Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024								
Course Code	B150103T/ES127	**Title of the Course**	Environmental Chemicals and Toxicants	**L**	**T**	**P**	**C**	
Year	1st	**Semester**	I	3	1	0	4	
Pre-Requisite	10+2 with Science	**Co-requisite**	None					
Course Objectives	1. To comprehend the basics of environmental chemistry in a precise and compact way. 2. To provide understating of various aspects of chemicals and chemistry, which are particularly valuable to environmental scientific practice. 3. During this course you student will study the chemistry of air, water, and toxic organic compounds. 4. To lay a foundation for understanding in specialized areas of environment management and practices. 5. To provide student with an understanding of the fundamental chemical processes that are central to important environmental problems.							

	Course Outcomes
CO1	Identify and evaluate the relative importance of various reactions, physical processes and transport mechanisms affecting different chemicals in the environment.
CO2	Apply quantitative problem-solving skills to questions in environmental chemistry.
CO3	Compare/contrast the composition and temperature profile as well as predominant types of reactions in different regions of the atmosphere.
CO4	Creating models to predict consequences for the environment.
CO5	To use chemistry knowledge to find the most suitable measures, management methods and industrial solutions to ensure a sustainable use of the earth's resources and ecosystem service.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Fundamentals of Environmental Chemistry	Fundamental Concept & Scope of environmental chemistry, stoichiometry, Gibb's energy, chemical potential, chemical equilibria, acid base reactions.	8	CO1
2	General Principles of Environmental Chemistry	Pollutant, Contaminant, Receptor, Sink, pathways of Pollutant, Speciation, Dissolved Oxygen, Chemical Oxygen Demand, Biological Oxygen Demand, Threshold Limit Value, Elementary Idea on carbohydrates, Proteins & lipids.	6	CO2
3	Chemical Accidents	Bhopal gas tragedy (India), Love Canal tragedy (USA) etc.	6	CO2
4	Atmospheric Chemistry	Composition of Atmosphere, Particles, Ions and Radicals in the atmosphere, Chemical Processes for Formation of Inorganic Particulate Matter, Chemical Processes for formation of Organic Particulate matter, Chemical & Photochemical Reactions in the atmosphere.	8	CO3
5	Aquatic Chemistry	Properties of water, chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration.	8	CO4
6	Soil Chemistry	Composition of Lithosphere/soil, water and air in soil, Inorganic and organic components in soil, Micro and Macro nutrients, Nitrogen Pathways and NPK in Soil.	8	CO4
7	Environmental Chemistry	Toxic chemicals in the environment, Impact of Toxic chemicals on Enzymes, Biochemical effects of Arsenic, Biochemical effects of Cadmium, Biochemical effects of lead, Biochemical effects of Mercury, Biochemical effects of Carbon Monoxides, Biochemical effects of Pesticides.	8	CO5
8	Green Chemistry for Sustainable Future	Reagents, Media, Special Importance of Solvents, Water the Greenest Solvents, Synthetic and Processing Pathways, Role of Catalyst, Biological Alternatives, Biopolymers, Principles and Application of Green Chemistry, Zero waste technology.	8	CO5

Reference Books:

1. Baird and Colin "Environmental Chemistry"

2. Bailey, Clark , Ferris, Krause and Strong "Chemistry of Environment"

3. Manahan, Stanley E. Fundamentals of Environmental Chemistry Boca Raton: CRC Press LLC,200

e-Learning Source:

1- https://www.futurelearn.com/courses/atmospheric-chemistry-planets-and-life-beyond-earth

2- https://inside.mines.edu/~epoeter/_GW/17WaterChem1/WaterChem1pdf.pdf

3- https://www.studocu.com/row/document/university-of-eldoret/soil-chemistry/soil-chemistry-notes-2nd-part/2253260

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO6	PSO7
CO1	2	1	1	1		2							2	2	2			
CO2	2	1	1	1		2							2	2	2			
CO3	2	1	1	1		2							2	2	2			
CO4	2	1	1	1		2							2	2	2			
CO5	2	1	1	1		2							2	2	2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024							
Course Code	B150104P/ES128	**Title of the Course**	Toxicant Analysis Lab	**L**	**T**	**P**	**C**
Year	1st	**Semester**	I	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 with Science	**Co-requisite**	NIL				
Course Objectives	1. Familiarize with the water analysis techniques to analyse acidity and alkalinity 2. Gain knowledge on BOD and COD. 3. Understand the basics of soil analysis						

Course Outcomes	
CO1	To know the basic idea on techniques of water analysis and acidity alkalinity.
CO2	To get experience with the calculations of BOD and COD.
CO3	To Understand the basics of air quality monitoring.
CO4	To have an experience on soil analysis

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Determination of physical parameters of water quality	Estimation of various physical water quality parameters like turbidity and conductivity	15	**CO1**
2	Determination of chemical parameter of water quality	Estimation of chemical water quality parameters like pH, Conductivity, alkalinity, DO etc.	15	**CO2**
3	Determination of air pollutants	$PM_{2.5}$ and PM_{10}	15	**CO3**
4	Determination of soil quality parameters	Measurement of soil parameters like pH, EC etc.	15	**CO4**

Reference Books:
AMRITA, OLABS, Study of pollutants in Air.
AMRITA, OLABS, Studies on Turbidity, pH and Microbial Presence in Water.
AMRITA, OLABS, Study of pollutants in Air.

e-Learning Source:
1. https://www.acs.org/greenchemistry/what-is-green-chemistry/examples.ht
2. https://www.ysi.com/parameters
3. PM - Particulate Matter, https://youtu.be/ZUsNCq8acYM.
4. Monitoring methods for Air – PM, https://youtu.be/-uZURNKE4z8.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO6	PSO7
CO1	2	1	1	1		2							2	2	2	2		
CO2	2	1	1	1		2							2	2	2	2		
CO3	2	1	1	1		2							2	2	2	2		
CO4	2	1	1	1		2							2	2	2	2		
CO5																		

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow
Department of Environmental Science

					L	T	P	C
Effective from Session:
Course Code	**I150106T/ES131**	**Title of the Course**		Introduction to Natural Hazard and Disaster Management	L	T	P	C
Year	**1st**	**Semester**		I	2	1	0	3
Pre-Requisite	Basic science	**Co-requisite**		NIL				
Course Objectives		1. To impart basic knowledge of concept of Hazard, risk and vulnerability. 2. To understand types of hazards, their causes and impact. 3. Assessment of risk and vulnerability. 4. Acquiring knowledge about mitigation and preparedness to combat disaster. 5. To aware about role of government bodies in disaster management.

Course Outcomes

CO1	Gain basic knowledge of concept of Hazard, risk and vulnerability.
CO2	Acquired knowledge of hazards its impact.
CO3	Understand about Assessment of risk and vulnerability related to disaster.
CO4	Formulate, organize and assess disaster Risk reduction activities
CO5	Demonstrate and practice Disaster Management.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Concept of Disaster and Vulnerability**	Hazard and disaster -Concept; risk and vulnerability; Types of hazards-Natural hazards: hydrological, atmospheric & geological hazards, Causes of Earthquake, floods, cyclone, tsunami, landslides and drought.	10	CO1
2	**Impact of Disaster**	Global and National Perspective. Disaster profile of India, Case studies from Disasters, Large Hydro projects and its risks-Uttarakhand Dsisaster-2013.	10	CO2 CO3
3	**Disaster Management**	Component of Disaster Management-Preparedness and Mitigation, Phases of Disaster Management. Compensation and Insurance.	10	CO4 CO5
4	**Intervention of technologies**	Application of geoinformatics in hazard, risk & vulnerability assessment. Early warning System; PTWS & IMD.	10	CO5
5	**Disaster Risk Reduction**	Approaches to Disaster risk Reduction (DRR)- Role of public, education and media in DRR. Community Based DRR,International/National Humanitarian aid.	10	CO4
6	**Disaster Act. And Policies**	National Acts and policies for mitigating Disasters (Disaster Management Act 2005, National Policy for Disaster Management-2009, Institutional Framework for disaster management (NDMA, SDMA, SDMA &NIDM).	10	CO5

Reference Books:

1-Coppola D. P. 2007. Introduction to International Disaster Management. Butterworth Heinemann.

2-Cutter, S.L. 2012. Hazards Vulnerability and Environmental Justice. EarthScan, Routledge Press.

3-Keller, E. A. 2012. Introduction to Environmental Geology. Prentice Hall, Upper Saddle River, New Jersey.

4-Pine, J.C. 2009. Natural Hazards Analysis: Reducing the Impact of Disasters. CRC Press, Taylor and Francis Group.

5-Schneid, T.D. & Collins, L. 2001. Disaster Management and Preparedness. Lewis Publishers, New York, NY.

6-Smith, K. 2001. Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge Press.

7-Wallace, J.M. & Hobbs, P.V. 1977. Atmospheric Science: An Introductory Survey. Academic Press, New York.

e-Learning Source:

https://www.researchgate.net/publication/323794760_Natural_Hazards_and_Disaster_Management

https://link.springer.com/article/10.1007/s11069-019-03677-2

https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf

SWAYAM MOOC, e-Skill India, Coursera, Udemy,NPTEL

Course Articulation Matrix: (Mapping of COs with POs and PSOs)
PO-PSO **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1						2	2	-	-	-	-	3	2	2	1	1	-
CO2			2			2		-	-	-	-	2	2	3	1	1	-
CO3			2			2		-	-	-	-	1	3	2	1	1	-
CO4		3				2		-	-	-	-	1	3	1	3	3	-
CO5		2	2			2	2	-	-	-	-	1	1	3	3	3	-

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2022-2023								
Course Code	B150203T/ES135	**Title of the Course**	Eco-Restoration and Invaded Ecosystems		**L**	**T**	**P**	**C**
Year	**1st**	**Semester**	II		**3**	**1**	**0**	**4**
Pre-Requisite	10+2	**Co-requisite**	NONE					
Course Objectives	The aim of the course is to define the principles of ecological restoration and ecotourism and investigate the complex and dynamic interactions between humans and their environment. This advanced ecosystem management course will begin with an overview of the ecological basis for plant invasions in managed forests and terrestrial ecosystems, and then focus on methods for restoration of invaded and formerly invaded systems. Management tools and techniques for prevention, control, and restoration will be discussed, and plant invasions							

Course Outcomes

CO1	Be able to interpret and critically assess theories related to restoration ecology, biotic interactions, and ecological succession
CO2	Predict the issues related to the environmental ecosystem degradation and Eco restoration
CO3	Understand how to use modern tools, methods, and traditional knowledge to prevent and control plant invasions and to restore formerly invaded ecosystems.
CO4	Predict the issues related to the environmental ecosystem degradation and Eco restoration
CO5	Develop skills and demonstrate how to integrate ecological concepts into management efforts

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Restoration Concept**	Concepts of restoration, single vs. multiple endpoints; ecosystem reconstructions; physical, chemical, biological, and biotechnological tools of restoration. Various approaches to Restoration Ecology of Disturbed Ecosystems: disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems.	8	CO1
2	**Restoration of Ecosystems & Biodiversity**	Ecology of Disturbed Ecosystems: disturbance and its impact on the structure and functioning of terrestrial and aquatic ecosystems. Restoration of biological diversity: Acceleration of ecological succession, reintroduction of biota. Restoration of contaminated soils and soil fertility, mine spoil restoration. Restoration in the context of Sustainability, Globalization and Sustainability	8	CO2
3	**Role of Local people, Organization, and collaboration**	Community participation in eco-restoration traditional sacred land restoration, water restoration its techniques, practices regulation concept of traditional knowledge and transmission and maintenance of traditional knowledge on eco restoration over generations, ecosystem services and human wellbeing, NGO's, educational, research institutions and other agencies.	8	CO3
4	**Eco restoration Ethics**	Ethics in Eco-restoration: virtue, utilitarian and deontological theories; Religion and ethics; Political ecology; Ownership and intellectual property rights; Codes of conduct.	6	CO3
5	**Invasion theories and mechanism**	Introduction, Theories and Mechanisms for Invasion, Dispersal Mechanisms, Dispersal Mechanisms, Biotic interactions (competition, facilitation, mutualism)	6	CO4
6	**Ecological Impacts following Invasion and Ecosystem reclamation**	Impacts to ecological processes (nutrient cycles), Impacts to ecological processes (fire and water), Impacts to plant communities (biodiversity vs saturation), Eco remediation techniques, general principles, bioremediation, phytoremediation in eco-restoration	8	CO4
7	**Management and Restoration of Invaded Ecosystems**	Management and Restoration of Invaded Ecosystems, Techniques for control I- Integrating plant biology into control, Restoration of invaded ecosystem I- restoring plant communities, Restoration of invaded systems II- restoring ecosystem function, Restoration of invaded systems II- case studies and efficacy, Invasive species management and restoration in a changing environment	8	CO5
8	**Case Studies**	Ecological Restoration of Lantana-Invaded. Landscapes in Corbett Tiger Reserve, Restoration of Lake Kukkarahalli in Mysore, Mangrove restoration, Land reclamation and restoration of natural ecosystem: a case study from opencast mines of northeastern Coalfields of India.	8	CO5

Reference Books:

1. Agarwal, A. N (1980) Indian Agriculture, Vikas publishing House, New Delhi,

2. Weaver, D. B (2001) The Encyclopedia of Ecotourism, CABI, Publishing, U.K.

3. Byrne, P. 1999. The Philosophical and Theological Foundations of Ethics. 2d ed. Palgrave Macmillan, London, UK.

4. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000282/M027568/ET/1519296718Paper12_EM_Module28_etext.pdf

5. Sinha, P. C (2003) Encyclopedia of Ecotourism, Vol – I, II & III, Anmol publications Pvt. Ltd, New Delhi.

6. Bhatia, A. K (1978) Tourism in India

7. Ecological Restoration, Second Edition: Principles, Values, and Structure of an Emerging Profession (Society for Ecological Restoration) Paperback – Import, 28 February 2013 by Andre F. Clewell (Author), James Aronson (Author)

8. Google book: International principles and standards for the practice of ecological restoration. Second edition George D. Gann ,Tein McDonald ,Bethanie Walder ,James Aronson ,Cara R.Nelson ,Justin Jonson ,James G. Hallett ,Cristina Eisenberg ,Manuel R. Guariguata ,Junguo Liu ,First published: 04 September 2019,https://doi.org/10.1111/rec.13035

e-Learning Source:

1. SWAYAM

2. Virtual Labs

3. ALMS

4. MOOC

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
Course Articulation Matrix: (Mapping of COs with POs and PSOs)																		
CO1	3	2	1	1	1	3	2						3	3	3	2	1	-
CO2	3	2	2	1	1	3	2						3	3	3	2	1	-
CO3	3	2	2	2	2	3	2						3	3	3	2	1	-
CO4	3	2	2	1	1	3	2						3	3	3	2	2	-
CO5	2	3	1	1	1	3	2						3	3	3	2	2	-

4- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2022-2023								
Course Code	B150204P/ES136	**Title of the Course**	Ecosystem Dynamic Lab	**L**	**T**	**P**	**C**
Year	Ist	**Semester**	II	0	0	4	2
Pre-Requisite	10+2	**Co-requisite**	None				
Course Objectives			This course provides knowledge about the various type of invasive species its establishment, area extent, influence of biotic and abiotic factor etc. Further, student will explore the advance tool and techniques of eco restoration of terrestrial and aquatic ecosystem.				

Course Outcomes	
CO1	To identify the invasive plant species.
CO2	Student will explore the landscape ecology in term of degraded area extant, population and community ecological changes.
CO3	To study about the ecological succession steps.
CO4	Students will explore the advance techniques for environmental monitoring.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Field visit**	• Explore the invasive species in the focused area	15	CO1
2	**Landscape Ecosystem**	• Identification of degraded areas/landscape/ecosystems • Study the population and community ecology changes in the area	15	CO2
3	**Ecological Succession**	• Specific areas of focus include effects of abiotic and biotic disturbances on vegetation and animals.	15	CO3
4	**Ecosystem Disturbance**	• Identify the disturbing factors in and ecosystem viz. natural disasters, climate change, invasion, anthropogenic activities. • To study about the forest fire area extent using environmental monitoring techniques namely RS and GIS, ecological methods, surveys, and ground studies	15	CO4

Reference Books:

1. Gardner, R.H., Robert,V., O'Neill, T.irner,M.G. 2001. Landscape Ecology in Theory & Practice. Pattern and Process. Springer-Verlag, USA

2. Agarwal, A. N (1980) Indian Agriculture, Vikas publishing House, New Delhi,

3. Bharucha, E. 2003. Biodiversity of India. The. Mapin Publishing, India

4. Egan,D. and Howell, E.A. (eds.) 2001. The Historical EcoogyHandbook : A Restorationist's Guide to Reference Ecosystems. Island Press, Washington DC USA

e-Learning Source:

1. SWAYAM

2. MOOC

3. https://www.youtube.com/watch?v=3GfoRRxpVVA

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	1	1	1	3	2						2	3	3	2	1	-
CO2	3	2	2	1	2	3	2						3	3	3	1	1	-
CO3	2	1	1	1	1	3	1						3	3	3	1	1	-
CO4	3	2	1	1	1	3	2						3	3	3	1	3	-

5- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow
Department of Environmental Science

Effective from Session:									
Course Code	B150205T/ES137	**Title of the Course**	Natural Resources and its Management		**L**	**T**	**P**	**C**	
Year	**1st**	**Semester**	II		3	1	0	4	
Pre-Requisite	Basic science	**Co-requisite**	NIL						
Course Objectives	To be aware about different types of resources and its distribution. To understand sustainable exploration, use and conservation of different types of resources. To approaches to natural resource management and to maintain ecological diversity								

Course Outcomes	
CO1	Students will be able to introduced and aware from different types of resources and its distribution.
CO2	Students will be able to analyze soil resources and how soil quality get affected by different factors/events.
CO3	Understand sustainable exploration, use and conservation of different types of mineral resources.
CO4	Students will be able to know about importance of water resources, Remedial Measures in conserving water resources.
CO5	The knowledge can be apply to prevent overexploitation, long-term measures for productivity and conservation resources.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1.	Introduction to Natural Resources	Resources and Reserves, Classification, and types of of natural resources- Renewable and Non-renewable resources, Major Resources of India	6	CO1
2.	Soil Resources	Soil Formation and soil degradation - Soil erosion, Soil Fertility, Role of organic matter and its significance in soil quality – Diagnosis of soil nutrient deficiencies, Green manuring, Animal manures and Composting -Wasteland development strategies.	8	CO2
3.	Mineral Resources	Origin, distribution and types of minerals -Exploration of mineral resources, Impact of mining activities on environment - Conservation of mineral resources.	8	CO3
4.	Water Resources	Potential of Water resource, Causes and impact of water scarcity, Integrated water resource management -Watershed management, Introduction to Wetland and its conservation Ecological significance of mangroves	8	CO4 CO5
5.	Forest Resources	Forest resources: Distribution, economic and ecological importance of forests, Deforestation: Cause & impact. Forest management Strategies, Afforestation &Reforestation	8	CO5
6.	Renewable energy	Current status and future prospect of Renewable energy, Solar Energy-Solar Thermal Systems, solar cells, Hydro-power development, potential, Wind Energy, Tidal Energy, Ocean Thermal Energy Conversion (OTEC), Geothermal Energy, Energy from Biomass, Bio-Diesel.	8	CO1 CO5
7.	Non-renewable energy	Oil-exploration, extraction and processing, Natural Gas: exploration, liquified petroleum gas, Coal: reserves, classification, extraction, processing, Environmental impacts of nonrenewable energy consumption.	8	CO1 CO5
8.	Resource Conservation	Approaches of natural resource conservation: ecological approach, economic approach, ethnological approach, integrated resource management strategies	6	CO5

Reference Books:
Craig, J.R., Vaughan. D.J. & Skinner. B. J. 1996. Resources of the Earth: Origin, use and Environmental Impacts (2nd edition). Prentice Hall, New Jersey.
Freeman, A.M. 2001 . Measures of value mid Resources. Resources for the Future. Washington DC.
Ginley, D.S. & Calien, D. 20.11.Fundamentals of Materials for Energy and Environmental .
Klee, G.A. 1991 . Conservation of Natural Resources. Prentice Hall Publication.
Dutta A (2001) Biodiversity and ecosystem Conservation. Kalyani Publisher, Kolkata.
Jha LK (1997) Natural Resource Management. APH Publishing Corporation, New Delhi.
Kumar HD (1995) Modern Concepts of Ecology. Vikas Publishing House (P) Ltd., New Delhi.
MaDicken KG and Vergora NT (1990) Agroforestry: Classification & Management. John Wiley & Sons, New York.

e-Learning Source:
Nalini KS (1993) Environmental Resources and Management, Anmol Publications (P) Ltd., New Delhi.
Nautiyal S and Kaul AK (1999) Forest Biodiversity & its Conservation Practices in India.
http://web.worldbank.org/archive/website00675/WEB/PDF/ENVST-18.PDF
https://www.researchgate.net/publication/294369522_Integrated_Soil_and_Water_Resource_Management_for_Livelihood_and_Environmental_Security
https://www.isric.org/utilise/global-issues/water
https://www.mdpi.com/journal/resources/special_issues/Mineral_Resource_Assessment_Mining_Processing
SWAYAM MOOC, e-Skill India, Coursera, Udemy,NPTEL

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						2	2	-	-	-	-	3	2	2	1	1	-
CO2			2			2		-	-	-	-	2	2	3	1	1	-
CO3			2			2		-	-	-	-	1	3	2	1	1	-
CO4		3				2		-	-	-	-	1	3	1	3	3	-
CO5		2	2			2	2	-	-	-	-	1	1	3	3	3	-

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024						
Course Code:	B150206P/ES138	**Title of the Course**	Natural Resources Lab	**L**	**T**	**P**	**C**
Year	1st	**Semester**	II	**0**	**0**	**4**	**2**
Pre-Requisite	10+2	**Co-requisite**	Nil				
Course Objectives		This course provides students the knowledge and understanding of lab related to Natural Resource To understand estimation of particle size distribution of the soil. To know how to determine the specific gravity and moisture content of the soil.					

Course Outcomes	
CO1	Able to explain and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goal
CO2	Gain practical knowledge about productivity and usage of forest resource.
CO3	Gain knowledge on analysis and interpretation of different physical properties of soil.
CO4	Able to monitor impact of developmental activities on natural resources

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Field Visit	Visit to different reservoir of Natural Resource (River, Forest, mines etc.) field report submission based on the survey of local sites.	15	CO1
2	Study of Forest	Estimation of Forest Canopy Cover, Forest produce, Deforestation pattern	15	CO2
3	Soil &Mineral analysis	To diagnose Soil nutrient deficiency, Soil Horizon Measurements To study pore space, water holding capacity and bulk density of soil.	15	CO3
4	Environmental Monitoring	Environmental Impact Assessment of Hydro project/Mining sites Prepare a working model on Solar light, Rainwater harvesting system, Soil Profile	15	CO4

Reference Books:

1. Anne E. Magurran, Brian J. McGill (2011) Biological Diversity: Frontiers in Measurement and Assessment. Oxford University Press. ISBN: 978-0199580675.

2. Loreau, M. & Inchausti, P. 2002. Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK

3. Pandey, P.N. (2017). Biodiversity Environmental Science Forestry, Narendra Publication house.

4. Rao K.S, K.S. Rao (1993). Practical Ecology. Anmol Publication, 190 pages

5. Singh, J. S. & Singh, S. P. 1987. Forest vegetation of the Himalaya. The Botanical Review 53:80-192.

6. Dane, J.H. & Topp, G.C. (2004). (eds) Methods of Soil Analysis: Part 4, Physical Methods. SSSA

7. Kaushik, Anubha and Kaushik, C.P. (2018) Perspectives in Environmental Studies.

e-Learning Source:

1. Study of soil pH, https://youtu.be/ViWCoeFwH9M.

2. Preparation of herbarium sheets, https://youtu.be/CK4vepuWzrM

3. Herbarium - CSIR-NBRI, https://youtu.be/6tJdvDzPzR8.

4. Primary productivity, https://youtu.be/9LpMskfUgz0.

5. Light-Dark bottle method, https://youtu.be/i5Tit4BgfIE.

6. AMRITA, OLABS, Study of Physical Properties of Soil. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=235&cnt=1

Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	1	-	1	2	2						2	2	2	2	2
CO2	1	1	-	-	1	2	2						2	2	2	2	2
CO3	2	1	-	-	-	1	2						2	1	2	2	2
CO4	2	-	-	-	-	2	2						2	1	1	2	2

6- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Effective from Session: 2023-2024

Course Code	I150208T /ES140	Title o f the Course	Ecotourism & Wildlife Management	L	T	P	C
Year	1st	Semester	II	2	1	0	3
Pre-Requisite	Natural Resource	Co-requisite	NIL				
Course Objectives	To provide basic knowledge of Eco-Tourism. To provide knowledge of methods and data used for Interesting Eco-tourism. To provide knowledge of Impact of Eco-tourism. To provide knowledge of the concept of bioassay. To develop knowledge of Wildlife management.						

Course Outcomes	
CO1	Have an enhanced knowledge o f Eco-tourism.
CO2	Be able to make connection and interrelations between data used for Interesting Eco-tourism.
CO3	Be able to explain Impact of Eco-tourism and their environment.
CO4	Be able to explain Wildlife Conservation and related problems.
CO5	Be able to describe Wildlife Management.

Unit No.	Title of the Unit	Content of Unit	Contac tHrs.	Mapped CO
1	Introduction to Eco-Tourism	Ecotourism – study history of tourism; identify various forms of tourism and evolution of ecotourism. Dimensions of tourism and essential conditions for tourism to occur. Differences between tourism components. Mass tourism versus ecotourism. Consumptive and Non-Consumptive Tourism.	08	1
2	Interesting Eco-tourism	- Places of interests of Ecotourism in India. Ecotourism in practice in important PA's of India- case studies of Periyar Tiger Reserve, Keoladeo National Park, Kanha National Park and Jim Corbet National Park. Important Biosphere Reserves as ecological centre.	08	2
3	Ecosystems study	Study of different Ecosystems – Rain forest Ecotourism – Mountain Ecotourism – Polar, Islands and Coasts Ecotourism – Wilderness - Marine Ecosystem.	06	2
4	Impact of Eco-tourism	Impact of Ecotourism, Types and Degree of Impacts from Ecotourism activities– Ecotourism related organization. Positive and negative impact of Ecotourism, Responsible ecotourism, Impact of eco-tourism on Economy.	08	3
5	Wildlife Conservation	Wildlife conservation - Protected Areas Network in India - Goals of management, Strategies for planning.	08	4
6	Factors influencing wildlife management	Factors influencing wildlife management such as habitats, population, behaviour, food- habits health etc. Tools for data collection and analysis.	06	4
7	Wildlife Management	Wildlife Management process, elements of wildlife management in India. Role of local communities in Wildlife management.	08	5
8	Wildlife conflicts	Man-wildlife conflicts – Poaching of wildlife – Wild life conservation laws – The Wildlife (Protection) Act, 1972 (2002 amendment).	08	5

Reference Books:
1-Dasma RF (1968) Environmental Conservation Joh Wiley a nd Sons New York.
2-Mukherje N (2008) Ecotourism and s ustainable Development. Cybetech Publications, New Delhi.
3-Prabha Chandra (2003) Global Ecotourism Kaniskha Publishers, New Delhi.
4-Sinha P.C (2003) Encyclopedia of Ecotourism, Volume I, II a n d III, Anmol Publication Pvt. Ltd., New Delhi.
5-Weaver DB (2001) The Encyclopedia of Ecotourism, CABI Publishing, UK.

e-Learning Source:
https://www.slideshare.net/chandikeehelamalpe/ecotourism-64745161
https://www.slideshare.net/ravindraprasad5/eco-tourism-42047943
https://www.slideshare.net/AndrewMyrthong/ecotourism-57238509
https://slideplayer.com/slide/6063870/
https://www.slideshare.net/apoorvkumar9277/wildlife-conservation-37245301
https://www.google.com/search?client=firefox-b-d&q=Wildlife+Management+ppt

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	2	2	2	1	-	-	-	-	-	2	2	2	2	2	-
CO2	3	2	2	2	2	2	1	-	-	-	-	-	2	1	1	2	2	-
CO3	3	3	2	2	2	2	2	-	-	-	-	-	2	2	1	2	1	-
CO4	3	3	3	2	3	2	2	-	-	-	-	-	3	3	2	3	1	-
CO52	2	2		2	2	3	1	-	-	-	-	-	2	3	3	2	3	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator

Sign & Seal of HoD