M.Sc. Environmental Science

Syllabus (CBCS)

New Syllabus for Semester III & IV

With Effective from Academic Year 2024-2025

Dept. of Botany
Palamuru University
Mahabubnagar

SEMESTER - I					
S.NO	Subject Code	Paper No. and Subject Title	Credits	Hrs/Week	Total Marks
		THEORY			
1.	ES.101 T–(Paper I)	**Paper-I: Environmental Chemistry**	**3**	**3**	**100** (Int. 40, Ex.60)
2.	ES102 T–(Paper II)	**Paper-II: Climatology**	**3**	**3**	**100** (Int. 40, Ex.60)
3.	ES.103 T–(Paper III)	**Paper-III: Air pollution and control**	**3**	**3**	**100** (Int. 40, Ex.60)
4.	ES.104 T–(Paper IV)	**Paper-IV: Environmental Instrumentation and Methods**	**3**	**3**	**100** (Int. 40, Ex.60)
		Practicals			
5.	ES.105 P–(Paper 1)	Paper-I	**2**	**4**	**50**
6.	ES.106 P–(Paper 2)	Paper-II	**2**	**4**	**50**
7.	ES.107 P–(Paper 3)	Paper-III	**2**	**4**	**50**
8.	ES.108 P–(Paper 4)	Paper-IV	**2**	**4**	**50**
		Total	**20**		**600**

SEMESTER - II					
S.NO	**Subject Code**	**Paper No. and Subject Title**	**Credits**	**Hrs/Week**	**Total Marks**
		THEORY			
1.	ES.201 T–(Paper I)	**Paper-I: Environmental Microbiology**	**3**	**3**	**100** (Int. 40, Ex.60)
2.	ES.202 T-(Paper II)	**Paper-II: Ecology and Ecosystem Dynamics**	**3**	**3**	**100** (Int. 40, Ex.60)
3.	ES.203 T - (Paper III)	**Paper-III :Wastewater Treatment Technology**	**3**	**3**	**100** (Int. 40, Ex.60)
4.	ES.204 T - (Paper IV)	**Paper-IV :Geo Environment**	**3**	**3**	**100** (Int. 40, Ex.60)
		Practicals			
5.	ES.205 P(Paper 1)	Paper-I	**2**	**4**	**50**
6.	ES.206 P(Paper 2)	Paper-II	**2**	**4**	**50**
7.	ES.207 P(Paper 3)	Paper-III	**2**	**4**	**50**
8.	ES.208 P(Paper 4)	Paper-IV	**2**	**4**	**50**
		Total	**20**		**600**

SEMESTER - III					
S.NO	**Subject Code**	**Paper No. and Subject Title**	**Credits**	**Hrs/Week**	**Total Marks**
THEORY					
1.	ES - 301T(Core Paper-I)	**Core Paper I: Water Treatment and Solid Waste Management**	**3**	**3**	**100** (Int. 40, Ex.60)
2.	ES-302 T(Core Paper-II)	**Core Paper II: Remote Sensing and GIS**	**3**	**3**	**100** (Int. 40, Ex.60)
3.	ES.-303 T(Paper-III)	**Paper III : Biodiversity and Conservation**	**3**	**3**	**100** (Int. 40, Ex.60)
4.	ES-304 T(Paper-IV)	**Paper IV : Resource Management**	**3**	**3**	**100** (Int. 40, Ex.60)
Practicals					
5.	ES.305 P –(Core Paper 1)	Core Paper I - Practical Lab	**2**	**4**	**50**
6.	ES.306 P – (Core Paper 2)	Core Paper II - Practical Lab	**2**	**4**	**50**
7.	ES.307 P-(Paper-3)	Paper III	**2**	**4**	**50**
8.	ES.308 P -(Paper-4)	Paper IV	**2**	**4**	**50**
		Total	**20**		**600**

SEMESTER - IV					
S.NO	**Subject Code**	**Paper No. and Subject Title**	**Credits**	**Hrs/Week**	**Total Marks**
THEORY					
1.	ES.401 T–(Core Paper I)	**Core Paper I: Environmental Biotechnology**	**3**	**3**	**100** (Int. 40, Ex.60)
2.	ES.402 T–(Core Paper II)	**Core Paper II: Environmental Toxicology**	**3**	**3**	**100** (Int. 40, Ex.60)
3.	ES.403 T–(Paper III)	**Paper III: Urban Ecosystems and Green Chemistry**	**3**	**3**	**100** (Int. 40, Ex.60)
Practicals					
4.	ES.404 P–(Core Paper 1)	Core Paper - I	**2**	**4**	**50**
5.	ES.405 P–(Core Paper 2)	Core Paper- II	**2**	**4**	**50**
6.	ES.406 P–(Paper 3)	Paper – III	**2**	**4**	**50**
7.	**Project**	**Project**	**5**	**4**	**150**
	Seminar	**Seminar**		**2**	
		Total	**20**		**600**

M.Sc. III-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS

ES -301 T (Paper –1): WATER TREATMENT AND SOLID WASTE MANAGEMENT

Unit I

1. Water Health and Sanitation- Water borne diseases

2. Need for public water supply schemes (Urban and Rural)

3. Sources of water - Surface sources - Sub surface sources- Selection of water for Protected water supply

4. Water Demand and Quality

5. Design Period -Per Capita Demand -Population Forecast- Fire Fighting-Industrial and other needs

Unit II

1. Drinking water quality- Standards CPHEEO-BIS-WHO guidelines -Need for water treatment.

2. Conventional Water Treatment Methods - Slow sand filters -Rapid sand filters –Pressure Filters

3. Criteria for good disinfection-Chlorination-Ozonization-UV rays

4. Water softening by deflouridation-Removal of Iron-Manganese -Colour- Control of taste and odours

5. Urban Local Bodies-Service Level Bench Marks (SLB's) for water supply and Solid Waste Management

Unit III

1. Solid Wastes-Types- Source - Dumping of garbage from Houses, Hotels and hospitals

2. Deposition of xenobiotics in soil-Effects on soil and public health

3. Solid wastes disposal – Incinerators -Sanitary Land Filling

4. Pit Dumping –Composting- Recycling

5. Municipal Solid Waste Management and Handling Rules 2000- Bio-medical waste management Rules 2016- Plastic Waste Management Rules 2022

Books Recommended

1. Text books of Water Supply & Sanitary Engineering: S.K. Garg, Oxford IBH Publ.

2. Water Supply and Sanitary Engineering: H.S. Birdi New Delhi.

3. Environmental Engineer's Hand Book. Vol 1,2,3 (Ed.) Bela G. Liptak, Chilton Book Company, Radnor, PennsylVania, 1975.

4. Standard methods for the Examination of water and waste water- 19th Ed. 1995. Andrew and Eaton - APHA.

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M.Sc. ENVIRONMENTAL SCIENCE

(Practical Syllabus)

ES -305 P (Paper –1): WATER TREATMENT AND SOLID WASTE MANAGEMENT

1. Calculate the Design Period, Per Capita Demand and Population Forecasting
2. Coagulation by chemical methods (Aluminium Sulphate, Ferrous Sulphate)
3. Sedimentation by Gravitational method Volume Index (SVI)
4. Water treatment by Filtration (Sand/Activated Carbon)
5. Disinfection by Chlorination
6. Solid waste – Identification and classification
7. Characterization of Municipal Solid Waste
8. Characterization of coal/fly ash/metal
9. Preparation of Vermi-composting by various organic materials
10. Service Level Benchmarks (SLB's) for Water and SWM of Municipalities

M.Sc. III-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS

ES- 302 T (Paper –2): REMOTE SENSING AND GIS

Unit I

1. Fundamentals and Principles of Remote Sensing (Optical/Microwave)

2. Physical principles - Aerial photography -Image systems –Satellites- Sensors -Data Generation and Products Data Indexing

3. Principles of image interpretation -Visual image Interpretation- Image Elements Visual Interpretation Aids

4. Digital Processing- Image Enhancement-Image Classification and Image processing systems

5. Advantages and limitations of visual and digital interpretation for environmental studies

Unit II

1. Application of remote sensing - Urban landscape mapping - Industrial land use

2. Remote sensing for vegetation-Spectral Characters of Vegetation

3. Land Scape Ecology- Remote Sensing for Vegetation Change

4. Remote Sensing for Surface Water -Biophysical Characteristics -Remote Sensing for

Soil Properties (Soil Texture ,Moisture Content, Soil Organic Matter)

5. Remote Sensing for Flood Mapping - Flood Damage Assessment - Drought Assessment -Watershed Management

Unit III

1. GIS and GPS System- GIS Concepts -Spatial and Attribute Data - Data Structures Vector andRaster Data

2. Map Features -Data Inputting -Data Storage -Data Manipulation- Data Analysis, Output Generation -Hardware and Software requirement

3. Application of GIS for Environmental Studies

4. GIS as Decision Support System - GPS: Concepts - Available Constellations - Accuracy - Types of Errors

5. Types of GPS Machines -Applications for Environmental Studies -Interface of GPS Data with GIS

Books Recommended

1. Remote sensing and Image interpretation. Thomas M. Lillesand and Ralph W. Keifer, John Wiley & Sons Inc. New York.

2. Introduction to Remote Sensing, James B. Campbell, Tylor& Francis Ltd, London.

3. Fundamentals of GIS Micheal N. Demers.

4. Remote sensing applications in applied geosciences by Sumitra Mukherjee, Milton Book Company.

5. Environmental Geography, H.M. Saxena, Milton Book Company

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M.Sc: ENVIRONMENTAL SCIENCE

(Practical Syllabus)

ES -306 P (Paper –2): REMOTE SENSING AND GIS

1. Study of toposheet and base map preparation
2. Description of satellite and sensor details of the imagery used for thematic mapping
3. Land use/land cover map preparation
4. Scanning/digitization of maps
5. Digital image display and image enhancement
6. Image Registration- Ground Control Points from toposheets (GCP)
7. Geo Referencing
8. Image classification for land use/land cover using ERDAS
9. Digital Mapping: GIS software, ARC GIS and Geo-Server
10. Application of Global Positioning System (GPS)

M.Sc. III-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS

ES - 303 T (Paper –III): BIODIVERSITY AND CONSERVATION

Unit I

1. Biodiversity-Definition – Biodiversity Types - Global Biodiversity
2. Bio-geographical classification of India
3. Value of biodiversity- Direct use value - Consumptive value- Millets Benefits
4. Endemism and Biodiversity -Key stones species, Umbrella species, Flagship species
5. Loss of biodiversity- Peoples Biodiversity Registers (PBR's)

Unit II

1. India as a mega biodiversity nation
2. Bio-wealth of India – Forests- Deserts –Wetlands –Mangroves-Coral reefs -Rivers and lakes
3. Identification of Hot spots - Hot spots of India.
4. Extinct – Rare- Endangered- Threatened Flora and Fauna of India
5. IUCN Red List categories - Red Data Book and its significance - Conventions – CBD, CITES

Unit III

1. Conservation of biodiversity
2. Principles of conservation In-situ conservation - Protected areas -National parks- Wild life sanctuaries-Biosphere reserves- Sacred groves
3. Ex-situ conservation - Botanical gardens -Zoo parks
4. Role of NBPGR -NBAGR in the conservation of bio diversity
5. Policies on biodiversity conservation in India

Books Recommended

1. Global Biodiversity Assessment V.H.Heywood and RT Watson, Cam.univ.pre-1995.
2. Biodiversity principles and conservation Kumar and Asija Agrobios India-2000.
3. Essential Environmental studies S.P.Misra and S.N.PandeyAne Books India -2008.

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M.Sc. ENVIRONMENTAL SCIENCE

(Practical Syllabus)

ES - 307 P (Paper –III): BIODIVERSITY AND CONSERVATION

1. Important value index (IVI)
2. Similarity and Dissimilarity index
3. Diversity index
4. Identification of Endemic plant species
5. Identification of Medicinal plants
6. Identification of Exotic plants
7. Economic value species
8. Vegetation and Biodiversity
9. Identification of Millets and its importance
10. Preparation of Peoples Biodiversity Registers of a Village

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M.Sc. III-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS

ES -304 T (Paper –IV): RESOURCE MANAGEMENT

Unit I

1. Energy Resource -Source of Energy -Renewable and Non-renewable -Solar energy

Wind energy-Tidal energy- Hydroelectric-Nuclear energy- Bio-energy

2. Biomass and Biogas-Eco-technology - Sustainable development

3. Mineral resources –Types- Mineral exploration-Methods of minerals extraction

4. Impact of over- Exploitation of minerals-Environmental effects of extraction

5. Fossil Fuels – Classification- Composition, and Characters of the energy content of

Coal, Petroleum and Natural Gas

Unit II

1. Water resource - Global water balance, ice sheets and Fluctuation of sea levels

2. Types of water, overutilization of Surface and Groundwater

3. Conservation of water- Rain water harvesting

4. Eutrophication and Restoration of Indian lakes

5. Wetland conservation-Watershed management

Unit III

1. Land Resources - Land as resource land degradation causes -Man induced Landslides

2. Soil erosion-Prevention of Soil erosion

3. Forest Resources- Forest Distribution-Deforestation - Causes of deforestation

4. Conservation of forest -Production forestry – Aforestation- Social forestry- Agroforestry - Protection of Forestry Reforestation of Sacred Forest -Reserve Forest

5. Social movements - Chipko movement - Apikko movement

Books Recommended

1. PD Sharma. 1996 Ecology and environment

2. Misra. S.N. 2010 Pandey Essential Environmental studies

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B. Krishna Murthy

M.Sc. ENVIRONMENTAL SCIENCE

(Practical Syllabus)

ES - 308 P (Paper –IV): RESOURCE MANAGEMENT

1. Production of biogas
2. Production of Hydrogen gas
3. Production of vermicompost
4. Rainwater harvesting -estimation of the quantity of rain on the rooftop
5. Techniques of restoration of lakes
6. Techniques of conservation of Wetlands
7. Identification of different types of coal
8. Finding the calorific value of coal
9. Quantitative Estimation of Conversion of inorganic carbon to organic carbon by plants.
10. Quantitative estimation of Oxygen released into the atmosphere by plants.

M.Sc. IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES -401 T (Core Paper –1): ENVIRONMENTAL BIOTECHNOLOGY

(THEORY)

ES.401 T **(CORE)** **3 Hrs/week 2 Credits**

Unit -I

1.Biodegradation and Bioremediation- Degradation of Cellulose-Hemicelluloses -Lignin

2.Biodegradation of pesticides- Aromatic and Aliphatic Hydrocarbons Bioremediation in-situ and ex-situ, Bioremediation of contaminated soils Phytoremediation- Rhizofilteration- Phytoextraction- Phytotransformation Phytostimulation- Phytostabilisation

3.Bioindicators- Algae and macrophytes

Unit-II

1.Biofertilizers and Biopesticides- Mass cultivation and application of Rhizobium, BGA, Azolla and Anabena

2.Blue-green algae - reclamation of alkaline and saline soils

3.Symbiotic cyanobacteria –Algalization-BGA and nitrogen fixationFungal biofertilizers - AM mycorrhiza and ectomycorrhiza, Vermicomposting. Isolation and purification of important biopesticides: Trichoderma PseudomonasBacillus thuringensis, Nuclear polyhodrosis virus

Unit III

1. Industrial Microbiology- Fermentation technology- Bio-fermentors -Major products of microbes -Alcohols, Antibiotics, Aminoacids and Organic acids

2. Immobilization technology -Methods of Immobilization and applications

3.Hydrogen Evolving bacteria - Methanogenesis

4.Biomining:. Microorganisms in mineral recovery, indirect leaching, and direct leaching

5.Biosurfactants, definition, classification, types and their application in environment, petroleum recovery and other fields

M.Sc. IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES -404 P (Core Paper –1): ENVIRONMENTAL BIOTECHNOLOGY

(Practical)

ES-404P **(CORE)** **4 Hrs/week 2 Credits**

1. Demonstration of agarose gel electrophoresis
2. Biosurfactant isolation and its characterization
3. Demonstration of the fermenterand its part andits functioning
4. Use of microbes in fermentation technology (Alcohols, Antibiotics) Isolation of pure cultures in fermentation processes.
5. Cellulose and lignin-degrading enzymes
6. Experiment showing Phytoremediation
7. Bio-indicators: Use of Biological organisms
8. Role of Biofertilizers in the Environment Vermicomposting
9. Reclamation of soils

Core Paper –1: Environmental Biotechnology- Practical Model Paper

Time- 3hrs	**50 marks**
1. Major Experiment	14M
2. Minor Experiment (2X5)	10M
3. Spotters 4 (4x4)	16M
4. Record and Viva	10M

MSc_ IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES -402 T (Core Paper —2): ENVIRONMENTAL TOXICOLOGY

(THEORY)

ES.402 T **(CORE)** **3 Hrs/week 2 Credits**

Unit I

1.Basic concepts of Eco-toxicology - Introduction to eco-toxicology - Principles of toxicology- Scope of toxicology

2.Types of toxic substances - Degradable and Non-Degradable

3. Factors influencing toxicity-Drug Toxicity

4. Biochemical basis toxicity — Mechanism of toxicity and receptor mediated events, Acute And Chionic toxicity

5. Toxic agents- Metals —Solvents -Vapours - Radiation -Chemical carcinogens- Food additives

Unit II

1.Toxic substances in the environment - Sources and Entry routes

2.Transport of toxicants by air and water: Transport through food chain bioaccumulation and biomagnifications of toxic materials in food chain.

3.Toxicology of major pesticides- Biotransformation — Biomonitoring -Concept and groups of bio-indicators

4.Environmental impacts of pesticides

5.Physiological and metabolic effects of chemicals on flora and fauna.

Unit III

I. Evaluation of toxicity -Methods and classification of toxic materials

2. Concepts of Bioassay- Types- Characteristics

3. Importance and significance of bioassay- Microbial bioassay for toxicity testing-Bioassay test models and classification.

4. Threshold limit value- LC_{50}- LD_{50}-Toxicity Testing -Concept of Dosimetry: lethal, sub-lethal and chronic tests

5. Dose response curves

Books Recommended

1. Principles of Environmental Toxicology: I. C. Shaw and J. Chadwick; Taylor &Francis Ltd

2.Environmental biology and Toxicology, by Sharma P.D. Rastogi and Lamporary., 1994.

3. Environmental Pollution and Toxicology — Meera Asthana and Astana D.K., Alka printers, 1990.

4. D.K Asthana Environmental: Problems and Solutions (2005)

5.Basic Toxicology, Frank .C. Lu, Hemisphere Publishing Corporation. New York. Washington (1993)

M.Sc. IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES -405 P (Core Paper —2): ENVIRONMENTAL TOXICOLOGY

(Practical)

ES-405P **(CORE)** **4 Hrs/week 2 Credits**

1.Effect of effluents containing heavy metals on seed germination

2.Determination of LC50 and LD50

3.Methylene Blue Reduction Test (MBRT) for testing milk samples

4.Identification of residues of Pesticides on fruits/vegetables

5.Effect of sewage sludge containing heavy metals on seed germination

6.Determination of dust accumulation on leaf samples for polluted and control environment

7.Test of carbohydrates and proteirriTin food stuffs

8.Determination/estimation of adulterants in food samples

9.Toxic effect on chlorophyll content of the plants exposed to toxicants/pollutants

Study of symptoms and effects of heavy metals on plant growth

Core Paper —2 : ENVIRONMENTAL TOXICOLOGY

Time- 3hrs	**50 marks**
1. Major Experiment	14M
2. Minor Experiment (2X5)	10M
3. Spotters 4 (4x4)	16M
4. Record and Viva	10M

MSc_ IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES 403 T (Paper-III)URBAN ECOSYSTEMS AND GREEN CHEMISTRY

(THEORY)

ES.403 T **(CORE)** **3 Hrs/week 2 Credits**

Unit I

1. Introduction to Urbanization – Urban Sprawl and Environmental issues

2.Urban ecosystem – commodization of nature metros,cities and towns as sources and sinks of resources

3.Resource Consumption and its social, cultural, economic and ecological perspectives

4.Urban transformation causes

5.Increasing challlengesposed by modernity for the environment

Unit II

1. Natural spaces in a city - Scope -Importance - Threats to nature in the city

2. Organization and planning of green spaces such as Parks, Gardens and Public spaces

3. Concept of green belts; urban natural forest ecosystem as green lungs

4. Introduction to Green buildings- Urban Governance - Smart cities

5. Management of Urban Environment

Unit III

1. Introduction to Green Chemistry- Principles and recognition of green criteria in chemistry

2. Biodegradable and bio-accumulative products in environment

3. Green alternatives- Photodegradable plastic bags - Green practices to conserve natural resources (organic agriculture, agro-forestry, reducing paper usage and consumption)

4. Waste reduction instead of recycling - Carbon Credits

5. Role of advancement in science in developing environmental friendly technologies

Books Recommended

1. Gaston, K.J. 2010. Urban Ecology. Cambridge University Press, New York.

2. Richter, M. & Weiland, U. (ed.). 2012. Applied Urban Ecology. Wiley-Blackwell, UK.

3. Anastas, P.T. & Warner, J.C. 1998. Green Chemistry: Theory & Practice. Oxford University Press.

4. Arceivala, S.L. 2014.

5. Green Technologies: For a Better Future. Mc-Graw Hill Publications.

M.Sc. IV-SEMESTER ENVIRONMENTAL SCIENCE SYLLABUS
ES -406 P (Paper-III)URBAN ECOSYSTEMS AND GREEN CHEMISTRY

(Practical)

ES-406P **(CORE)** **4 Hrs/week 2 Credits**

1. Estimate the carbon credits of various activities
2. Identify the greenbelt areas, types of plants and measures for improvement
3. Determination of carbon footprint of solid waste
4. Prepare the green audit of selected areas
5. Identify the urban green space (parks and garden) and explore the types of plants with its importance
6. Preparation of briquettes from municipal solid waste
7. Reuse and recycle of construction and demolition waste
8. Reuse and recycling of plastic items
9. Study the types of biogas plant and biogas production from organic waste
10. Combustion efficiency evaluation -design of a biomass cook stove

Core paper-III: URBAN ECOSYSTEMS AND GREEN CHEMISTRY-Practical Model Paper

Time- 3hrs	**50 marks**
1. Major Experiment	14M
2. Minor Experiment (2X5)	10M
3. Spotters 4 (4x4)	16M
4. Record and Viva	10M