachment, poaching, grazing, fencing, and theft. Effect of wild animals on forest regeneration, Role of Afforestation and reforestation.

UNIT 4: Forest Legislation

Forest Conservation Act 1980. Indian forest policy 1990. National Forest Policy 1998. Scope and objective s of forest inventory.

UNIT 5: Forest management

Objective and principles of forest management; techniques; commercial forests, forest cover monitoring. Agroforestry, Social Forestry and Combined Forest Management.

COURSE OUTCOMES

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

1. Define the forest ecology, types of forests, its resources and threats.
2. Recognize the social, economic and environmental values of forest resources.
3. Identify the threats to forest resources.
4. Restate the forest policy, legislation and forest management strategies.
5. Apply the management strategies towards forest conservation.

Text Books

1. Puri, G.S., Gupta, R.K., Meher-Homji VM and Puri, (1989). *Forest Ecology*,Oxford and IBH publishing Co., Pvt. Ltd, New Delhi.
2. FSI, State of Forest Report (1997). *Forest survey of India*, Ministry of Environment and Forests, Dehradun.
3. Gadgil, M. and Guha. R, (1995). *Ecology and Equity: the use and abuse of nature in contemporary India*, Penguin books, New Delhi.

OUTCOME MAPPING

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| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
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| CO3 | 2 | 3 | 2 | 2 | 3 |
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| **SEMESTER:III****PART: III** | **COURSE CODE: 22UEVMC33****COURSE TITLE : NATURAL RESOURCES MANAGEMENT** | **CREDIT:4****HOURS:4/W** |

**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 and urban forestry- Eco development committees - Ecotourism - Climate change reduction- Carbon trading

**UNIT – III: WATER RESOURCE MANAGEMENT**

 Water resources - Hydrological cycle- Surface water - Ground water - Over utilization of surface and 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.

**CourseOutcomes:**

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

1. The types and 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.

**Textbooks**

1. Jha, L.K. and S.S.Negi (1997). *Natural resource management*, APH Publishing corporation, New Delhi.

2. Alagappa Moses, A., Vasanthy, M., Kumaraswamy, K. And 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.

4. Sharma, J.P. (2016). *Environmental Studies*. Laxmi Publications (P) Ltd., New Delhi.

5. Brebbia, C.A. (2013). *Water Resources Management* VII. WIT Press.

**Reference Books**

1. MaDicken, K.G. and Vergara, N.T. (1990).*Agroforestry: Classification & Management.* John Wiley & Sons, New York.

2. Owen, O.S., Chiras, D.D. and J.P. Reganold (1998).*Natural Resources Conservation: Management for a Sustainable Future*, (7thed.), Pearson.

3. Sarah, F. (2011). *Natural ResourceManagement*,Oriental Enterprises, Dehradun, India.

4. Nautiyal, S. and Kaul, A.K. (1999).*Forest Biodiversity and its Conservation Practices in India*, Oriental Enterprises, Dehradun, India.

5. Russel, D. T. and T. Emmanuel (2011).*Natural Resource Management and Local Development*, Springer, Netherlands.

1. Brady, N.C. & Well, R.R. (2007). *The Nature and Properties of Soils* (13th edition), PearsonEducationInc.

**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** |
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| **SEMESTER:III****PART:III** | **ALLIED – II PAPER – 1****COURSE CODE: 22UEVMA35****COURSE TITLE : ENVIRONMENTAL CHEMISTRY** | **CREDIT:4****HOURS:4/W** |

**Course Objectives**

1. To learn about the fundamentals of Environmental Chemistry

2. To study the atmospheric structure and composition

3. Tounderstand the water chemistry and relation with environment

4. To learn about soil chemistry and characteristics

5. To study the pollutants and their interaction with environment

**UNIT – I: FUNDAMENTALS OF ENVIRONMENTAL CHEMISTR**

Fundamental concepts in Environmental Chemistry - Environmental segments -Preparation of Standard Solutions -Molarity, Molality, Normality, Percent and PPM (mg/l) solutions -Acid-base Reactions -pH and pOH and Buffer Solutions - Solubility and Solubility Product - Unsaturated and Saturated Hydrocarbons -Radionuclides.

**UNIT – II: ATMOSPHERIC CHEMISTRY**

Structure and composition of Atmosphere -Particles in the atmosphere -Physical behaviour of particles in the atmosphere -Composition of in organic particles-Toxic metals-Radioactive particles-The composition of organic particles-Effect of particles-Control of particulate emissions.

**UNIT – III: WATER CHEMISTRY**

 Formation of Water- Water Resources-Sources and Types-Hydrological Cycle-Unique Properties of Water - Role of Water in the Environment-Physical, Chemical and Biological Parameters of Water - Dissolved Oxygen - Biochemical Oxygen Demand-Chemical Oxygen Demand.

**UNIT – IV SOIL CHEMISTRY**

Formation of soil - Types of soil - Physical and Chemical Properties of Soil: Structure, Texture,Temperature, Bulk Density, Permeability, Moisture, Air, pH, Cation Exchange Capacity, Macro and Micronutrients, Humus and Organic Matter.

**UNIT – V: POLLUTANT CHEMISTRY**

Chemistry of various Organic and Inorganic Compounds- Pesticides-Biochemical effects of Pesticides-Heavy metals-Cadmium-Itai-Itai disease-Mercury-Minamata disease–Lead-Chromium-Zinc-Impact of heavy metals on man and animals-Thalidomide tragedy-Bio-chemical Effects of Carbonmonoxide and Sulphurdioxide.

**Course Outcomes**

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

1. The concepts in Environmental Chemistry.

2. The chemical process in the air, water and soil.

3. The water quality parameters and water pollutants.

4. The properties of soil and water.

5. Various types of organic and inorganic pollutants their effects on environment.

**Textbooks**

1. De,A.K., (2012). *EnvironmentalChemistry*,(7thed.),NewAgeInternationalPublishers, New Delhi.

2. Sharma, B.K. andH. Kaur, (1994).*Environmental Chemistry*,Goel Publishing House Ltd.,Meerut,UP

3. Pani,B.(2007). *TextbookofEnvironmentalChemistry*.IKInternationalPublishingHouse.

4. Dara, S.S., Mishra, D.D. (2009). *A Text Book of Environmental Chemistry and Pollution Control*, (10th ed.), S. Chand and co., New Delhi.

5. Harnung,S.E.&Johnson,M.S.(2012).*ChemistryandtheEnvironment*.CambridgeUniversityPress.

1. Hites,R.A.(2012).*ElementsofEnvironmentalChemistry*(2ndedition).Wiley&Sons.

**Reference Books**

1. Girard, J. E. (2013). *Principles of Environmental Chemistry,* (3rd ed.). Jones & Bartlett, London.

2. Manahan, S.E. (2017). *Environmental Chemistry*, (10th ed.), CRC Press.

3. Manhan,S.E.(2000).*FundamentalsofEnvironmentalChemistry*. CRCPress.

1. Beard,J.M.2013.*EnvironmentalChemistryinSociety*(2ndedition).CRCPress.
2. Connell,D.W.(2005).*BasicConceptsofEnvironmentalChemistry*(2ndedition).CRCPress.

**Supplementary Readings:**

1. <http://www.nptel.ac.in/courses/122106030/Pdfs/3_1.pdf>

2. [http://www.*crystal.med.upenn.edu/sharp-lab-pdfs/sharp\_EncLifeSci.pdf*](http://www.crystal.med.upenn.edu/sharp-lab-pdfs/sharp_EncLifeSci.pdf)

*3. http://www.fao.org/docrep/field/003/AC172E/AC172E04.html*

#### Outcome Mapping

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| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: III** | **22UEVME36-1: AQUACULTURE AND ENVIRONMENT** | **CREDITS: 3** |
| **PART: III** | **HOURS: 3/W** |

**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 of aquatic pollution on fishes- water quality management- physical, chemical, biological parameters- assessment of a water quality.

**UNIT –3: WEED and 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.

**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.

**Textbooks**

1. Jhingaran, V.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. Arumugam, N. (2008). *Aquaculture*, Saras Publications, Nagercoil, Tamilnadu.

**Reference Books**

1. Pillay, T.V.R. (1990). *Aquaculture. Principles and Practices*. Blackwell Publishing, Oxford.

2. Srinivasalu Reddy, M. and K.R.S Sambasiva Rao. (2004). *A Textbook of Aquaculture*. Discovery Publishing House, New Delhi.

**Supplementary reading**

1. h[ttps://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

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| **SEMESTER: III** | **22UEVME36-2: ENERGY RESOURCES** | **CREDITS: 3** |
| **PART: III** | **HOURS: 3/W** |

**Course Objectives:**

1. To know the non-renewable energy resources

2. To know the renewable energy resources and principles of Solar Energy

3. To understand the principles of Wind Energy.

4. To understand the basics principles of Nuclear Energy

5. To realize the importance of conservation of energy and developing green energy.

**UNIT 1: Fossil fuels**

Types of fossil fuels, composition and energy content of coal, petroleum and natural gas. Shale oil, Coal bed Methane, Gas hydrates.

**UNIT 2: Solar energy**

Principles and generation of solar power - solar cells – photo voltaic modules - solar ponds. Industrial and domestic and solar panel, large-scale exploitation.

**UNIT 3: Wind Energy**

Basic principles of wind energy, Basic components of a wind mill, Types of wind machines –Applications of wind energy. Impacts of large-scale exploitation of wind energy.

**UNIT 4: Nuclear energy**

Introduction, nuclear energy resources, fusion and fission, Nuclear fuels and Nuclear reactor, Impacts of large-scale exploitation of nuclear energy sources.

**UNIT 5 Bio-energy**

 Introduction to Biomass energy, Methods, Biomass and Biogas generation. Environmental implications of energy use; energy use pattern in India and the world.

**Course Outcomes:**

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

1. Classify the energy sources (both renewable and non-renewable).

2. Explain the physical basis of Energy, sources and applications.

3. Analyze the pros and cons of alternative energy utilization.

4. Review various techniques to avail non-polluting energy sources.

5. Develop green energy technologies.

**Textbooks**

1. Rai, G.D. (2001). *Non-conventional energy sources*, Khanna publishers, New Delhi.

2. Murray, R.L. (2009). *Nuclear Energy–An Introduction to Concepts, Systems and Applications of Nuclear Processes*, (6th ed.), Elsevier.

3. Sukhatme, S.P. (1996). *Solar Energy,* Tata McGraw Hill publishing company Ltd., New Delhi.

4. Tyagi, P.D. (1989).*Fuels from weeds and wastes*, Batra Book Service Publishers.

**Reference Books**

1. Maheswari, A. and Parmar, G. A. (2002). *Text book of Energy, Ecology Environment and Society*, Anmol Publications, New Delhi.

2. Dunn, P.D. (1979). *Appropriate Technology*. Macmillan Education limited.

3. Johnson Gary L. (1985). *Wind Energy System,* Prentice - Hall Inc., New Delhi.

4. Trivedi, P.R. and Sudarshan, K.N. (1994). *Environment and natural resources conservation*, Common Wealth Publishers, New Delhi.

**Outcome Mapping**

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

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| **SEMESTER:III****PART:IV** | **COURSE CODE: 22UEVMN37****COURSE TITLE : GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT** | **CREDIT:2****HOURS:2/W** |

**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

**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. Recognizing 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.

**Textbooks**

1. Frances Harris (2012). *Global Environmental Issues*, (2nd ed.), John Wiley & Sons Ltd., UK.

2. Poulopoulos, S.G. and V. J. Inglezakis (2016). *Environment and Development: Basic Principles, Human Activities, and Environmental Implications*. Elsevier, Netherlands.

3. Walther, J.V. (2014). *Earth’s Natural Resources*, Jones & Bartlett Learning, USA.

**Reference Books**

1. Hyndman, D.W. and D.W. Hyndman (2005). *Natural Hazards & Disasters*, Brooks/Cole Publishing Company, USA.

2. Modak, P. (2018). *Environmental Management towards Sustainability*, CRC Press, FL, USA.

3. Mondal, P. and A. K. Dalai (2017).*Sustainable Utilization of Natural Resources*, CRC Press, FL, USA.

4. Raveendranathan, D. (2018). *Development lead to Pollution and Depletion of Natural Resources,* Notion Press, Chennai.

5. Thangavel, P. and Sridevi, G. (2015). *Environmental Sustainability: Role of Green Technologies*, Springer, India.

**Supplementary Readings:**

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

2. www.who.int/airpollution/

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

#### Outcome Mapping

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

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| **SEMESTER:III****PART:IV** | **COURSE CODE: 22UEVMS38****COURSE TITLE: VERMICOMPOSTING**  | **CREDIT:2****HOURS:2/W** |

**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 species 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**

Harvesting techniques of vermicast, Marketing of vermicompost.

**CourseOutcomes**

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.** Harvesting of vermicast and Marketing of vermicompost.

**Textbooks**

1. NPCS Board of Consultants & Engineers (2004). *The Complete Technology Book on Vermiculture and Vermicompost*, Asia Pacific Business press.

2. Rehan Ahmad, S. (2020). *Vermicompost production*, Nitya Publications, Bhopal.

3. Singh, K. (2014). *A Textbook of Vermicompost: Vermiwash and Biopesticides*, Biotech, New Delhi

4. Edwards, C.A. N. Q. Arancon and R. L. Sherman (2011). *Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management*, CRC Press, Taylor and Francis.

5. Edwards, C. A. (2004). *Earthworm ecology*. CRC Press, Taylor and Francis.

# Supplementary Readings

1. Ganesh kumar,T. (2013). Sustainable vermicomposting of Salvinia molesta, Mitchell

Lap Lambert Academic Publishing House, Germany.

2. Ganesh Kumar, T., (2014). Vermicomposting of the pernicious weed Salvinia molesta, Mitchell. Lap Lambert Academic Publishing House Germany.

3. Ganesh Kumar, T. (2015). Utilization of two of the worlds worst weeds Salvinia molesta Mitchell and Lantana camara Linnaeus by vermicomposting. Ph.D. Thesis, Pondychery University.

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

5. Ganesh Kumar, T., Gajalakshmi, S. and S.A. Abbasi (2014). *A new process for the rapid and direct vermicomposting of the aquatic weed salvinia(Salviniamolesta).* Bioresources and Bioprocessing.

6. <http://hdl.handle.net/10603/284437>

#### 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 |
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| **SEMESTER: IV****PART: III** | **COURSE CODE: 22UEVMC43****COURSE TITLE : ENVIRONMENTAL POLLUTION AND CONTROL MEASURES** | **CREDIT: 4****HOURS: 4/W** |

**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 and 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.

**Course Outcomes**

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.

**Textbooks**

1. Rao, M.N. and Rao, H.V.N.(1989). *Air pollution*, Tata Mc Graw Hill publishing Co.Ltd.,New Delhi.

2. Sharma, B. K.(2014). *Soil and noise pollution*, Goel Publishing House, Meerut..

3. Bhatia, H. S, (2018). *A Text Book on Environmental Pollution and its control,* (2nd ed.), Galgotia publications(p) limited, New Delhi.

4. Kudesia, V.P. (1985). *Water pollution*, Pragati Prakashan, Meerut.

5. Dara, S.S. (2001). *A Text Book of EnvironmentalChemistry and Pollutioncontrol*,S. Chand and Co., New Delhi.

6. De. A. K, (2006). *EnvironmentalChemistry*,Wiley EasternLtd, New Delhi.

**Reference Books**

1. Kannan, K. (1991). *Fundamentals of environmental pollution,* S. Chand and Co Delhi.

2. Khopkar,S.M, (2010). EnvironmentalpollutionAnalysis, (2nd ed.), WileyEastern limited, New York.

**Supplementary readings**

**1.** <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 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 2 | 2 |
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| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER:IV****PART:III** | **COURSE CODE: 22UEVMP34 and 44****COURSE TITLE : POLLUTION MONITORING TECHNIQUES AND NATURAL RESOURCES** | **CREDIT:3****HOURS:4/W** |

**Practicals**

1. Estimation of total dissolved solids.

2. Estimation of acidity and alkalinity in water samples.

3. Estimation of carbonate and bicarbonate in water samples.

4. Estimation of total hardness.

5. Estimation of chloride in soil.

6. Demonstration of BOD.

7. Demonstration of Noise level meter.

8. Demonstration HVA sampler

9. Distribution of mineral resources in India.

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

11. Rain water harvesting – demonstration.

12. Demonstration of Bio Gas plant.

13.Distribution of coal resources in India.

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| **SEMESTER: IV****PART: III** | **ALLIED – II PAPER – 2****COURSE CODE: 22UEVMA04****COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY** | **CREDITS: 4****HOURS: 3/W** |

**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 agent**s.**

**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-wastewater-treatment/

**Outcome Mapping**

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

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| **SEMESTER: IV****PART: III** | **ALLIED PRACTICAL – II** **COURSE CODE: 22UEVMP02****COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY AND** **ENVIRONMENTAL TOXINS** | **CREDITS: 3****HOURS: 3/W** |

**Practicals**

1. To show the presence of microorganisms around us.

2. Gram staining of Bacteria.

3. Isolation of Microorganisms from the soil.

4. Observation of Root nodule Bacteria.

5. Isolation of Root Nodule Bacteria.

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. Demonstration of bacterial colony counter.

12. Biochemical effects of Mercury.

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| **SEMESTER:IV****PART:IV** | **COURSE CODE: 22UEVMN47****COURSE TITLE: OCCUPATIONAL SAFETY, HEALTH AND MANAGEMENT** | **CREDIT:2****HOURS:2/W** |

**CourseObjectives**

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: AIR AND WATER BORNE DISEASES**

 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.

**Course Outcomes**

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.

4. The importance of industrial safety.

5. The ISO certification procedure.

**Textbooks**

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.

3. Park, K. JR (2021). *Park’s Textbook of Preventive and social medicine*, Banarsidas Bhanot Publishers.

**Reference 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.

3. Schilling, R.S.E. (1973). *Occupational health practices*, Buffer Worth, London,

4. Gurjar, B.R., Molina, L.T. and 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>

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** |
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| **CO2** | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: IV****PART:IV** | **22UEVMS48: ENVIRONMENTAL TOXICOLOGY** | **CREDIT:2****HOURS:2/W** |

**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.

**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) byAlbert 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 |
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| **SEMESTER: V****PART:III** | **COURSE CODE: 22UEVMC51****COURSE TITLE: ENVIRONMENTAL SAFETY, HEALTH AND MANAGEMENT** | **CREDIT:4****HOURS:4/W** |

**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.

**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.

**Textbooks**

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

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

3. Gurjar, B.R., Molina, L.T., and 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 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: V****PART: III** | **COURSE CODE:22UEVMC52****COURSE TITLE: ENVIRONMENTAL IMPACT ANALYSIS** | **CREDITS:4****HOURS:4/W** |

**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-Historicalperspectives of EIA -Organization responsible for EIA- Pre-project analysis-Siteselection 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 anddata

Collection-Environmental auditing.

**UNIT -III: EIA METHODLOGIES**

Various Steps of EIA - Content of EIA -Analytical and Integrated Approach AssessmentMethodology-Adhoc,Overlay Network, Matrix and Checklist-Environmental Values andTechnique - 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 PowerPlants, 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,* NewDelhi.

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

Publishers.

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

*Assessment*,I.K.International Publishing HousePvt.

**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 | 2 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 |

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| **SEMESTER : V****PART : III** | **COURSE CODE: 22UEVMC53****COURSE TITLE: COMPUTERS IN ENVIRONMENT** | **CREDIT : 4****HOURS : 4/W** |

**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 - BGColor, 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

**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 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: V****PART: III** | **COURSE CODE:22UEVMC54****COURSE TITLE: SOLID WASTE MANAGEMENT** | **CREDITS: 4****HOURS: 4/W** |

**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: DISPOSALOF 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.

**Course Outcomes**

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.

**Textbooks**

**1.** Kinnaman, T.C and Takeuchi, K. (2014). *Handbook on Waste Management*, Edward Elgar Publishing, UK.

2. Chandrappa, R., D.B.Das and J. Brown, (2012). Solid Waste Management: Principles and Practice, Springer Science and Business Media Publishers.

**Reference Books**

1. Blackman, W.C.Jr. (2016). Basic Hazardous Waste Management, (3rd ed.). CRC Press.

2. Asnani, P.U. (2006). *Solid waste management*. India Infrastructure Report, Oxford University Press, New Deihi, India.

3. Bagchi, A. .(2004). *Design of landfills and Integrated solid waste management*. John Wily& Sons.

4. McDougall, F. R., White, P. R., Franke, M. and Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory (2nd ed.), John Wiley & Sons.

5. Arumugam, N., V. Kumaresan, (2016). *Applied Plant Biotechnology*, Saras Publication, Nagarcoil. Tamil Nadu.

**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 | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 2 | 2 |
| **CO3** | 2 | 3 | 2 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 2 |

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| **SEMESTER: V****PART: III** | **COURSE CODE: 22UEVME58****COURSE TITLE: 1. FOREST CONSERVATION AND MANAGEMENT** | **CREDITS: 3****HOURS: 4/W** |

**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.

**CourseOutcomes**

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.

**Suupplementary 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 | 2 | 3 |
| **CO3** | 2 | 2 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: V****PART: III** | **COURSE CODE: 22UEVME58****COURSE TITLE: 2. ENVIRONMENTAL EDUCATION AND AWARENESS** | **CREDITS: 3****HOURS: 4/W** |

**Course Objectives**

* + - 1. To understand the meaning and importance of environmental education.
			2. To know the methodologies of environmental education.
			3. To make the school students to acquire knowledge on environmental awareness.
			4. To make the college students to acquire knowledge on environmental awareness.
			5. To make the public to acquire knowledge on environmental awareness.

**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 for** general public

Environmental Awareness for general public, Planning, preparation and Implementation

**CourseOutcomes**

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.

**Textbooks**

1. UNEP. *Public Environmental Awareness and Education*, 2007
2. MOEF. *National Environment Awareness Campaign.2011-2012*, Ministry of Environment & Forests. Government of India Paryavaran Bhawan Cgo Complex Lodhi Road, New Delhi.

**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. (2000). *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.
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**

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

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| **SEMESTER:V****PART:IV** | **COURSE CODE: 22UEVMS59****COURSE TITLE : REMOTE SENSING AND GIS** | **CREDIT:2****HOURS:2/W** |

**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.

**ReferenceBooks**

* + - 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. *RemoteSensingandDigitalImageProcessing*. 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 | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 2 | 3 | 2 | 3 | 3 |

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| **SEMESTER: VI****PART: III** | **COURSE CODE: 22UEVMC61** **COURSE TITLE - WILDLIFE CONSERVATION BIOLOOGY AND MANAGEMENT** | **CREDIT: 4****HOURS: 5/W** |

**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.

**Textbooks**

1. Krishnamoorthy,KV, (2002). *An Advanced Textbook of Biodiversity:Principles and Practices*, Oxford and IBH.Publ.co.New Delhi.

2. Odum, E.P, (1971). *Fundamentals of ecology*, WB SoundersCo. Philadelphia and London.

3. Melchiar, G. (2002). *Biodiversity and Conservation*, Oxford IBH, New Delhi.

**Reference Books**

1. BharuchaErach, (2002). *TheBiodiversityofIndia*,MapinPublishingPvt.Ltd.,Ahmedabad,India.

2. Singh, S.K (2020). *Textbook of Wildlife Management*, (3rd ed.), CBS.

# 3. Gupta, T. (2017). *Ecology, Wildlife Conservation and Management*, (1st ed.), EBH Publishers, India.

**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** |
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| **CO2** | 3 | 2 | 3 | 2 | 2 |
| **CO3** | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
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| **SEMESTER: VI****PART: III** | **COURSE CODE:22UEVMC62****COURSE TITLE: NATURAL HAZARD AND DISASTER MANAGEMENT** | **CREDITS:4****HOURS:5/W** |

**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-I: 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-II: 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 -III: 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-IV: 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 -V: 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).

**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 disastermanagement.

5. Disaster management program.

**Textbooks**

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

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

3. Carter, N.W. (1992). *Disaster Management: A Disaster Manager’s Hand book*, AsianDevelopment Bank, Manila.

4. Diwan , P. (2010). *A Manual On Disaster Management*, Pentagon Earth, NewDelhi.

5. Zschau, J and Kuppers, N.(2003). *Early Warning Systems for Natural Disaster Reduction*, Springer-Verlag, USA.

**Reference Books**

**1.** Singh, R.B. (2006). *Natural Hazards and Disaster Management-Vulnerability and mitigation*, Rawat Publications.

2. Foster, H.D. (1980). Disaster Planning: The Preservation of Life and Property, Springer Verlay, NewYork.

3. Mishra, G.K. and Mathur, G.C. (1993). *Natural Disaster Reduction*, Reliance Publishing House,NewDelhi.

**Supplementary reading:**

1. [*https://www.GIS.Development.net*](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** |
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| **SEMESTER:VI****PART:III** | **COURSE CODE: 22UEVMC63****COURSE TITLE: ENVIRONMENTAL LAWS AND POLICIES** | **CREDIT:4****HOURS:4/W** |

**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: NTRODUCTION 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.

**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.

**Textbooks**

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

2.Agarwal, V.K.(2005). *Environmental Laws in India,Challenges for Enforcement*, Bulletin of The National Institute of Ecology.

3. Jadhav, H. and Bhosale, Y.M. (1995). *Environmental Protection & Laws*,Himalayan Publications,NewDelhi.

4. Diwan, S. and Rosencranz, A. (2002). Environmental Law and Policy inIndia: Cases, Materials and Statues ,Oxford University Press.

**Reference Books**

1. Nanditha Krishna, (1998). *Environmental Laws of India-An Introduction*,C.P.R. Environmental Education Center,Chennai.

2. Anil Agarwal and Sunita Narain (1985). *The State of India's Environment, 1984–85: The Second Citizens' Report*, The Centre for Science and Environment, New Delhi.

.**Supplementary Readings:**

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

**Outcome Mapping**

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
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| **SEMESTER :V****PART: III** | **COURSE CODE : 22UEVMP 55 and 64****COURSE TITLE : ENVIRONMENTAL IMPACT ASSESSMENT AND COMPUTERS IN ENVIRONMENT** | **CREDITS : 4****HOURS : 3/W** |

Practicals

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. Creating, saving and closing a work sheet
8. Prepare a Calendar for the current year using dragging method
9. To apply filter in a worksheet
10. Compute mean, Median ,Mode and standard deviation using built-in functions
11. Sorting data ,Creating pie & bar chart in MS Excel .
12. Creating a web page with simple formatting tags, lists, inserting image.

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| **SEMESTER:VI****PART:III** | **COURSE CODE: 22UEVMP 56 and 65****COURSE TITLE : POLLUTION MANAGEMENT AND WASTE HANDLING AND RECYCLING TECHNIQUES** | **CREDIT:3****HOURS:4/W** |

Practicals

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 – land fills.
11. Demonstration of waste Recycling methods.
12. Preparation of vermin compost kitchen waste.

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| **SEMESTER:VI****PART:III** | **COURSE CODE:22UEVME66****COURSE TITLE :**1. **ENVIRONMENTAL ECONOMICS**
 | **CREDIT:3****HOURS:4/W** |

**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**–**EcologicalEconomics - 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** |
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| **CO2** | 3 | 2 | 3 | 3 | 2 |
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| **CO5** | 3 | 3 | 2 | 3 | 3 |

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| **SEMESTER: VI****PART: III** | **COURSE CODE:22UEVME66****COURSE TITLE :**1. **WASTE HANDLING MANAGEMENT**
 | **CREDIT: 3****HOURS: 4/W** |

**Course Objectives**

1. To study various types of waste and its management

2. To know collection, transfer and transportation of solid wastes

3. To learn skills in establishing waste management unit

4. To develop skills on processing techniques of waste handling management

5. To know the role of Government and Non-government agencies on waste handling

**UNIT I: Introduction to Municipal solid waste**

Definition - Sources and types of solid waste- composition, Solid waste generation-quantity assessment of solid wastes.

**UNIT II: Compilation and transportation:**

Collection of Solid waste – collection system, equipments. Transfer and Transport: types –and methods, Operation & maintenance.

**UNIT III: Processing and Recovery Techniques**

 Purposes mechanical volume reduction, chemical volume reduction – incinerators –drying and dewatering. Recovery of Resources, conversion products and energy recovery.

**UNIT IV: Disposal of Solid Wastes**

Types of solid waste disposal – incinerations, sanitary landfill, gas and leachate control – necessary equipments.

**UNIT V: Role of government and Non-governmental agencies**

Governmental organization – Central and State governmental agencies – Non-governmental organization–Public awareness. Lab scale study on vermicomposting.

**Course Outcomes**

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

1. Recall the sources and types of waste & their characteristics

2. Compare waste transportation & disposal methods, sanitary land filling Techniques.

3. Explain solid waste disposal techniques

4. Discuss the ethical and socio-economic issues related to Rag-Pickers

5. Recommend the 4 Rs – Reduction, Reuse, Recycle and Recovery strategies

**Textbooks**

1. Chandrappa, R and Das, D. B. Solid Waste Management Principles and Practice. Springer, Verlag- Heidelberg, 2012. ISBN: 978-3-642-28681-0

2. Subash Anand, Solid Waste Management. Mittal Publications, New Delhi, 2010.

**Reference Books**

Santra, S. C. Environmental Sciences. NBCA, Kolkata, India, 2011. ISBN: 978-8173814044

2. Young, G C. Municipal Solid Waste to Energy Conversion Process- Economic, Technical and Renewable Comparisons. John Wiley and sons Inc. NJ, USA, 2010. ISBN: 978-0470539675 WEB

**Supplementary Readings**

1. [www.satavic.org/vermicomposting.htm](http://www.satavic.org/vermicomposting.htm)
2. [www.encapafrica.org/EGSSAA/solidwaste.pdf](http://www.encapafrica.org/EGSSAA/solidwaste.pdf)

Outcome Mapping

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| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
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| **SEMESTER: VI****PART: IV** | **COURSE CODE:22UEVMS68****COURSE TITLE: ENVIRONMENTAL BIOTECHNOLOGY AND** **HERBAL SCIENCE** | **CREDITS: 2****HOURS: 2/W** |

**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-II: AGRICULTURAL BIOTECHNOLOGY**

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

**UNIT -III: 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.

**Course Outcomes**

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. Arumugam, N. andV. Kumaresan, (2016). *Applied Plant Biotechnology*. Saras Publication, Nagarcoil.

2. Kumaresan, V. (2015). *Herbal Biotechnology andPharmacognosy,* Saras Publication, Nagarcoil.

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

1. Evans,G.G.&Furlong,J. (2010).*EnvironmentalBiotechnology:TheoryandApplication*(2ndedition).Wiley-Blackwell Publications.

**Reference Books**

1. Scagg, A.H. (2005). *Environmental Biotechnology*. Oxford University Press.

2. Wainwright, M. (1999). *An Introduction to Environmental Biotechnology*. Springer.

3.Jordening,H.J.&WinterJ.(2005).*EnvironmentalBiotechnology:ConceptsandApplications*.JohnWiley& Sons.

4..Rittman,B.E.&McCarty,P.L.2001.*EnvironmentalBiotechnology.PrinciplesandApplications.*McGraw-Hill, New York.

**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

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