



Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B150101T/ES125	Title of the Course	Basics of Environmental Science	L	T	P	C
Year	I	Semester	I	3	1	0	4
Pre-Requisite	10+2	Co-requisite					

Course Objectives
This course provides students with a working knowledge of concept of environment and the relation between human and its relation with the environment.

Course Outcomes

CO1	Gain knowledge about origin of life and related theories.
CO2	Learn fundamental concept of environmental science.
CO3	Develop the understanding about environmental education and able to understand the relationship between human and environment.
CO4	Understand the concept of sustainable development and SDG and also able to understand the current scenario of environmental degradation.
CO5	Learn the significance and importance of environmental management and have the practical knowledge about the affected areas of environment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Evolution	Origin of life and speciation, Darwinism and modern synthetic theory of evolution, Natural Selection; Biochemical basis of origin of life; Hardy Weinberg Equilibrium; Genetic drift.	8	CO1
2	Concept of Environment	Definition, Principles and Scope of Environmental Science; Environment, its components and segments; Moral and Aesthetic Nature of Environmental Science; Objectives and Historic roots of the subject; for Public Awareness.	8	CO2
3	Environmental	Goals of environmental education; Environmental Literacy, Environmental Careers, Environmental Justice, Individual Organisms, Environmentalism, Environmental Education at Primary, Secondary level.	6	CO3
4	Man and Environment:	Man-Environment relationships; Impacts of human activity on environment (Agriculture, transportation, mining, urbanization, industrialization); Environmental Degradation and Conservation Issues, Modern concept of environmental conservation	8	CO3
5	Sustainable development	Concept and Significance of sustainable development, Core elements of sustainable development, Over-view of SDG (Sustainable Development Goals).	6	CO4
6	Current Environmental Issues	Ill effects of fireworks and environmental degradation, Climate change and its effects on human health, Deforestation and its impacts on human communities and flora and fauna of the Environment.	8	CO4
7	Environmental Management	Significance of Environment Management, Resettlement and rehabilitation of project affected areas, Environmental ethics: Role of Indian's religions and cultures in environmental conservation, Communication and public awareness programs for environment management.	8	CO5
8	Field Survey	Assessment of impacts of anthropogenic activities in the surrounding environment; Evaluation of the consequences rising from agricultural and commercial logging practices to preserve environment, case study, Reclamation and monitoring of the affected area by developmental activities: case study.	8	CO5

Reference Books:

1. Environmental Science by William P. Cunningham and Mary Ann Cunningham; McGraw-Hill Publications.
2. Environmental Science: Earth as a Living Planet by Botkin and Keller; JOHN WILEY & SONS, INC
3. A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand & Co.
4. Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. Atmosphere, Weather and Climate, Barry, R. G. 2003, Routledge Press, UK.
6. Environmental Science: S. C. Santra, New Central Book Agency.

e-Learning Source:

1. Environmental Science, Dr. Y. K. Singh, <https://www.hzu.edu.in/bed/E%20V%20S.pdf>
2. Textbook for Environmental Studies, Erach Bharucha, <https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf>
3. Fundamentals of Environmental Studies, <https://www.jkcprl.ac.in/download/11567250727.pdf>

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	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2022-2023

Course Code	B150102P/ES126	Title of the Course	Practical on Environment	L	T	P	C
Year	I	Semester	I	0	0	4	2
Pre-Requisite	10+2	Co-requisite					
Course Objectives	This course provides students with a working knowledge of Lab practices, environment and its relation with the human being, Meteorological parameters.						

Course Outcomes

CO1	Students will be able to understand the good Laboratory Practices including Dos & DON'Ts in the laboratory.
CO2	Students will be able to learn interaction of human with environment.
CO3	Students develop understanding about local environmental problems and able to find remedy.
CO4	Gain knowledge about different meteorological parameters.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Good Lab Practices (GLP).	i. Instructions ,ii. DOs and DON'Ts in the Laboratory,iii. General Information,iv. Introduction	8	CO1
2	Environmental Issues and Impacts	Study the effects of environmental problem and its impact on human population.	8	CO2
3	Plants/ Trees and Its Importance	Choose five common species of Trees / plants from your near areas and list their common names.Describe each plant in terms of its height and leaves	8	CO3
4	Weather Parameters measuring Devices	To record the following parameters of weather monitoring station: A. Atmospheric Pressure, B.Rainfall, C.Outdoor, indoor temperature D.Wind speed and Direction E.Humidity & dew point	8	CO4

Reference Books:

Environmental Science: Earth as a Living Planet by Botkin and Keller; JOHN WILEY & SONS, INC.

A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand & Co.

Atmosphere, Weather and Climate, Barry, R. G. 2003, Routledge Press, UK.

Environmental Science: S. C. Santra, New Central Book Agency.

e-Learning Source:

1. Good Lab Practices, <https://youtu.be/YXl6MLvcGic>; <https://youtu.be/TADfGsai3Ro>.

2.Indian Meteorological Department, Weather, https://mausam.imd.gov.in/imd_latest/weather_video/video.php.

3, Atmospheric Pressure, <https://youtu.be/r7ZfzJ-yP3U>; <https://youtu.be/JQp63iUYsGU>.

4. Anemometer, <https://youtu.be/cWzGDEDVEgY>; <https://youtu.be/J5Eh6EU18Us>; <https://youtu.be/n5deIWQigrk>.

5. Rain gauge, https://youtu.be/y6tyAy_MRv0; <https://youtu.be/IU9CsbAkRbc>.

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	1	2	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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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	1 st	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:

- Baird and Colin "Environmental Chemistry"
- Bailey, Clark, Ferris, Krause and Strong "Chemistry of Environment"
- Manahan, Stanley E. Fundamentals of Environmental Chemistry Boca Raton: CRC Press LLC, 200

e-Learning Source:

- <https://www.futurelearn.com/courses/atmospheric-chemistry-planets-and-life-beyond-earth>
- https://inside.mines.edu/~epoeter/_GW/17WaterChem1/WaterChem1pdf.pdf
- <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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	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

Name & Sign of Program Coordinator

Sign & Seal of HoD



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>.

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	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
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Integral University, Lucknow

Effective from Session: 2022-23

Course Code	B150105T/ES129	Title of the Course	Earth & Earth Surface Processes	L	T	P	C
Year	I	Semester	I	3	1	0	4
Pre-Requisite	10+2	Co-requisite					
Course Objectives	The purpose of this course is to impart basic and key knowledge of Earth Surface and its processes. This will help in enhancing knowledge of Solar System, Earth, Atmosphere, Hydrosphere, Geological timescale and evolution of Earth, Weathering and Erosion, different types of Rocks and Plate Tectonics. After successfully completion of course, the student will able explore subject into their respective dimensions.						

Course Outcomes

CO1	Students will be able to analyze formation of Solar System, details about Earth, Atmosphere & Hydrosphere through study of Solar System and history of Earth.
CO2	Students will be able to Analyze role of Plate Tectonics in Various Earth Surface Processes.
CO3	Create in student's ability to understand about changes in Earth's history with time and movements of continents
CO4	Students will be able to evaluate the significance of Rocks and role of atmosphere as life support system.
CO5	Students will Evaluate the importance of mountains in Earth Surface processes.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Solar System & Its Formation	Solar System formation: Sun, Planets, Moon, asteroids, Meteoroids, Formation of Earth, Differentiation of the Earth, Evidence of Differentiation of Earth.	6	CO1
2	Planet Earth , its Composition & Internal Structure	Size and Distance , Orbit and Rotation, Earth's Chemical Composition, Internal Structure of Earth, gravitational and magnetic fields of the earth, origin of the main geomagnetic field	8	CO1
3	Lithospheric Plates & Plate Tectonics	Movement of Lithosphere Plates, Mantle Convection, Plate Tectonics, Major Plates, Plate Tectonic Boundaries :Destructive, Constructive & Conservative Plate boundaries	8	CO2
4	Geological Time Scale & Major Changes on the Earth Surface	Geological Time Scale, Geochronology, Divisions of Geologic Time Scale: Eon, Era, Period & Epoch, Cryptozoic Eon, Phanerozoic Eon, Holocene & emergence of Humans, Mass extinctions	6	CO3
5	Theory & Concepts related to movements of Continents and Disasters having origin inside Earth	Hydrosphere as life support System, Sea Floor Spreading , Continental Drift Theory & evidences in support, Hot Spots, Volcanoes & Earthquake	8	CO3
6	Mineral & Rocks	Minerals and important rock forming minerals, rock Cycle, lithification , metamorphism Igneous Rocks, Sedimentary Rocks & Metamorphic Rocks, Physical Weathering Processes, Chemical Weathering Processes, Biological Weathering Process, Erosion & agents of Erosion, Physical Processes of Erosion, Factors affecting Erosion	8	CO4
7	Atmosphere as Life Support System	Role of Atmosphere on Earth: evolution of earth's atmosphere, composition and structure of atmosphere, physical and optical properties, circulation; interfaces: atmosphere-ocean interface, atmosphere-land interface, ocean-land interface; land surface processes.	8	CO4
8	Importance of being a mountain	Formation of Peninsular Indian mountain systems - Western and Eastern Ghats, Vindhya, Aravallis, etc. Formation of the Himalaya; development of glaciers, perennial river systems and evolution of monsoon in Indian subcontinent; formation of Indo-Gangetic Plains	8	CO5

Reference Books:

1. Bridge, J., & Demicco, R. 2008. Earth Surface Processes, Landforms and Sediment deposits. Cambridge University Press
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. Holmes' Principles of Physical Geology. Taylor & Francis.
3. Gupta, A.K., Anderson, D.M., & Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. Nature 421: 354-357.

e-Learning Source:

1. <https://swayam.gov.in/>
2. <https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-163-surface-processes-and-landscape-evolution-fall-2004/lecture-notes/>
3. <https://nptel.ac.in/courses/105104190/>

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	3	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO4	1	3	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Department of Environmental Science

Effective from Session: 2022-2023							
Course Code	B150106P/ES130	Title of the Course	Earth Surface Processes Lab.	L	T	P	C
Year	I	Semester	I	0	0	4	2
Pre-Requisite	10+2	Co-requisite					
Course Objectives	This course provides students with a working knowledge of optical physics, including diffraction, polarization and laser physics.						

Course Outcomes	
CO1	Students will be able to Analyze formation of Solar System.
CO2	Students will be able to Analyze role of geological time scale and internal structure of Earth.
CO3	Create in student's ability to understand about identification of Mineral and physical properties of Earth.
CO4	Create in student's ability to understand about identification of Rocks.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	To Study about Solar System through a Model	Students will be able to Analyze formation of Solar System	8	CO1
2	To Study about geological Time Scale through a Model To Study about internal Structure of Earth through a Model.	Students will be able to Analyze role of geological time scale and internal structure of Earth.	8	CO2
3	Identification of Mineral using Physical Properties: Feldspar, Quartz, Muscovite, Galena, Haematite	Create in student's ability to understand about identification of Mineral and physical properties of Earth	8	CO3
4	Identification of Rock:	Create in student's ability to understand about identification of Rocks. Identification of Rock: a. Igneous Rocks: Granite, Compact Basalt, Rhyolite. b. Sedimentary Rocks: Sandstone, Limestone, Shale, Laterite, Conglomerate. c. Metamorphic Rocks: Slate, Marble	8	CO4

Reference Books:

1. Bridge, J., & Demicco, R. 2008. Earth Surface Processes, Landforms and Sediment deposits. Cambridge University Press
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. Holmes' Principles of Physical Geology. Taylor & Francis.
3. Gupta, A.K., Anderson, D.M., & Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. Nature 421: 354-357.

e-Learning Source:

1. <https://soe.unipune.ac.in/studymaterial/swapnaGaikwadOnline/3bgeologictimescaleandextinction-150126074104-conversion-gate02.pdf>
2. <http://ppup.ac.in/download/econtent/pdf/Geological%20Timescale%20-%20BA%20Part%201,%20Paper%20-1,%20unit%20-2.pdf>
3. <https://www3.nd.edu/~cneal/planetearth/Chapt-13-Marshak.pdf>
4. <https://sci.waikato.ac.nz/evolution/Geolimescale.pdf>
5. <https://www.dnr.sc.gov/geology/pdfs/education/Geologic%20Time.pdf>
6. <https://ncert.nic.in/textbook/pdf/fess201.pdf>
7. https://web.njit.edu/~cao/Phys320_L8.pdf
8. [https://nitsri.ac.in/Department/Civil%20Engineering/CIV-404\(P\)_Geology_Lab_EGM_Lab_Manual_2.pdf](https://nitsri.ac.in/Department/Civil%20Engineering/CIV-404(P)_Geology_Lab_EGM_Lab_Manual_2.pdf)
9. <https://egyankosh.ac.in/bitstream/123456789/58880/1/EXPERIMENT%204.pdf>
10. https://www.atri.edu.in/images/pdf/publications/Manual_Geology.pdf
11. <https://www.youtube.com/watch?v=libKVRa01L8>
12. <https://www.youtube.com/watch?v=EytrFc9qIOo>

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	3	2											3	3				
CO2	3	2											3	3				
CO3	3	2											3	3				
CO4	3	2											3	3				

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

Name & Sign of Program Coordinator	Sign & Seal of HOD
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Integral University, Lucknow
Department of Environmental Science

Effective from Session:												
Course Code	I150106T/ES131	Title of the Course	Introduction to Natural Hazard and Disaster Management	L	2	T	1	P	0	C	3	
Year	1st	Semester	I									
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	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
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Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024							
Course Code	I150107T/ES132	Title of the Course	Water Monitoring and Conservation Techniques	L	T	P	C
Year	1 st	Semester	I	2	1	0	3
Pre-Requisite	10+2	Co-requisite	Basic knowledge of water				
Course Objectives	The objective of this course is to impart knowledge of hydrology that deals with the occurrence, distribution, movement, and properties of water on the earth. The students will also be aware of different water quality standards for the application of water in different sectors. It is expected to give an exposure to students of social and natural sciences and humanities for better understanding of water resources, water economics, water governance and policy.						

Course Outcomes

CO1	Describe the role water plays in the lithosphere, hydrosphere, cryosphere, atmosphere, and biosphere, with emphasis on interactions between these reservoirs.
CO2	Apply the scientific method to investigations of hydrologic processes, Earth systems, and interactions among the various physical and biological realms utilizing standard scientific field and laboratory methods.
CO3	Plan water quality surveillance for a given aquatic environment and to understand what a test result means in terms of the health of the ecosystem. water quality and water quality criteria and standards, and their relation to public health, environment, and urban water cycle
CO4	Use their knowledge environment, research skills to current issues pertaining to water resources, management, and remediation, with emphasis on related economic, social, and public policy dimensions.
CO5	Analyze, interpret, and report on laboratory and field findings using appropriate statistical techniques and computer applications.

Unit No.	Title of the Unit	Content of Unit	Cont act Hrs.	Mapped CO
1	Introduction to water	Origin of water on earth, Unique properties of water (Polarity, Cohesion, Density, Surface Tension, Viscosity, Heat capacity, Boiling and freezing points, Temperature, Taste, Odour, Colour). Importance of water in human civilization (Mesopotamian and Indus), Water catastrophes: Historical perspective and consequences, Water infrastructure and tools (Ancient, Medieval and modern).	9	CO1 & 2
2	Hydrology and hydrological cycle	Concept and scope of hydrology, Hydrological cycle: Evaporation: Process, Factors effecting evaporation, Measurement of evaporation, Transpiration: process, Factors affecting transpiration, Condensation: Process and measurement, Precipitation: Process, Types and forms, Measurement and distribution,	9	CO, 2& CO5
3	Water conservation Practices	Rainwater harvesting methods, classes, benefits, approach, water saving technologies, rainwater harvesting and drought mitigation, crop productivity and water security. Concept and definition of watershed, importance of watershed management and its role in conservation of natural resources. Methods of irrigation - surface, subsurface, sprinkler, drip and pitcher. Reducing water losses, water resource in India, water budget in India, planning and optimum use of water resources.	11	CO2, 3 & 5
4	Water resources and sustainable development	Water as a resource, Dublin-Rio Principles on Water and Sustainable Development, Brief account of concept of water stress, scarcity, water footprint and virtual water trade, Right to Water (SDG-6); Entitlements and criteria, Concept and overview of Water, Sanitation and Hygiene (WASH), Swachh Bharat Mission and National Water Mission,	9	CO 2,3,4 & 5
5	Water Resource: Governance and Policy	Water Governance: Elements and dimensions of water governance; Effective water governance schemes; Indicators of good governance. Water Governance in India: Salient features of National water policy 2012 and Jammu and Kashmir Water Resource (Regulation and Management) act 2010, Conflicts in Water Pricing: Conflicts on subsidy verses sustainability, overview of global water conflicts and interstate water conflicts in India.	11	CO4 & CO5
6	Water Economics	Valuing of water: The use and non-use values of water, Introduction to water valuation methods: Non-revenue waters (NRW) and unaccounted for water (UFW); Metering water uses; Water management through economic instruments. Water Pricing - Approach and Models: Significance of water pricing water pricing models - flat rate and uniform rate, Brief account of water pricing practices in India and abroad.	11	CO5

Reference Books:

Standard methods for the examination of water and wastewater published by APHA 15th ed.

Keith, L.H. [Ed.] 1988 Principles of Environmental Sampling. American Chemical Society

Mays, L.W. 2006. Water Resources Sustainability. The McGraw-Hill Publications.

Schward and Zhang, 2003. Fundamentals of Groundwater. John Willey and Sons.

Souvorov, A.V. 1999. Marine Ecogonomics: The Ecology and Economics of Marine Natural Resource Management. Elsevier Publications. Vickers, A. 2001.

Handbook of Water Use and Conservation. Water Plow Press.

Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.

e-Learning Source:

SWAYAM, MOOC, e-Skill India, Coursera, Udemy, National Digital Library of India

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

PO- PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1		2			2		3				3		2
CO2	3		2					2	3	2		2	
CO3	2				2			2					2
CO4			3			2		2			2	3	
CO5	3				3	2					3		3

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Effective from Session: 2022-2023							
Course Code	B150201T/ES133	Title of the Course	Environmental Biology	L	T	P	C
Year	First	Semester	Second	3	1	0	4
Pre-Requisite	10+2 with Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	This course introduces the basic principles of Environmental biology, ecology, and the relationship between humans and natural world. This major course is designed to provide students with a foundation in population, whole organism, evolutionary biology and environmental science as well as in chemistry and mathematic						

Course Outcomes

CO1	The student will be to understand the basic elements of ecology and environmental factors and ecosystem dynamics.
CO2	The course will lead the students understand the different functions played by ecosystem and its various positive and negative interactions with organisms.
CO3	Develop understanding about Evolutionary Theories, Ecological Succession and Taxonomy.
CO4	Ability to realize the usefulness of flora and fauna for pollution control mechanism.
CO5	Students will study about the growth of different types of microorganisms based on various environmental factors

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Ecology	Introduction of Ecology (Definition, History, Branches and Scope). Basic principles of Environment and Ecology; Environmental factors (Abiotic and biotic) their importance and role.	8	CO1
2	Ecosystem	Components, Structure, and function of Ecosystem; Major ecosystems (terrestrial, aquatic, and marine); Trophic Levels, food chain and food webs; Energy flow in Ecological systems; Ecological Pyramids, Productivity.	8	CO2
3	Autecology	Population Characteristics- Dispersion, Density, Natality, Mortality, Age Structure, Population Growth; Human population & growth; Ecological niche and habitat; Positive and Negative Interactions of Populations.	6	CO2
4	Synecology	Community Structure, Growth Forms; Methods of Plant Community Analysis; Concept of Keystone Species, Ecotone, Ecotypes, Ecophene, ecological indicators; Ecological Succession.	8	CO3
5	Biogeochemical Cycles	Hydrological, Gaseous and Sedimentary Cycle- Carbon, Oxygen, Nitrogen, Phosphorus and Sulphur Cycles; Major biome of the world.	6	CO4
6	Limiting factors of Environment	Concept of limiting factors, laws of limiting factors – laws of minimum and tolerance, combined concept of limiting factors, Earth’s carrying capacity	8	CO5
7	Taxonomy	Definition of taxonomy, Systematics, and classification; morphological and taxonomical studies of flora and fauna.	8	CO3
8	Microbiology	Basic concept on structures and functions of bacteria and viruses	8	CO5

1. Ecology and Environment: P.D. Sharma., Rastogi Publication.
2. Fundamental of Ecology: E. P. Odum, W. B. Saunders Company, USA
3. Ecology, 2nd Edition by Paul Colinvaux, Wiley.
4. Ecology: From Individuals to Ecosystems by Michael Begon & Colin R. Townsend & John L. Harper; Blackwell publishing.
5. Ecology: Theories and Applications (4th Edition) by Peter Stiling; Prentice Hall.
6. Textbook of Environmental Studies, Erach Bharucha, Orient longman Pvt. Ltd., Ernakulam.

e-Learning Source:

1. <https://www.docsity.com/en/environmental-science-environmental-biology-lecture-notes/233205/>
2. https://www.bdu.ac.in/cde/SLM/SLM_SAMPLE/BSc-Zoology.pdf
3. <https://www.youtube.com/watch?v=I3WLJFXSbhw>

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	3	2											3	2				
CO2	3	3											3	2				
CO3	2	2											2	2				
CO4	3	3											3	2				
CO5	2	2											2	2				

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	B150202P/134	Title of the Course	Practical on Environmental Biology	L	T	P	C
Year	1st Year	Semester	2	0	0	4	2
Pre-Requisite	10+2 with Science	Co-requisite					
Course Objectives	This course provides an introduction to the basic laboratory principles. Furthermore, students will have hands on experience and perform laboratory work in identifying and analyzing different environmental problems related with air, water pollution, and environmental degradation.						

Course Outcomes	
CO1	The student will be to understand about Good Laboratory Practice (GLP).
CO2	Student will develop practical knowledge on Measurement of different soil parameters.
CO3	Be able to Illustrate abiotic/biotic interactions and symbiotic relationships
CO4	Develop knowledge on Preparation of Herbarium and its Documentation

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Good Laboratory Practices	All Laboratory Rules and Regulations, Safety Precautions, Introduction to Laboratory Instruments, etc	8	CO1
2	Soil Analysis	To Study the NPK of soil samples using soil analysis Kit.	8	CO2
3	Ecosystem	Study of a simple ecosystem (Suggested habitats: pond, river, estuarine, grassland, forest and desert) and description of the biotic and abiotic components of the ecosystem	8	CO3
4	Survey of Flora and Fauna	1. Survey of vegetation in an area. 2. Survey of birds, insects and other animals in an area. 3. Preparation of Herbarium	8	CO4

Reference Books:	
1.	Muller-Dombois, D. and Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology, Wiley, New York.
2.	Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
3.	Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
4.	Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
5.	Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
6.	Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
7.	Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. ThirdEdition. John Wiley and Sons Inc.
e-Learning Source:	
1.	https://www.docsity.com/en/environmental-science-environmental-biology-lecture-notes/233205/
2.	https://www.bdu.ac.in/cde/SLM/SLM_SAMPLE/BSc-Zoology.pdf
3.	https://www.youtube.com/watch?v=I3WLJFXSbhw

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	3	1	1	2	3	1	1	-	-	-	-	-	1	3	1	3	1	-
CO2	3	1	1	1	1	1	1	-	-	-	-	-	1	3	1	3	1	-
CO3	1	1	1	1	3	2	1	-	-	-	-	-	2	1	1	2	2	-
CO4	2	1	1	1	2	3	1	-	-	-	-	-	1	2	3	1	1	-
CO5	3	1	1	2	3	1	1	-	-	-	-	-	3	3	3	3	3	-

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

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

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

PO- PSO	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	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	-

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2022-2023

Course Code	B150204P/E S136	Title of the Course	Ecosystem Dynamic Lab	L	T	P	C
Year	I st	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	<ul style="list-style-type: none"> Explore the invasive species in the focused area 	15	CO1
2	Landscape Ecosystem	<ul style="list-style-type: none"> Identification of degraded areas/landscape/ecosystems Study the population and community ecology changes in the area 	15	CO2
3	Ecological Succession	<ul style="list-style-type: none"> Specific areas of focus include effects of abiotic and biotic disturbances on vegetation and animals. 	15	CO3
4	Ecosystem Disturbance	<ul style="list-style-type: none"> 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.imer, 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 Ecology Handbook : 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
	CO1	2	1	1	1	1	3	2						2	3	3	2
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

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow

Effective from Session:											
Course Code	B150205T/ES137	Title of the Course	Natural Resources and its Management	L	3	T	1	P	0	C	4
Year	1st	Semester	II								
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-..3 Renewable and Non-renewable resources, Major Resources of India...3	6	CO1
2.	Soil Resources	Soil Formation and soil degradation - Soil erosion, Soil Fertility,...2 Role of organic matter and its significance in soil quality2- Diagnosis of soil nutrient deficiencies, Green manuring,...2 Animal manures and Composting -Wasteland development strategies...2	8	CO2
3.	Mineral Resources	Origin, distribution and types of minerals ...2-Exploration of mineral resources,...2. Impact of mining activities on environment...2 - Conservation of mineral resources...2	8	CO3
4.	Water Resources	Potential of Water resource, Causes and impact of water scarcity,...2 Integrated water resource management -Watershed management,...4 Introduction to Wetland and its conservation Ecological significance of mangroves...2	8	CO4 CO5
5.	Forest Resources	Forest resources: Distribution, economic and ecological importance of forests,...4 Deforestation: Cause & impact. Forest management Strategies....2, Afforestation &Reforestation...2	8	CO5
6.	Renewable energy	Current status and future prospect of Renewable energy...2, Solar Energy-Solar ,Thermal Systems...2,solar cells, Hydro-power development, potential, Wind Energy..2, Tidal Energy, Ocean Thermal Energy Conversion (OTEC), Geothermal Energy, Energy from Biomass, Bio-Diesel...2	8	CO1 CO5
7.	Non-renewable energy	Oil-exploration, extraction and processing..2, Natural Gas: exploration, liquified petroleum gas..2, Coal: reserves, classification, extraction, processing...2, Environmental impacts of nonrenewable energy consumption....2.	8	CO1 CO5
8.	Resource Conservation	Approaches of natural resource conservation: ecological approach, economic approach...3, ethnological approach, integrated resource management strategies...3	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	-

Department of Environmental Science

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

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

- Anne E. Magurran, Brian J. McGill (2011) Biological Diversity: Frontiers in Measurement and Assessment. Oxford University Press. ISBN: 978-0199580675.
- Loreau, M. & Inchausti, P. 2002. Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK
- Pandey, P.N. (2017). Biodiversity Environmental Science Forestry, Narendra Publication house.
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- Singh, J. S. & Singh, S. P. 1987. Forest vegetation of the Himalaya. The Botanical Review 53:80-192.
- Dane, J.H. & Topp, G.C. (2004). (eds) Methods of Soil Analysis: Part 4, Physical Methods. SSSA
- Kaushik, Anubha and Kaushik, C.P. (2018) Perspectives in Environmental Studies.

e-Learning Source:

- Study of soil pH, <https://youtu.be/ViWCoeFwH9M>.
- Preparation of herbarium sheets, <https://youtu.be/CK4vepuWzrM>
- Herbarium - CSIR-NBRI, <https://youtu.be/6tJdvDzPzR8>.
- Primary productivity, <https://youtu.be/9LpMskfUgz0>.
- Light-Dark bottle method, <https://youtu.be/i5Tit4BgfIE>.
- 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	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
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

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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Integral University, Lucknow
Department of Environmental Science
Effective from Session: 2023-2024

Course Code	I150208T /ES140	Title of 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 of 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	Contact Hrs.	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 and Sons New York.
- 2-Mukherje N (2008) Ecotourism and sustainable 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 and 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/ravindradas5/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>

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	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	-
CO5	2	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
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