



Integral University, Lucknow

Effective from Session: 2018-19												
Course Code	ES203	Title of the Course	Biodiversity and Conservation	L	3	T	1	P	0	C	4	
Year	II	Semester	III									
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite										
Course Objectives	1. Assessment of biodiversity. 2. To predict pattern of biodiversity distribution.3.Exploration of biodiversity and importance of biodiversity.4To identify various threats related to biodiversity.5To conserve all life forms through various methods.											
Course Outcomes												
CO1	Acquire in-depth knowledge and critical understanding of the theory and principles of biodiversity and the interrelationships of its levels with the basic effects from infrastructure development in nature conservation areas.											
CO2	Able to determine the distribution pattern of Biodiversity											
CO3	Will be able to harness various benefits related to biodiversity											
CO4	Describe the threats to biological diversity, that is, direct harvesting, habitat destruction, and introduction of non-native species, among others, and their interactions.											
CO5	Gain knowledge and skills to realize and combine the complexity of the relations and interactions between ecosystem for sustainable management & conservation of biodiversity at all level.											
Unit No.	Title of the Unit	Content of Unit									Contact Hrs.	Mapped CO
1	Introduction to Biodiversity	Concept and levels of biodiversity, India as a mega diversity nation; Biogeographic zones of the country; Measurement of biodiversity, impact of hydropower development on biological diversity; status of protected areas and biosphere reserves in the country; National Biodiversity Action Plan									8	CO1
2	Biodiversity patterns	Gradient of Biodiversity, Geological distribution of biodiversity. Spatial patterns: latitudinal and elevation trends in biodiversity; temporal patterns: seasonal fluctuations in biodiversity patterns, Barriers and means of disposal.									8	CO2
3	Importance of biodiversity	Economic values–medicinal plants, drugs, fisheries and livelihoods; ecological services – primary productivity, role in hydrological cycle, biogeochemical cycling; ecosystem services – purification of water and air, nutrient cycling, climate control, pest control, pollination, and formation and protection of soil; social, aesthetic, consumptive, and ethical values of biodiversity.									8	CO3
4	Threats to biodiversity	Natural and anthropogenic disturbances; habitat loss, habitat degradation, and habitat fragmentation; climate change; pollution; hunting; over-exploitation; deforestation; hydropower development; invasive species; land use changes; overgrazing; man wildlife conflicts; consequences of biodiversity loss; Intermediate Disturbance Hypothesis									8	CO4
5	Conservation of Biodiversity	Conservation of biodiversity 10 In-situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); Ex-situ conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks), role of local communities and traditional knowledge in conservation; biodiversity hotspots; IUCN Red List categorization – guidelines, practice and application; Red Data book.									8	CO5
Reference Books:												
1. Gaston, K.J. & Spicer, J.I. 1998. Biodiversity: An Introduction. Blackwell Science, London, UK.												
2. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.												
3. Pandit, M.K. & Grumbine R.E. 2012. Ongoing and proposed hydropower development in the Himalaya and its impact on terrestrial biodiversity. Conservation Biology 26:1061-1071.												
4. Primack, R.B. 2002. Essentials of Conservation Biology (3rd edition). Sinauer Associates, Sunderland, USA.												
5. Singh, J. S. & Singh, S. P. 1987. Forest vegetation of the Himalaya. The Botanical Review 53: 80-192.												
6. Singh, J. S., Singh, S.P. & Gupta, S. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.												
7. Sodhi, N.S. & Ehrlich, P.R. (Eds). 2010. Conservation Biology for All. Oxford University Press.												
8-Sodhi, N.S., Gibson, L. & Raven, P.H. 2013. Conservation Biology: Voices from the Tropics. Wiley-Blackwell, Oxford, UK.												
e-Learning Source:												
1. https://ncert.nic.in/textbook/pdf/lebo115.pdf												
2. https://www.cbd.int/												
3. https://www.iucn.org/regions/europe/our-work/biodiversity-conservation												

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

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

Effective from Session: 2018-2019							
Course Code	ES204	Title of the Course	Natural Resource Management and Sustainability	L	T	P	C
Year	II	Semester	III	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	To develop a knowledge of natural resources and its conservation. To provide knowledge of renewable and non-renewable energy resources and its management techniques.						

Course Outcomes	
CO1	Be able to Protection of Natural Resources
CO2	Responsible Use of Natural Resources.
CO3	To Promote energy conservation through efficient land use planning and building design through energy conservation
CO4	Students are able to understand the benefits of sustainable use of Natural Resources.
CO5	Students are able to encourage conservation of natural resources, the city should work towards ensuring that users are charged for the full local costs of their individual use of water, electricity and sanitary sewers. There should also be educational programs to encourage conservation of natural resources.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mappe d CO
1	Introduction to Natural Resources	Resources and Reserves, Classification of natural resources, Renewable and Non-renewable resources, availability, degradation and conservation, land resources, water resources, energy resources, human impact on natural resources, ecological, social and economic dimension of resource management.	8	CO1
2	Natural Resources and Conservation	Forest resources: economic and ecological importance of forests, forests management strategies, sustainable forestry, water resources: supply, renewal and use of water resources, fresh water shortages, strategies of water conservation: Soil resources: importance of soil, soil conservation strategies, food resources: world food problem, techniques to increase world food production , green revolution	8	CO3
3	Non-renewable energy resources:	Oil: formation, exploration, extraction and processing, oil shale, tar sands, natural gas: exploration, liquified petroleum gas, liquified natural gas, Coal: reserves, classification, formation, extraction, processing, coal gasification, environmental impacts of non renewable energy consumption, impact of energy consumption on global economy, application of green technology.	8	CO2
4	Renewable energy resources	Energy efficiency, solar energy: technology, advantages, solar thermal systems, solar cells, JNN solar mission, Hydropower: technology, potential, operational costs, benefits of hydro-power development, Nuclear power: nuclear fission, fusion, reactor, pros and cons of nuclear power, storage of radioactive waste, tidal energy, wave energy, ocean thermal energy conversion (OTEC), geothermal energy, energy from biomass, bio-diesel	8	CO4
5	Resource Management:	Approaches in resource management: ecological approach, economic approach, ethnological approach, integrated resource management strategies, concept of sustainability science: sustainable energy strategy, principle of energy conservation, Indian renewable energy programme.	8	CO5

Reference Books:

1-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.

2-Freeman, A.M. 2001 . Measures of value mid Resources. Resources for the Future. Washington DC.

3-Ginley, D.S. & Calien, D. 20.11.Fundamentals of Materials for Energy and Environmental .

4-Klee, G.A. 1991 . Conservation of Natural Resources. Prentice HallPublication.

e-Learning Source:

https://docs.google.com/document/d/1HMf_BlxSbsXUkQsUuVXj_VibeEq_nu4C/edit?usp=sharing&ouid=114555250431858417199&rtfpof=true&sd=true

https://www.youtube.com/watch?v=LxHdUd_Q12Y

<https://www.youtube.com/watch?v=f14oBaPNhdc>

<https://www.youtube.com/watch?v=zBHI9rTEcRE>

<https://www.youtube.com/watch?v=1kUE0BZtTRc>

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

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

<p align="center">Name & Sign of Program Coordinator</p>	<p align="center">Sign & Seal of HoD</p>
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Integral University, Lucknow

Effective from Session: 2018-19																		
Course Code	ES205		Title of the Course	Human- Wildlife Conflict & Management									L	T	P	C		
Year	II		Semester	III									3	1	0	4		
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)		Co-requisite															
Course Objectives	Provide general introduction about wildlife management, To study Role of government in wild life conservation and management. Evolution of wildlife conservation and policies regarding protected areas in 21th century. To study different types of Environmental Act. for wild life conservation. Importance of forest produces to tribal population and tribal right in India. Impact of human wild life conflict in environment.																	
Course Outcomes																		
CO1	To Provided knowledge of government in Biodiversity conservation.																	
CO2	Be able to explain protected areas and Evolution of wildlife conservation.																	
CO3	To created knowledge Environmental Act. For wild life conservation.																	
CO4	To provided knowledge tribal population and tribal right in India.																	
CO5	To provided knowledge of human wild life conflict.																	
Unit No.	Title of the Unit	Content of Unit											Contact Hrs.	Mappe d CO				
1	Introduction to wildlife management	Need of Wildlife management; Reasons of Man-wildlife conflict, Importance of Wild life conservation, Role of government, biologists and social scientists in Wildlife management. Types of protected areas (Wildlife Sanctuaries, National Parks, Biosphere Reserves). IUCN categories. Concept of deep and Shallow ecology.											08	CO1				
2	Evolution of wildlife management	Journey of mankind from predator to conservator. Prehistoric association between wildlife and humans: records from Bhimbetkawall paintings. Conservation of wildlife in the reign of king Ashoka: excerpts from rock edicts, Bishnoi community. Understanding wildlife management, conservation and policies regarding protected areas in 21st century.											08	CO2				
3	Wildlife conservation laws in India	National policy governing wildlife protection in India, Historical perspective evolution of policies during different eras. Current policy, National Wildlife action plan and its detailed review. Concept of core and buffer area in a protected range, Brief introduction to Wildlife Protection Act of 1972, Forest Act 1927, Environmental Protection Act 1986, and Forest conservation Act 1980. Introduction of Tiger task force and National Tiger Conservation Authority.											08	CO3				
4	Legal basis of wildlife conflicts	Impact of conflict on humans and wildlife, impact of habitat fragmentation, social inequality in terms of forest conservation. The nature and extent of legal and illegal trade in wildlife species. Illegal wildlife trade in India and different parts of the world. Major trade routes and trade centers with reference to India. Introduction to tribal rights in India. Importance of forest produce to tribal populations. Scheduled tribes and other traditional Forest dwellers (Recognition of forest right) Act, 2006.											08	CO4				
5	Wildlife Conflicts	Insight into the important conflicts: Keoladeo National park conflict of Bharatpur, Human and Elephant conflicts of Kerala and West Bengal, Fisherman and tiger conflict of Sundarbans forest, Shifting cultivation in North east India.											08	CO5				
Reference Books:																		
1-Conover, M. 2001. Resolving Human Wildlife Conflicts, CRC Press.																		
2-Dickman, A. J.2010.Complexities of conflict: the importance of considering social factors for effectively resolving human-wildlife conflict. Animal Conservation 13: 458-466.																		
3-Messmer, T. A. 2000. The emergence of human-wildlife conflict management: Turning challenges into opportunities. International Bio deterioration & Biodegradation 45:97-102.																		
4-Paty, C. 2007. Forest Government and Tribe. Concept Publishing Company.																		
5-Treves, A. & Karanth, K. U. 2003. Human--carnivore conflict and perspectives on carnivore management worldwide. Conservation Biology 17: 1491-1499.																		
6-Woodroffe, R. 2005. People and Wildlife: Conflict and Coexistence. Cambridge.																		
Woodroffe, R., Thirgood, S., & Rabinowitz, A. 2005. People and Wildlife, Conflict or Coexistence? (No. 9). Cambridge University Press																		
e-Learning Source:																		
https://www.slideshare.net/sajjadmughal3344/human-wildlife-conflict-75556196																		
https://www.slideshare.net/kpkc1633/human-wildlife-conflict-in-banke-national-parknepal																		
https://www.slideshare.net/SAISIKANPATRA/human-wildlife-conflict-155300729																		
https://slideplayer.com/slide/4897971/																		
https://www.slideshare.net/subinkmohan/strategies-adopted-to-mitigate-humanelephant-conflict-hec-in-and-around-kerala-																		
https://www.slideshare.net/rajatrmr/wildlife-presentation-87241681forests																		
Course Articulation Matrix: (Mapping of COs with POs and PSOs)																		
PO- PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6
CO1	3	3	3	3	3	3	2	-	-	-	-	-	2	2	3	2	2	-
CO2	3	3	3	3	3	3	3	-	-	-	-	-	2	1	2	2	1	-
CO3	3	3	2	2	3	2	3	-	-	-	-	-	1	1	2	2	3	-
CO4	3	2	2	3	2	2	3	-	-	-	-	-	2	2	2	2	3	-
CO5	3	3	3	3	3	3	3	-	-	-	-	-	2	2	2	2	2	-
3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation																		
Name & Sign of Program Coordinator											Sign & Seal of HoD							



Integral University, Lucknow

Effective from Session: 2017-2018							
Course Code	ES206	Title of the Course	Environmental Pollution and Human Health	L	T	P	C
Year	II	Semester	III	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	1. To help the social groups and individuals to acquire knowledge of pollution and environmental degradation. 2. To help social groups and individuals to acquire a set of values for environmental protection. 3. Environmental pollution also aims at producing scientists with technical and analytical skills, environmental policy makers and researchers						

Course Outcomes	
CO1	Explain the effects of water, land and air pollution on environment and suggest ways to reduce them.
CO2	To have experience in real-world problem solving through a research project for an external client.
CO3	Develop improved understanding of the principles and application of environmental management tools including legislation and regulation.
CO4	Evaluate the relations among environment, human, and health.
CO5	Define the concepts acid rain, greenhouse gases and global warming.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mappe d CO
1	Introduction to Environmental Pollution	Environmental pollution, types of environmental pollutants, basis and challenges of environmental pollution	8	CO1
2	Air and Water Pollution	Natural and anthropogenic sources of air pollution, ambient air quality, air quality index, effects of different air pollutants on human health and control measures, Sources of surface and ground water pollution, water quality parameters and standards, effect of water contaminants on human health, water borne diseases. National Ambient Air Quality Standard.	8	CO2
3	Soil and Noise Pollution	Inequalities Causes of soil pollution and degradation, effect of soil pollution on environment, vegetation and other life forms; control strategies, soil microorganisms and their functions, degradation of different insecticides, fungicides and weedicides in soil. Noise pollution: sources, frequency, intensity and permissible ambient noise levels, effect on communication, impacts on life forms working efficiency, physical and mental health and control measures.	8	CO3
4	Radioactive and thermal pollution	Radioactive material and sources of radioactive pollution, effect of radiation on human health (somatic and genetic effects). Radiation and thermal pollution: causes, effects and control measures.	8	CO4
5	Pollution control	Activated Sludge Process, Trickling Filters, Oxidation ponds, Fluidized bed reactors, Membrane bioreactor neutralization, ETP sludge management, digesters, Upflow anaerobic sludge blanket reactor, Fixed film reactors, Sequencing batch reactors, Hybrid reactors, Bio-scrubbers, Bio-trickling filters, Regulatory framework for pollution monitoring and control. Case study: Ganga action plan; Yamuna action plan; Implementation of CNG in NCT of Delhi.	8	CO5

Reference Books:
1-Gurjar, B.R., Molina, L.T. & Ojha C.S.P. 2010. Air Pollution: Health and Environmental Impacts. CRC Press, Taylor & Francis.
2-Hester, R.E. & Harrison, R.M. 1998. Air Pollution and Health. The Royal Society of Chemistry, UK.
3-Park, K. 2015. Park's Textbook of Preventive and Social Medicine (23rd edition). Banarsidas Bhanot Publishers.
4-Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2006. Environmental and Pollution Science. Elsevier Academic Press.
e-Learning Source:
1- https://www.frontiersin.org/articles/10.3389/fpubh.2020.00014/full
2- https://www.hindawi.com/journals/jep/2012/341637/
3- https://www.epa.gov/air-quality-management-process/managing-air-quality-human-health-environmental-and-economic

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	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	3	3	2	-	-	-	-	-	3	1	2	1	1	-
CO2	3	1	2	2	1	3	3	-	-	-	-	-	3	1	1	1	1	-
CO3	3	2	3	3	3	3	3	-	-	-	-	-	3	1	1	1	1	-
CO4	3	2	3	3	3	3	3	-	-	-	-	-	3	1	1	1	1	-
CO5	3	1	2	1	1	3	3	-	-	-	-	-	3	1	1	1	1	-

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

Effective from Session: 2018-19											
Course Code	ES207	Title of the Course	Environmental Impact & Risk Assessment	L	3	T	1	P	0	C	4
Year	II	Semester	III								
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite									
Course Objectives	The purpose of this course is to impart basic and key knowledge of Environmental Impact and Risk Assessment. This will help in enhancing knowledge of Environmental Impact assessment Process, methodologies of Environmental Impact assessment and Risk assessment. After successfully completion of course, the student will able explore subject into their respective dimensions.										
Course Outcomes											
CO1	Students will be able to Analyse the role of Project Proponents, Project Developers and Consultant through Study of Environmental Impact Assessment Process.										
CO2	Students will be able to Evaluate methods, Scope and methodologies of Environmental Impact Assessment in understanding impacts of developmental Projects on Environment.										
CO3	Create an Understanding among Students about Impacts of developmental Projects on Environment through Case studies.										
CO4	Students will be able to Analyse importance of Risk Assessment in studying impacts of Project Activities through study of Exposure, Toxicity, Hazard, human and ecological risks.										
Unit No.	Title of the Unit	Content of Unit								Contact Hrs.	Mapped CO
1	Introduction to EIA	Environmental impact assessment (EIA): definitions, introduction and concepts; rationale and historical development of EIA; scope and methodologies of EIA; role of project proponents, project developers and consultants; Terms of Reference; impact identification and prediction; baseline data collection; Environmental Impact Statement (EIS), Environmental Management Plan (EMP).								8	CO1
2	Methods of EIA	Rapid EIA; Strategic Environmental Assessment; Social Impact Assessment; Cost-Benefit analysis; Life cycle assessment; environmental appraisal; environmental management - principles, problems and strategies; environmental planning; environmental audit; introduction to ISO and ISO 14000; sustainable development.								8	CO2
3	Status of EIA	EIA regulations in India; status of EIA in India; current issues in EIA; case studies of hydropower and thermal projects.								8	CO3
4	Impact Assessment	Risk assessment: introduction and scope; project planning; exposure assessment; toxicity assessment; hazard identification an assessment; risk characterization; risk communication; environmental monitoring; community involvement; legal and regulatory framework, Human and Ecological risk assessment.								8	CO4
5	EIA of Major Development Projects & Environmental Auditing	Transportation , River valley Projects , Irrigation and dams , Mining and quarrying , Oil refinery , Thermal Power Project , Cement Industries . Environmental Auditing: Scope, Objectives and Procedures for environmental auditing								8	CO3
Reference Books:											
1. Barrow, C.J. 2000. Social Impact Assessment: An Introduction. Oxford University Press.											
2. Glasson, J., Therivel, R., Chadwick, A. 1994. Introduction to Environmental Impact Assessment. London, Research Press, UK.											
3. Judith, P. 1999. Handbook of Environmental Impact Assessment. Blackwell Science.											
4. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill, New York, USA											
e-Learning Source:											
1. http://www.fao.org/3/i2802e/i2802e.pdf											
2. http://www.environmentwb.gov.in/pdf/EIA%20Notification,%202006.pdf											
3. http://extwprlegs1.fao.org/docs/pdf/ind4656.pdf											
4. http://awsassets.wfindia.org/downloads/session_13_1.pdf											

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	PS O6
CO1	3	1	3	1	2	2	3	-	-	-	-	-	3	1	3	2	2	-
CO2	3	1	3	2	2	3	3	-	-	-	-	-	3	1	3	2	2	-
CO3	3	1	2	2	2	3	2	-	-	-	-	-	3	1	3	2	2	-
CO4	3	1	2	1	2	1	2	-	-	-	-	-	3	1	3	2	2	-
CO5	3	1	2	2	2	2	2	-	-	-	-	-	3	1	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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Effective from Session: 2022-2023							
Course Code	ES209	Title of the Course	Biodiversity and Environmental Lab	L	T	P	C
Year	II	Semester	III	0	0	8	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	To help students to acquire a knowledge of qualitative structure of plant community. To help students to acquire a set of values for environmental protection. Biodiversity and Environment also aims at producing scientists with technical and analytical skills, environmental policy makers and researchers.						

Course Outcomes	
CO1	Explain the qualitative structure of plant community in a given area and also able to explain the medicinal properties of plants
CO2	Able to explain air pollutants and soil erosion and their impacts on the organisms
CO3	Able to explain watershed management technique and impact of abiotic stresses on plants
CO4	Able explain Conversion of organic or domestic waste into Vermicomposting and also able to discuss why man wild life conflict arises
CO5	Able to define Bishnoi Tribe efforts to conserve Biodiversity and About the collection of forest produce.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Forest and medicinal properties of plant	1. To study the qualitative structure of the plant community in a forest area. 2. To study the medicinal properties of the given flora.	08	CO1
2	Air pollution and soil erosion	3. To study the effects of gaseous air pollutants on the organism in a polluted area. 4. Study the various types of soil erosions and their prevention techniques in your area.	08	CO2
3	Watershed management and abiotic stresses on plants	5. Prepare a working model on watershed management technique. 6. To study the impact of abiotic stresses on given plants.	08	CO3
4	Conservation and Man wildlife conflict	7. Study of Conservation of Organic/domestic waste into Compost/ Vermicomposting. 8. Case Study of Man-Wildlife Conflict.	08	CO4
5	Conservation Case Studies and Forest Produce	9. Case Study of Bishnoi Tribe Efforts for Conservation of Biodiversity. 10. Collection of Forest Produce & explain its Significance.	08	CO5

Reference Books:
1.Pandey, P. N. (2017). Biodiversity, Environmental and Ecology, Narendra Publishing House. ISBN: 9789384337728
2.Pandey, P. N. (2017). Biodiversity' 'Environmental Science' 'Forestry. Narendra Publishing House. '
3.Sakhare, V.B. (2011). Applied Ecology. Narendra Publishing House. ISBN: 9789380428161
e-Learning Source:
https://www.slideshare.net/shalinipandey77985/medicinal-plants-27019694
https://www.slideshare.net/ShekhAlisha/medicinal-plants-importancescope-and-uses
https://www.slideshare.net/shivacivil1401/soil-erosion-59780618

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

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

Effective from Session: 2017-2018

Course Code	ES210	Title of the Course	Environmental Legislation and policy	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	The purpose of this undergraduate course is to impart basic and key knowledge of fundamental rights of freedom and equality. This will help students in enhancing the knowledge of Environmental Concerns in Economic and social development. After successful completion of course, the student will able to explore subject into their respective dimensions.						

Course Outcomes

CO1	To create knowledge of laws and policies related to environment.
CO2	To understand judicious use of environmental resources to meet the need of present and future generation.
CO3	To provide knowledge regarding good governance.
CO4	To understand environmental conservation through mutually beneficial multi stakeholder partnerships between local communities.
CO5	To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output, to minimize adverse environmental impacts.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	History of environmental legislation and policy	Medieval period: Forests as woodland and hunting resources during Mughal reign and British India. Indian Penal Code 1860, Forest Act 1865, Fisheries Act 1897. Independent India: Van Mahotsava 1950, National Forest Policy 1952, Orissa River pollution and prevention Act 1953.	8	CO1
2	Environmental legislation	Legal definitions (environmental pollution, natural resource, biodiversity, forest, sustainable development); The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; Air (Prevention and Control of Pollution) Act 1981; Environment (Protection) Act 1986; Noise Pollution (Regulation and Control) Rules 2000; Biological Diversity Act 2002, National Green Tribunal Act; 2010	8	CO2
3	Government institutions	Role of Ministry of Environment, Forests & Climate Change in environmental law and policy making; role of central and state pollution control boards in environmental law and policy making.	8	CO3
4	Case studies	National Green Tribunal Act 2010: Case Study; Aditya N Prasad vs. Union of India & Others; Ganga Tanneries Case: M.C. Mehta vs. Union of India 1988; Environmental education case: M.C. Mehta vs. Union of India, WP 860/1991.	8	CO4
5	International laws and policies	Stockholm Conference 1972, Kyoto Protocol 1997, MARPOL (1973), CITES (1973), Montreal Protocol 1987, Convention on Biological Diversity (1992); United Nations Conference on Environment and Development 1992; Rio de Janeiro (Rio Declaration, Agenda 21), Copenhagen and Paris summits, Ramsar convention, Cartagena Protocol, Nagoya Protocol	8	CO5

Reference Books:

- 1-Abraham, C.M. 1999. Environmental Jurisprudence in India. Kluwer Law International.
- 2-Aganval, V.K. 2005. Environmental Laws in India: Challenges for Enforcement. Bulletin of the National Institute of Ecology 15: 227-238.
- 3-Divan, S. & Rosencranz, A. 2001. Environmental Law and Policy in India. Oxford University Press.
- 4-Divan, S. & Rosencranz, A. 2002. Environmental Law and Policy in India. Cases, Materials and statutes (2nd edition). Oxford University Press.

e-Learning Source:

- <https://www.youtube.com/watch?v=Lq4suQu6FPo>
<https://www.youtube.com/watch?v=vsbasQiGONk>

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

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	PSO7
CO1	3	3	3	3	3	3	2	-	-	-	-	-	3	3	2	3	2	-
CO2	3	3	3	3	3	3	3	-	-	-	-	-	2	2	3	2	3	-
CO3	3	3	2	2	3	2	3	-	-	-	-	-	1	3	2	3	3	-
CO4	3	2	2	3	2	2	3	-	-	-	-	-	2	3	3	2	2	-
CO5	3	3	3	3	3	3	3	-	-	-	-	-	3	3	3	1	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

Effective from Session: 2018-19							
Course Code	ES211	Title of the Course	Environmental Health Accounting and Auditing	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	1. Imparting basic knowledge of concept of health and disease, and its allied problems. 2. To understand types of diseases and spread of disease. 3. Motivating public to participate in awareness for health and education and communication of disease. 4. To acquire knowledge for Environmental accounting. 5. To get knowledge of environmental auditing.						
Course Outcomes							
CO1	Developed basic knowledge of concept of health and disease, and its allied problems.						
CO2	Provided knowledge of types of diseases and spread of disease.						
CO3	Developed awareness for health and education and communication of disease.						
CO4	Acquired knowledge for Environmental accounting.						
CO5	Got knowledge of environmental audit.						
Unit No.	Title of the Unit	Content of Unit				Contact Hrs.	Mapped CO
1	Environmental Health	Concept of health and disease, principles of epidemiology and epidemiological methods - aims of epidemiology; measurement of mortality, measurement of morbidity.				8	CO1
2	Environmental Diseases	Some communicable diseases - small pox, acute diarrheal disease, viral hepatitis, water-borne pathogens, diseases caused by contaminated food and water, soil-borne infections, insect-borne diseases ; immunology - elementary idea about antigens and antibody				8	CO2
3	Health Programs	Health Programs in India (NRHM), demography and family planning; nutrition and health, communication and awareness for health and education, health care of the country.				8	CO3
4	Environmental Accounting	Environmental accounting, objectives of environmental accounting, methods of Environmental accounting, financial accounting, social accounting.				8	CO4
5	Environmental Auditing Environment	Overview of environmental audit, eco-management and audit scheme; typical audit programme, benefits of environmental auditing; environmental audit programme in India; ICC basic steps of an Environmental audit.				8	CO5
Reference Books:							
1-Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan							
2-Fischer (1984): Resources and Environment Economics, CUP							
3-Dasgupta (1982): The Control of Resources; Basil Blackwell							
4-Georgeacus-Roger (1971): The Entropy Law and Economic Process; HUP							
5-Concard and Clerk (1987): Natural Resources Economics; CUP							
6-Pearce and Turner (1991): The Economics of Natural Resource and Environment, Harvester & Wheatsheaf							
7-Dasgupta and Heal (1979): Economic Theory of Exhaustible Resources; CUP							
8-Kneese & Sweeny (1993): Handbook of natural Resource and Energy Economics/3 Volumes; North-Hollane							
e-Learning Source:							
https://www.researchgate.net/publication/327662482_Health_and_disease_concepts_an_approach_to_health_development							
https://aiimsrishikesh.edu.in/newwebsite/wp-content/uploads/2018/09/768_Concept_of_health_and_disease.pdf							
https://www.sciencedirect.com/science/article/pii/B9780444517876500027							
https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-accounting							
https://www.env.go.jp/en/policy/ssee/eag02.pdf							
https://www.nrep.org/blog/environmental-audit							
https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/environmental-audits							

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	1	3	1	1	3	2	-	-	-	-	-	1	2	3	1	1	-
CO2	2	1	3	1	2	2	2	-	-	-	-	-	1	2	3	1	1	-
CO3	2	1	3	2	1	2	2	-	-	-	-	-	1	3	2	1	1	-
CO4	2	1	1	1	1	3	2	-	-	-	-	-	1	1	3	3	3	-
CO5	2	1	1	1	1	3	2	-	-	-	-	-	1	1	3	3	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: 2017-2018												
Course Code	ES212	Title of the Course	Environmental Methods and Analytical Techniques	L	3	T	1	P	0	C	4	
Year	II	Semester	IV									
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite										
Course Objectives	COURSE OBJECTIVES:											
	To introduce concepts of various analytical techniques.											
	To give an introduction to modern methods of analysis that is used in environmental and process analysis.											
	To understand the basic design and operating principles of some modern instruments used in chemical analysis.											
	To understand the basics of experimental design.											
Course Outcomes												
CO1	Student gained insight into advanced theoretical knowledge in methodologies in environmental management.											
CO2	Demonstrate extensive knowledge of the area, relevant technologies, methods and theories.											
CO3	Students can describe the most common methods of chemical analysis that are used in environmental analysis.											
CO4	Students will be able to explain the general principles governing chromatographic separations based on the interactions between analytes and stationary phase											
CO5	Students will be able to explain the advantages of mass spectrometry over other techniques for the identification and quantification of analytes											
Unit No.	Title of the Unit	Content of Unit									Contact Hrs.	Mapped CO
1	Soil Analysis	Collection and preservation, analysis of particle size, water holding capacity, temperature, pH, conductivity, exchangeable calcium and Magnesium, sodium and potassium, available phosphorus, nitrogen, alkalinity, chlorides, sulphates, organic matter.									8	CO1
2	Ecological Instrumentation	Humidity measurement, rainfall measurement, pH meter, calorimeter, UV-visible spectrophotometer, Atomic absorption spectrophotometer and high-performance liquid chromatography (HPLC).									8	CO2
3	Principle and techniques of instrumentation	Thin layer chromatography and paper Electrophoresis, Spectrophotometry, Spectroscopy, Gas chromatography.									8	CO3
4	Water Analysis	Appearance: Color, turbidity, odor, taste, Acidity Alkalinity, Hardness, pH, conductivity, salinity and temperature. Heavy Metals: calcium, magnesium, chloride, sulphate, sodium and potassium.									8	CO4
5	Air Analysis	Classification and properties. Emission sources: Particulates, hydrocarbons, oxides of carbon, oxides of sulphur, oxides of nitrogen. Sampling methods, analytical gadgets and control measures									8	CO5
Reference Books:												
1-Chapin, F.S., Matson, P.A. and Mooney, H.A. 2002. Principles of Terrestrial Ecosystem Ecology. Springer-Verlag, New York												
2-Clark, R.N. 1999. Spectroscopy of Rocks and Minerals, and Principles of Spectroscopy.												
3-U.S. Geological Survey, Denver												
4-John Wainwright and Mark Mulligan (Eds).2004. Environmental Modelling: Finding Simplicity in Complexity. John Wiley & Sons Inc., New York.												
5-Manahan, S.E. 2000. Environmental Chemistry. Seventh Edition. Lewis Publishers, NY												
6-Odum, E.P. (1971), Fundamentals of Ecology: Saunders, Philadelphia.												
7-Pierzynski, G.M., Sims, J.T. and Vance, G.F. 2000. Soils and Environmental Quality. Second Edition. CRC press, New York.												
e-Learning Source:												
https://www.slideshare.net/joy_jnu/environment-analy												
https://slideplayer.com/slide/274533/												

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

Effective from Session:		2017-2018					
Course Code	ES213	Title of the Course	Introduction to Environmental Biotechnology	L	T	P	C
Year	II	Semester	IV	3	1	0	
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	To develop the student's interest in the field of environment biotechnology that may provide better understanding and solution to mitigate the pollutants. To inculcate the knowledge towards the application and future prospects of biotechnology						

Course Outcomes	
CO1	To explain the basic concepts of biotechnology
CO2	To define the principles of Genetic Engineering
CO3	To understand the techniques, involve in Genetic Engineering
CO4	To know the application of biotechnology
CO5	To study the future and scope of biotechnology

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Biotechnology	Concept of environmental biotechnology, Biodegradation of Xenobiotics, Vermicomposting, Bioremediation of metal contaminated soils, spilled oil and grease deposits and synthetic pesticides, Biosensors to detect environmental pollutants, Extremophiles.	8	CO1
2	Principles of Genetic Engineering	Basic concepts of genetic engineering of plants and its applications-herbicide and stress tolerant plant. Biotechnological strategies in forestry and wasteland management. Biotechnology in biodiversity conservation: gene banks, germplasm conservation and DNA banks.	8	CO2
3	Techniques of Genetic Engineering	08 Basic techniques in genetic engineering: Genetic manipulation, Restriction endonucleases, Introduction of cloned genes into new hosts using plasmid and phage vector systems. RFLP, Polymerase chain reaction. Environmental genomics/metagenomics-a general account. Microbes and environmental management.	8	CO3
4	Application of Biotechnology	Bioenergy, Ethanol fermentation, Liquid waste treatment, Biofilters, Activated sludge systems, Membrane bioreactors, Biotechnological approaches for solid waste management. Phyto technology: terrestrial phyto systems, metal phytoremediation, aquatic phyto systems, nutrient film techniques, algal treatment systems	8	CO4
5	Future aspects of Biotechnology	The future and Scope of Biotechnology, Biophysics in Biological Sciences, Current advancement in Toxicology, Clinical industry, Bio nanotechnology, Clinical Data Management and clinical Trials, Genetically modified organisms and Biosafety- a general account.	8	CO5

Reference Books:

- 1-Evans, G.M. and Furlong J.C. 2003. Environmental Biotechnology: Theory and Application. John Wiley and Sons.
- 2-Glick, B.R. and Pasternak J.J. 2007. Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington, D.C. ASN Press.
- 3-Horton, H.R., Moran L.A., Perry M.D. and Rawn J.D. 2006. Principles of Biochemistry, Pearson Education International.
- 4-Manahan, S.E. 1997. Environmental Science and Technology. Lewis, New York.
- 5-Metcalf and Eddy (Eds).2003. Wastewater Engineering: Treatment and Reuse.

e-Learning Source:

- <https://www.slideshare.net/krishnaSethi1/vermicomposting-118274903>
<https://slideplayer.com/slide/17997064/>

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

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: 2018-19							
Course Code	ES214	Title of the Course	Green Technologies	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	<ul style="list-style-type: none"> To impart basic knowledge of concept of green science and green technology To introduced with different types of green technologies. To know about green infrastructure, planning and economy To aware about need of green chemistry To aware about agenda of green development 						
Course Outcomes							
CO1	Gain basic knowledge of concept of green science and green technology.						
CO2	Acquired knowledge about different types of green technologies.						
CO3	Able to understand about green infrastructure, planning and economy .						
CO4	Acquired knowledge about need of green chemistry.						
CO5	Got knowledge about role and agenda of green development						
Unit No.	Title of the Unit	Content of Unit				Contact Hrs.	Mapped CO
1	Introduction and basic Concept	Introduction to green science and green technology, branches of Green Technology, sustainable consumption of resources, individual and community level participation (small-scale composting pits for biodegradable waste, energy conservation, public transport).				8	CO1
2	Green technologies	Green Energy, Green technologies in historical and contemporary perspectives, successful green technologies: wind turbines, solar panels, 3 R's of green technology: recycle, renew, reduce and reuse of wastewater.				8	CO2
3	Green infrastructure, planning and economy	Green buildings, concept of green building, history of green buildings, need and relevance of green buildings over conventional buildings, construction of green buildings, outlined examples of green buildings; LEED certified building, Eco-mark certification, establishment of Eco-mark in India, its importance and implementation, Green planning: role of governmental bodies, land use planning, concept of green cities, famous Green Buildings.				8	CO3
4	Green Chemistry	Introduction to green chemistry, principles and recognition of green criteria in chemistry, biodegradable and bio-accumulative products in environment, green nanotechnology, reagents, reactions and technologies that should be and realistically could be replaced by green alternatives, photodegradable plastic bags.				8	CO4
5	Green future	Agenda of green development, reduction of ecological footprint, role of green technologies towards a sustainable future, major challenges and their resolution for implementation of green technologies, green practices to conserve natural resources (organic agriculture, agro forestry, reducing paper usage and consumption, etc.), emphasis on waste reduction instead of recycling, emphasis on innovation for green future, green laws compliance.				8	CO5
Reference Books:							
<ul style="list-style-type: none"> Anastas, P.T. & Warner, J.C. 1998. <i>Green Chemistry: Theory & Practice</i>. Oxford Univ Press. Arceivala, S.L. 2014. <i>Green Technologies: For a Better Future</i>. Mc-Graw Hill Publications. Baker, S. 2006. <i>Sustainable Development</i>. Routledge Press. Hrubovcak, J., Vasavada, U. & Aldy, J. E. 1999. <i>Green technologies for a more sustainable agriculture</i> (No. 33721). United States Department of Agriculture, Economic Research Service. Thangavel, P. & Sridevi, G. 2015. <i>Environmental Sustainability: Role of Green Technologies</i>. Springer Publications. Woolley, T. & Kimmins, S. 2002. <i>Green Building Handbook</i> (Volume 1 and 2). Spon Press. 							
e-Learning Source:							
https://www.green-technology.org/ https://www.electropages.com/blog/2019/09/what-is-green-technology https://energytracker.asia/green-technology-examples-benefits-goals-and-future/							

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

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

Effective from Session: 2018-19							
Course Code	ES215	Title of the Course	Natural Hazards and Disaster Management	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	1. To impart basic knowledge of concept of Hazard, risk and vulnerability. 2. To understand types of hazards, its 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 causes and impact.
CO3	Understand about Assessment of risk and vulnerability related to disaster.
CO4	Acquired knowledge about mitigation and preparedness to combat disaster.
CO5	Got knowledge about role of government bodies in disaster management.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Definition of hazard; natural, technological, and context hazards; concept of risk and vulnerability; reasons of vulnerability - rapid population growth, urban expansion, environmental pollution, epidemics, industrial accidents, inadequate government policies.	8	CO1
2	Natural and Anthropogenic hazards	Natural hazards: hydrological, atmospheric & geological hazards; earthquake: volcanoes, floods, landslides, drought, cyclone & hurricanes, tsunamis, Impacts of anthropogenic activities such as rapid urbanization, deforestation, mangroves destruction, wildfires and biophysical hazards. Case studies of Bhopal, Minamata and Chernobyl disaster.	8	CO2
3	Risk and vulnerability assessment	Two components of risk: likelihood and consequences, qualitative likelihood measurement index; categories of consequences (direct losses, indirect losses, tangible losses, and intangible losses); application of geoinformatics in hazard, risk & vulnerability assessment.	8	CO3
4	Mitigation and preparedness	Concept of mitigation; types of mitigation: structural and non-structural mitigation, use of technologies in mitigations such as barrier, deflection and retention systems; concept of preparedness; importance of planning, exercise, and training in preparedness; role of public, education and media in hazard preparedness.	8	CO4
5	Disaster management in India	Lessons from the past considering the examples of Bhuj earthquake, tsunami disaster and Bhopal tragedy; Role of government bodies such as NDMC and IMD; role of armed forces and media in disaster management; role of space technology in disaster management; case study of efficient disaster management.	8	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. 1996. 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.
 8-Wasson, R.J., Sundriyal, Y.P., Chaudhary, S., Jaiswal, M.K., Morthekai, P., Sati, S.P. & Juyal, N. 2013. A 1000-year history of large floods in the upper Ganga catchment, central Himalaya, India. Quaternary Science Reviews 77: 156-166.

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>

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

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	2	2	3	2	-	-	-	-	-	1	2	3	1	1	-
CO2	1	1	1	1	1	3	2	-	-	-	-	-	1	2	3	1	1	-
CO3	1	1	1	1	1	3	2	-	-	-	-	-	1	3	2	1	1	-
CO4	1	1	2	1	1	3	2	-	-	-	-	-	1	1	3	3	3	-
CO5	1	1	1	1	1	3	2	-	-	-	-	-	1	1	3	3	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: 2018-19							
Course Code	ES216	Title of the Course	Green Technology Lab	L	T	P	C
Year	II	Semester	IV	0	0	8	4
Pre-Requisite	10+2 Physics, Chemistry & (Maths/ Biology)	Co-requisite					
Course Objectives	To know the basic guidelines and working of Composting. To develop student interest in the field of survey of eco-system and technical skills in the field of environment. To help students to acquire the experimental knowledge of nutrients present in the soil.						

Course Outcomes	
CO1	Develop the practical knowledge about the composting.
CO2	Develop practical knowledge to determine the working of Atomic Absorption spectrophotometer.
CO3	Gain knowledge about the general prone areas of environment. To understand the working of water treatment plant.
CO4	To understand the handling of air pollution control equipment and sound level meter.
CO5	Develop the knowledge of nutrients present in the soil.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Working of Composting	Demonstration of Composting techniques	8	1
2	Study of Heavy metals	Demonstration of working of an Atomic Absorption spectrophotometer for the detection of heavy metals.	8	2
3	Study of prone areas and working of water treatment plants	Preparation of hazard zone map of India for landslides, Earthquakes, floods etc. Visit to Waste water treatment plant.	8	3
4	Survey and demonstration of air pollution control equipments	Visit to industry for survey of air pollution control equipment. Measurements of noise level using sound level meter.	8	4
5	Study of nutrients	To study the NPK of soil samples by using soil testing kit.	8	5

Reference Books:	
Rao M. N and H.V.N.Rao,1989:Air pollution,TataMcGraw Hill Publishing Co. Ltd., New Delhi	
Misra, R,1986. Ecology workbook Oxford and IBH Publishing Co., New Delhi.	
Khopkar S.M.,1993;Environment Pollution Analysis, Eastern Limited, New York	
e-Learning Source:	
https://www.youtube.com/watch?v=mDIVpJgjoXQ&ab_channel=UrbanGardening	
https://www.youtube.com/watch?v=5fvWhCk7x6U&ab_channel=Edmerls	
https://www.youtube.com/watch?v=-a5NT4-6qSE&ab_channel=krishivalley	

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	PSO7
CO1	2	3	1	3	3	3	2	3					2	3	3	3	2	
CO2	2	1	2	3	2	1	2	3					3	2	3	1	3	
CO3	3	3	3	2	3	2	3	3					2	3	2	3	3	
CO4	2	3	2	1	2	2	3	2					2	1	2	2	2	
CO5	3	2	3	2	3	2	2	1					2	3	2	3	2	

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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