A) **Course Information: Environmental Science, B.Sc.ES, 6 semesters**
- Study Level: Undergraduate Study Degree
- Duration: 6 Semesters
- Total Credits: 180 ECTS

B) **Modules**

Semester 1 Modules	Module Code	Study Hours	Credits
Introduction to Environmental Science	ES101	60	10
Chemistry for Environmental Science	ES102	45	8
Biology and Ecology	ES103	45	8
Mathematics for Environmental Science	ES104	30	6
Communication Skills	ES105	30	6

Semester 2 Modules	Module Code	Study Hours	Credits
Environmental Physics	ES201	60	10
Geology and Soil Science	ES202	45	8
Environmental Policies and Regulations	ES203	45	8
Statistics for Environmental Science	ES204	30	6
Research Methods	ES205	30	6

Semester 3 Modules	Module Code	Study Hours	Credits
Environmental Microbiology	ES301	60	10
Environmental Impact Assessment	ES302	45	8
Climate Science and Policy	ES303	45	8
Environmental Economics	ES304	30	6
Geographic Information Systems (GIS)	ES305	30	6

Semester 4 Modules	Module Code	Study Hours	Credits
Environmental Law and Ethics	ES401	60	10
Water Resources Management	ES402	45	8
Air Quality Management	ES403	45	8
Renewable Energy Technologies	ES404	30	6
Environmental Data Analysis	ES405	30	6

Semester 5 Modules	Module Code	Study Hours	Credits
Sustainable Land Use Planning	ES501	60	10
Conservation Biology	ES502	45	8
Environmental Sociology	ES503	45	8
Environmental Education and Communication	ES504	30	6
Research Project I	ES505	30	6

Semester 6 Modules	Module Code	Study Hours	Credits
Environmental Management and Leadership	ES601	60	10
Disaster Management	ES602	45	8
Urban Ecology	ES603	45	8
Research Project II	ES604	30	6
Elective Module I	ES605	30	6
Elective Module II	ES606	30	6

C) Main Aims and Objectives

1. Develop a holistic understanding of environmental systems.
2. Equip students with the skills to analyze environmental issues.
3. Foster critical thinking for sustainable solutions.
4. Cultivate ethical and responsible environmental stewardship.
5. Enhance communication and collaboration skills.
6. Promote interdisciplinary approaches to problem-solving.
7. Develop proficiency in environmental research methods.
8. Understand the role of policies in environmental management.
9. Encourage practical fieldwork and laboratory skills.
10. Instill awareness of global environmental challenges.
11. Foster an appreciation for cultural and social dimensions of environmental issues.
12. Facilitate the development of leadership and teamwork skills.
13. Encourage innovation and creativity in sustainable practices.
14. Provide exposure to diverse ecosystems and environmental contexts.
15. Prepare students for careers in environmental science.

D) Outline of The Syllabus Per Semester

Semester 1 Modules

1. Introduction to Environmental Science (ES101)
   - Basics of Environmental Science
   - Historical Perspectives
   - Interdisciplinary nature of Environmental Science

2. Chemistry for Environmental Science (ES102)
   - Fundamental principles of chemistry
   - Chemical processes in the environment
   - Environmental chemistry applications

3. Biology and Ecology (ES103)
   - Introduction to Biology
   - Ecosystems and Biodiversity
   - Ecological Interactions

4. Mathematics for Environmental Science (ES104)
   - Basic Mathematical Concepts
   - Applied Mathematics in Environmental Science

5. Communication Skills (ES105)
   - Written and Oral Communication
   - Scientific Writing
   - Presentation Skills

Semester 2 Modules

6. Environmental Physics (ES201)
   - Fundamentals of Physics
   - Applications in Environmental Science

7. Geology and Soil Science (ES202)
   - Geologic Processes
   - Soil Formation and Composition

8. Environmental Policies and Regulations (ES203)
   - Introduction to Environmental Policies
   - Regulatory Frameworks

9. Statistics for Environmental Science (ES204)
   - Statistical Methods
   - Data Analysis Techniques

10. Research Methods (ES205)
    - Scientific Research Process
    - Experimental Design

Semester 3 Modules
11. Environmental Microbiology (ES301)
    - Microorganisms in the Environment
    - Microbial Processes

12. Environmental Impact Assessment (ES302)
    - Principles of Environmental Impact Assessment
    - Case Studies

13. Climate Science and Policy (ES303)
    - Climate Change Science
    - Climate Change Policies

14. Environmental Economics (ES304)
    - Economic Concepts in Environmental Decision-Making
    - Cost-Benefit Analysis

15. Geographic Information Systems (GIS) (ES305)
    - Introduction to GIS
    - GIS Applications in Environmental Science

Semester 4 Modules
16. Environmental Law and Ethics (ES401)
    - Environmental Legislation
    - Ethical Considerations

17. Water Resources Management (ES402)
    - Water Cycle and Availability
    - Water Management Strategies

18. Air Quality Management (ES403)
    - Air Pollution Sources and Control
    - Monitoring and Management

19. Renewable Energy Technologies (ES404)
    - Introduction to Renewable Energy
    - Applications and Technologies

20. Environmental Data Analysis (ES405)
    - Data Collection and Analysis Techniques

Semester 5 Modules
21. Sustainable Land Use Planning (ES501)
    - Principles of Sustainable Land Use
    - Planning Strategies

22. Conservation Biology (ES502)
    - Biodiversity Conservation
    - Conservation Strategies

23. Environmental Sociology (ES503)
    - Societal Perspectives on the Environment
    - Social Impact Assessment

24. Environmental Education and Communication (ES504)
   - Educational Strategies
   - Public Outreach and Communication

25. Research Project I (ES505)
   - Planning and Execution of Research Project

Semester 6 Modules

26. Environmental Management and Leadership (ES601)
   - Principles of Environmental Management
   - Leadership Skills

27. Disaster Management (ES602)
   - Natural and Man-made Disasters
   - Preparedness and Response

28. Urban Ecology (ES603)
   - Ecological Aspects of Urban Environments
   - Sustainable Urban Planning

29. Research Project II (ES604)
   - Advanced Research Project

30. Elective Module I (ES605)
   - Specialized Elective Topic

31. Elective Module II (ES606)
   - Specialized Elective Topic

E) Practicals:
- Field trips to diverse ecosystems
- Laboratory experiments in chemistry, physics, and biology
- Data collection and analysis projects
- GIS and remote sensing applications
- Environmental impact assessment simulations
- Pollution monitoring and control exercises

F) Industrial Internship:
- Industry-specific projects
- Environmental compliance assessments
- Report writing and presentation skills
- Networking with professionals
- Exposure to real-world problem-solving

G) Research Topics
- Biodiversity conservation strategies
- Climate change adaptation measures
- Sustainable waste management solutions
- Environmental impact of urbanization
- Renewable energy implementation
- Ecotourism development
- Environmental education programs

H) Benefits for the Country
1. Enhanced environmental sustainability practices.
2. Skilled workforce for environmental management.
3. Improved environmental policies and regulations.
4. Innovative solutions for environmental challenges.
5. Strengthened national resilience to climate change.
6. Conservation of biodiversity and natural resources.
7. Heightened public awareness of environmental issues.
8. Enhanced disaster preparedness and response.

9. Development of eco-friendly industries.
10. Global recognition for environmental responsibility.
11. Increased research contributions to global environmental knowledge.
12. Cultural and social awareness fostering national unity.
13. Green job creation for economic development.
14. Improved international collaborations on environmental issues.
15. Sustainable development in line with global goals.

I) Learner's Entrepreneurship Benefits
1. Ability to start eco-friendly businesses.
2. Consulting opportunities in environmental impact assessment.
3. Entrepreneurial ventures in renewable energy.
4. Environmental consultancy services.
5. Development of sustainable technologies.
6. Eco-tourism entrepreneurship.
7. Green product development and marketing.
8. Sustainable agriculture initiatives.
9. Waste management and recycling enterprises.
10. Environmental education and training services.
11. Water and air quality monitoring services.
12. Carbon footprint assessment and management.
13. Conservation-based tourism enterprises.
14. Climate change adaptation consulting.
15. Advocacy and lobbying for environmental policies.

J) Importance of AI
1. Data analysis for environmental monitoring.
2. Predictive modeling for climate change impact assessments.
3. Automated sensor networks for real-time data collection.
4. AI-driven optimization of resource management.
5. Machine learning in biodiversity conservation strategies.
6. Smart technology applications for sustainable cities.
7. AI-assisted risk assessment for disaster management.
8. Remote sensing and satellite data analysis.
9. Automated reporting on environmental compliance.
10. AI-powered solutions for pollution monitoring.
11. Advanced GIS applications for environmental mapping.
12. Natural language processing for policy analysis.
13. AI-driven simulations for environmental scenarios.
14. Robotics in environmental fieldwork and monitoring.
15. AI in precision agriculture for sustainable food production.

How the Graduate will Apply AI
1. Data-driven decision-making in environmental policy.
2. AI-based tools for environmental impact assessments.
3. Automated systems for real-time pollution monitoring.
4. Predictive modeling for climate change adaptation planning.
5. Integration of AI in GIS applications for spatial analysis.
6. AI in remote sensing for accurate environmental mapping.
7. Machine learning algorithms for biodiversity conservation.
8. Automation of routine environmental data analysis tasks.
9. AI-assisted environmental risk assessment in industries.
10. Smart technology applications for sustainable urban planning.
11. AI in water and air quality management systems.
12. Robotics for efficient fieldwork in environmental research.
13. Integration of AI in renewable energy optimization.
14. AI-powered tools for precision agriculture.
15. Development and implementation of AI-driven environmental monitoring systems.

K) Inventions and Discoveries

1. AI-powered waste sorting and recycling system.
2. Smart sensors for real-time air and water quality monitoring.
3. AI-based early warning system for natural disasters.
4. Automated wildlife monitoring and conservation drones.
5. Smart agriculture solutions for sustainable farming.
6. AI-driven energy-efficient building designs.
7. Robotic systems for efficient environmental field surveys.
8. Machine learning algorithms for predicting disease outbreaks in ecosystems.
9. Automated systems for tracking and managing endangered species.
10. AI-assisted urban planning for sustainable and eco-friendly cities.
11. Precision farming tools for optimal resource use in agriculture.
12. Virtual reality simulations for environmental education and awareness.
13. AI-powered tools for optimizing renewable energy production.

E) Practicals

- Advanced laboratory experiments in environmental microbiology
- Field visits for real-world Environmental Impact Assessment projects
- GIS mapping and analysis projects
- Economic analysis of environmental policies and projects
- Application of climate models for scenario analysis
- Renewable energy technology demonstrations
- Water and air quality monitoring in real-world scenarios
- Environmental data analysis using statistical software