



**Integral University, Lucknow**

<b>Effective from Session:</b> 2019-2020							
<b>Course Code</b>	ES301	<b>Title of the Course</b>	Basics of Remote Sensing, Geographic Information System	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	III	<b>Semester</b>	V	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 with Physics, Chemistry & Biology/Maths	<b>Co-requisite</b>					
<b>Course Objectives</b>	To study of remote sensing component and different types of platform. □ Measurement of biodiversity interaction with environment by satellite, sensors and aerial photography. □ Geographical analysis by Raster and vector data. □ Statistical analysis of geographical data structure. □ To monitoring forest diversity and urban sprawl analysis by Remote Sensing and GIS Technology.						

Course Outcomes	
<b>CO1</b>	To develop basic knowledge of remote sensing and GIS.
<b>CO2</b>	To provided knowledge of monitoring biodiversity by satellite, sensors and aerial photography.
<b>CO3</b>	To provided knowledge of Geographical analysis by Raster and vector data.
<b>CO4</b>	To created knowledge of Statically analysis of geographical data structure.
<b>CO5</b>	Be able to describe application of Remote Sensing and GIS Technology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Remote Sensing and GIS	Remote Sensing and GIS: Definition and Components, Development, Platforms and types.	8	CO1
2	Photogrammetric and Cartography	Aerial Photography and Satellite Remote Sensing: Principles, Types and Geometry of Aerial Photograph; Principles of Remote Sensing, EMR Interaction with Atmosphere and Earth Surface; Satellites (Landsat and IRS) and Sensors. Mapping/ Ortho projections etc.	8	CO2
3	Spatial analysis.	GIS Data Structures: Types (spatial and Non-spatial), Raster and Vector Data Structure.	8	CO3
4	Image statistics	Image Processing (Digital and Manual) and Data Analysis: Pre-processing (Radiometric and Geometric Correction), Enhancement (Filtering); Classification (Supervised and Un-supervised), Geo-Referencing; Editing and Output; Overlays.	8	CO4
5	Application of Geospatial Technologies	Interpretation and Application of Remote Sensing and GIS: Land use/ Land Cover, Urban Sprawl Analysis; Forests Monitoring.	8	CO5

<b>Reference Books:</b>	
1) Campbell J. B., 2007: Introduction to Remote Sensing, Guildford Press.	
2) Lillesand T. M., Kiefer R. W. and Chipman J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition).	
3) Joseph, G. 2005: Fundamentals of Remote Sensing, United Press India.	
4) Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGraw-Hill.	
5) Chauniyal, D.D. (2010) Sudur Samvedan evam Bhogolik Suchana Pranali, Sharda Pustak Bhawan, Allahabad	
<b>e-Learning Source:</b>	
<a href="https://www.nrsc.gov.in">https://www.nrsc.gov.in</a>	
<a href="https://www.iirsisro.gov.in">https://www.iirsisro.gov.in</a>	
<a href="https://www.youtube.com/watch?v=3fbEVtyJcK">https://www.youtube.com/watch?v=3fbEVtyJcK</a>	

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	3	3	2						2	2	2	2	2	
CO2	3	3	3	3	3	3	3						3	2	2	2	2	
CO3	3	3	2	2	3	2	3						3	2	2	2	2	
CO4	3	2	2	3	2	2	3						3	2	2	2	2	
CO5	3	3	3	3	3	3	3						3	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: 2019-20							
<b>Course Code</b>	ES302	<b>Title of the Course</b>	<b>Land and Soil Conservation and Management,</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	III	<b>Semester</b>	V	3	1	0	4
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	To develop the scientific attitude among the students for land and soil conservation. To develop attitude towards the fundamental education of soil among the students. To develop clear thinking about land use pattern awareness among the students. To develop attitude towards soil pollution, its degradation among the students. To provide knowledge to students about rational and scientific thinking about the measures to abate soil degradation.						
<b>Course Outcomes</b>							
<b>CO1</b>	Students can enhance their knowledge about of soil erosion and conservation.						
<b>CO2</b>	Students can increase their knowledge about agricultural productivity in sustained manner without deteriorating the soil health.						
<b>CO3</b>	Students can get efficient prospect to know about rainfall with development of water harvesting structures such as farm Ponds and check dams.						
<b>CO4</b>	Restoration of ecological balance by harnessing, conserving and developing natural resources.						
<b>CO5</b>	To minimize flood hazards in the valley bottom areas and farm lands by way of preventing silt deposition in the riverbed.						
<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>				<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction	Land as a resource, soil health, types and causes of soil degradation; impact of soil loss and soil degradation on agriculture and food security; need for soil conservation and restoration of soil fertility.				8	CO1
2	Fundamentals of soil science	Soil formation, classification of soil, physical properties of soil, soil texture, soil water holding capacity, soil temperature; soil colloids, soil acidity and alkalinity, soil salinity and sodicity, soil Organic matter, micronutrients of soil; nitrogen, Sulphur, potassium and phosphorus economy of soil, soil biodiversity, soil taxonomy maps.				8	CO2
3	Soil degradation - causes	Soil resistance and resilience, nature and types of soil erosion, non-erosive and erosive soil Degradation, losses of soil moisture and its regulation; nutrient depletion, soil pollution due to mining and mineral extraction, industrial and urban development, toxic organic chemicals, and Organic contaminants in soils, fertilizers and fertilizer management.				8	CO3
4	Land use changes and land degradation	Land resources: types and evaluation; biological and physical phenomena in land degradation; visual indicators of land degradation; drivers of land degradation-deforestation, desertification; habitat loss, loss of biodiversity, range land degradation, land Salinization, human population pressure, poverty, socio-economic and institutional factors. Drivers of land use and land cover change in major geographic zones and biodiverse regions with particular reference to the Himalaya and the Western Ghats.				8	CO4
5	Controlling land degradation	Sustainable land use planning, role of databases and data analysis in land use planning control and management, land tenure and land policy, legal, institutional and sociological factors, participatory land degradation assessment, integrating land degradation assessment into conservation.				8	CO5
<b>Reference Books:</b>							
1.Brady, N.C. & Well, R.R. 2007.The Nature and Properties of Soils (13th edition), Pearson Education Inc.							
2.Gadgil, M. 1993. Biodiversity and India's degraded lands. Ambio 22: 167-172.							
2.Johnson, D.L. 2006. Land Degradation (2nd edition). Rowman & Littlefield Publishers.							
3.Marsh, W. M. & Dozier, J. 1983. Landscape Planning: Environmental Applications. John Wiley & Sons.							
4.Oldeman, L. R. 1994. The global extent of soil degradation. Soil resilience and sustainable land use, 9.							
5. Pandit, M.K. & Kumar, V. 2013. Land use and conservation challenges in Himalaya: Past, present and future. In: Sodhi, N.S., Gibson, L. & Raven,							
<b>e-Learning Source:</b>							
<a href="https://www.youtube.com/watch?v=RWw09HU5n2I">https://www.youtube.com/watch?v=RWw09HU5n2I</a>							
<a href="https://www.youtube.com/watch?v=b3V988XYD-I">https://www.youtube.com/watch?v=b3V988XYD-I</a>							
<a href="https://www.youtube.com/watch?v=ValcMICik1w">https://www.youtube.com/watch?v=ValcMICik1w</a>							
<a href="https://www.youtube.com/watch?v=IXW05_jM2bM">https://www.youtube.com/watch?v=IXW05_jM2bM</a>							
<a href="https://www.youtube.com/watch?v=Cy6W5fHPBLg">https://www.youtube.com/watch?v=Cy6W5fHPBLg</a>							

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

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES303</b>	<b>Title of the Course</b>	<b>Agroecology and Agroforestry</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>V</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	Provide general introduction about Agroecology and Agroforestry. To learn about fundamentals, concepts and principles of Agroforestry. To develop silvicultural systems in Agroforestry and their management with its formulation and objectives. To learn about concept and principle of Agroecology with its Agroecological practices. To provide knowledge about Agro-ecological basis for the conversion to organic movements						

<b>Course Outcomes</b>	
<b>CO1</b>	Knowledge of Agroecology and Agroforestry
<b>CO2</b>	Knowledge about scope of global and national needs for Agroforestry with its practices
<b>CO3</b>	To understand silvicultural systems in Agroforestry and selection of tree species for Agroforestry
<b>CO4</b>	To understand the principle of Agroecology and its role in ecological agriculture
<b>CO5</b>	To learn the conversion of organic movements for crop rotation, crop diversity and enhance soil health

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction to Agro-ecology & Agro-forestry	Basic Terms: Agriculture, Ecology, Environment, Agro-ecology, Forestry and Agro-forestry, Silviculture, Agronomy, Tree Improvement.	08	CO1
2	Concepts in Agroforestry	Fundamental concepts in Agroforestry: Scope, global and national needs for Agroforestry: Principles of mixed cropping, multiple cropping and inter-cropping. Agroforestry systems and practices for various agro-climatic zones of India. Role and scope of genetics in tree improvement. Sexual and asexual propagation, genetic variability in trees.	08	CO2
3	Silvicultural systems in Agroforestry and their Management	Silvicultural systems: Introduction, definitions, scope, classification, formulation and objectives. Clear felling systems and their modifications, shelter-wood systems, selection system, coppice system. Selection of trees species for agroforestry systems. Selection of companion crops, intercrops and filler crops in orchards.	08	CO3
4	Concept and Principle of Agro-ecology	Concept and Principle of Agro-ecology, Agroecological practices and systems, Role of Biodiversity in Ecological Agriculture. Enhancing plant biodiversity for ecological pest management in agro-ecosystems.	08	CO4
5	Title of the unit: Agro-ecological basis for the conversion to organic movements	Crop rotations, Enhance soil health, crop diversity, indicators of sustainability, agro-ecology and rural movements.	08	CO5

<b>Reference Books:</b>	
1-Gliessman, S. R.2002. Agroecosystem Sustainability: Developing Practical Strategies. CRC Press	
2-Lynggaard, K.2006. The Common Agricultural Policy and Organic Farming: An Institutional Perspective on Continuity & Change. CAB International.	
3-Nair, P.K.R. 1989. Agroforestry Systems in the Tropics, Kluwer, Netherlands.	
4-Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, the Netherlands.	
5-Newton, Paul C.D., Carran R.A., Edwards,G.R. Pascal A. and Niklaus.2007.	
6-Agroecosystems in a Changing Climate. Advances in Agroecology Vol.12 CRC/Taylor & Francis.	
7-Rao, N.J. 2005. Indian Agriculture: Issues and Perspectives, ICFAI University Press.	
8-Singh,J.S., Singh S.P. and Gupta S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.	
9-Young, A. 1997. Agroforestry for Soil Management, CAB International, UK.	
<b>e-Learning Source:</b>	
<a href="https://www.youtube.com/watch?v=i00ycMkr8lo">https://www.youtube.com/watch?v=i00ycMkr8lo</a>	

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

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

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

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES304</b>	<b>Title of the Course</b>	<b>Solid waste management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>V</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	To select the most suitable solid waste management options in a specific local context. To conceptually design waste conversion/treatment processes. Assess the environmental impact of solid waste management options and criticize the results. Assess the economic impact of solid waste management options and criticize the results. Develop innovative solutions of solid waste management in urban areas.						
<b>Course Outcomes</b>							
<b>CO1</b>	Deep knowledge of disposal of solid waste.						
<b>CO2</b>	To create awareness among the people about the impact of waste.						
<b>CO3</b>	Knowledge for the protection of environment through effective waste management techniques.						
<b>CO4</b>	Knowledge to reduce and reuse of waste.						
<b>CO5</b>	Understanding of green techniques for solid waste disposal.						
<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>	
1	Introduction	Sources and generation of solid waste, their classification and chemical composition; characterization of municipal solid waste; hazardous waste and biomedical waste.			8	CO1	
2	Impact of solid waste disposal on environment.	Impact of solid waste on environment, human and plant health; effect of solid waste and industrial effluent discharge on water quality and aquatic life; mining waste and land degradation; effect of land fill leachate on soil characteristics and ground water pollution.			8	CO2	
3	Solid waste management	Different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); Thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques.			8	CO3	
4	Resource Recovery	4R-Reduce, reuse, recycle and recover; biological processing -composting, anaerobic digestion, aerobic treatment, reductive de-halogenation, mechanical biological treatment, green techniques for waste treatment.			8	CO4	
5	Policies for solid waste management	Municipal solid waste (Management and Handling) Rules 2000, Hazardous Wastes Management and Handling Rules 1989, Bio-Medical Waste (Management and Handling) Rules 1998, Eco-friendly or green products.			8	CO5	

**Reference Books:**

- 1-Asnani, P. U. 2006. Solid waste management. India Infrastructure Report 570.
- 2-Bagchi, A. 2004. Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.
- 3-Blackman, W.C. 2001. Basic Hazardous Waste Management. CRC Press.
4. McDougall, F. R., White, P. R., Franke, M., & Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons.
- 5-US EPA. 1999. Guide for Industrial Waste Management. Washington D.C.
- 6-White, P.R., Franke, M. & Hindle P. 1995. Integrated Solid waste Management: A Life cycle Inventory. Blackie Academic & Professionals
- 6-Zhu, D., Asnani, P.U., Zurbrugg, C., Anapolsky, S. & Mani, S. 2008. Improving Municipal Solid waste Management in India. The World Bank, Washington D.C. Bank, Washington D.C.

**e-Learning Source:**

- <https://www.youtube.com/watch?v=9fX9Klh9rck>
- <https://www.youtube.com/watch?v=YNFnwP8stUY>
- [https://www.youtube.com/watch?v=T\\_pJiZ8JYI](https://www.youtube.com/watch?v=T_pJiZ8JYI)
- <https://www.youtube.com/watch?v=nL354fxAfBk>

**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
	<b>CO1</b>	3	3	3	3	2	3	2	-	-	-	-	-	3	3	2	2	3
<b>CO2</b>	3	3	3	3	3	3	2	-	-	-	-	-	3	3	3	2	2	-
<b>CO3</b>	3	3	3	3	3	3	3	-	-	-	-	-	3	2	3	2	2	-
<b>CO4</b>	3	3	3	3	3	3	3	-	-	-	-	-	2	2	2	1	3	-
<b>CO5</b>	3	3	3	2	2	3	3	-	-	-	-	-	3	3	3	2	2	-

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES305</b>	<b>Title of the Course</b>	<b>Environmental Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>V</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	To Provide Knowledge of Sustainable Development. To learn about different methods of conservation of soil. To understand different strategies to conserve water. To understand the laws and National/International efforts for Environment Management.						

<b>Course Outcomes</b>	
<b>CO1</b>	To gain Knowledge of Sustainable Development
<b>CO2</b>	To gain Knowledge about different methods of conservation of soil
<b>CO3</b>	To understand different strategies to conserve water
<b>CO4</b>	To understand the laws for Environment Management
<b>CO5</b>	To learn the National/International efforts for Management of Environment

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	General concept for Environment management	Concept of Sustainable Development, Green Technologies, Forest Management, Wildlife Management, Project Tiger, Range Management	8	CO1
2	Soil Conservation and its Management	Soil, Types of soil, Soil erosion, Soil conservation techniques, Land conservation strategies, Biofertilizers, Organic farming, Bioremediation, Waste land Reclamation.	8	CO2
3	Water Conservation and its Management	Water resources: Types and use of water resources, Methods of enhancing fresh water supply, Watershed management and its importance, Sustainable use of water resources, Rain water harvesting	8	CO3
4	Laws for Environment Management	Wildlife Protection Act 1972, Water Prevention and control of pollution Act 1974, Forest Conservation Act 1980, Air prevention and control of Pollution Act 1981, Environmental Protection Act 1986.	8	CO4
5	National/International efforts for Management of Environment	Earth summit, World conference on sustainable development, Montreal protocol, Kyoto protocol, Role of NGO's in Environment protection.	8	CO5

**Reference Books:**

- 1-Rau, J.G. and Wooten, D.C (1980) Environmental Impact Analysis Hand Book, Mc Graw Hill, USA.
- 2-Houghton, J. 2005. Global warming: The Complete Briefing. Cambridge: Cambridge University Press. Cambridge.
- 3-Sanjay Saxena (2003) A First course in computers, Vikas publishing house Pvt. Ltd, New Delhi
- 4-Odum, E. P., (1971) Fundamentals of Ecology, W. B., Saunders Company, Philadelphia
- 5-Agriculture Production and Climate Change. Monowar Alam Khalid, Pawan Kumar Bharti, Alka Chauhan, 2018. Discovery Publishing House Pvt. Ltd. ISBN 978-93-86841-54-4.Pg203

**e-Learning Source:**

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

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

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**

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES306</b>	<b>Title of the Course</b>	<b>Urban Ecosystems</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>V</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	To Provide Knowledge of urbanization. To learn about Urban planning and its environmental aspects from historical and contemporary perspectives.						

<b>Course Outcomes</b>	
<b>CO1</b>	Able to Identify key issues in urban ecosystem management, and its linkage to urban sustainability and resilience.
<b>CO2</b>	Able to raise attention and public awareness of the importance of urban ecosystem management among scientists, policy makers, and general public.
<b>CO3</b>	Understand Urban Planning
<b>CO4</b>	To understand the laws for Environment Management
<b>CO5</b>	To gain advanced knowledge and guidance for better urban ecosystem management.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction to Urbanization	Introduction to urbanization, urban sprawl and associated environmental issues. Impact of industry and technology on urbanization, Impact of urbanization on environment	8	CO1
2	Environment in an urban setting	Man as the driver of urban ecosystem; resource consumption and its social, cultural, economic and ecological perspectives; urban transformation; increasing challenges posed by modernity for the environment; urban pollution (air, water, soil).	8	CO2
3	Urban dwelling	Housing scenario across a range of large-medium-small cities, poverty and slums in an urban context, Town planning Acts and their environmental aspects; energy consumption and waste disposal as well as accumulation; environmental costs of urban infrastructure.	8	CO3
4	Urban interface with the environment	Management of urban environment; alternative resources; policy and management decisions, urban settings as loci of sustainability, challenges associated with sustainability and urban future.	8	CO4
5	Planning and environmental management	Urban planning and its environmental aspects from historical and contemporary perspectives, benefits of environmental management, introduction to green buildings, urban governance, political complexity of applying ecological science to urban policy and planning, smart cities.	8	CO5

**Reference Books:**

- 1-D'Monte, Darryl. 1985. Industry versus Environment Temples or Tombs. Three Controversies, Delhi, CSE.
- 2-Ernstson, H. 2011. Re-translating nature in post-apartheid Cape Town: The material semiotics of people and plants at Bottom Road. In: Heeks, R., (Ed.) Conference on "Understanding Development through Actor-Network Theory", London School of Economics, 30 June, London.
- 3-Gaston, K.J. 2010. Urban Ecology. Cambridge University Press, New York.
- 4-Grimm, N. B., Faeth, S. H., et al. 2008. Global Change and the Ecology of Cities. Science 319:756-760.
- 5-Hinchliffe, S. & Whatmore, S. 2006. Living cities: Towards a politics of conviviality. Science as Culture 15: 123-138.
- 6-McIntyre, N.E. 2000. Urban ecology as an interdisciplinary field: differences in the use of 'urban' between the social and natural sciences. Urban Ecosystems 4: 5-24.

**e-Learning Source:**

<https://www.britannica.com/science/urban-ecosystem>

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

<b>PO-PSO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO1</b>	3	2	3	2	2	2	2	-	-	-	-	-	3	2	1	2	1	-
<b>CO2</b>	2	3	3	2	3	2	2	-	-	-	-	-	3	3	3	2	1	-
<b>CO3</b>	3	2	3	3	2	1	2	-	-	-	-	-	1	2	2	2	1	-
<b>CO4</b>	3	2	3	3	2	1	2	-	-	-	-	-	3	2	1	1	1	-
<b>CO5</b>	2	3	3	2	3	2	3	-	-	-	-	-	2	1	3	2	1	-

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES307</b>	<b>Title of the Course</b>	<b>Environmental Management Lab.</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	V	<b>0</b>	<b>0</b>	<b>7</b>	<b>2</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	This course provides students with a working knowledge of optical physics, including diffraction, polarization and laser physics.						

<b>Course Outcomes</b>	
<b>CO1</b>	Analysis of solid waste disposal methods.
<b>CO2</b>	Remote sensing software ARC GIS and its application.
<b>CO3</b>	Nursery techniques for agro-forestry.
<b>CO4</b>	Proximate analysis of soil samples.
<b>CO5</b>	Model making of a green building.
<b>CO6</b>	Visit to Solid waste Treatment Plant.
<b>CO7</b>	Visit to agro-forestry plantation.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Solid waste Management	Different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques.	8	CO1
2	Application of Geospatial Technologies	Interpretation and Application of Remote Sensing and GIS: Land use/ Land Cover, Urban Sprawl Analysis; Forests Monitoring.	8	CO2
3	Introduction to Agro-ecology and Agro-forestry	Basic Terms: Agriculture, Ecology, Environment, Agro-ecology, Forestry and Agro-forestry, Silviculture, Agronomy, Tree Improvement	8	CO3
4	Soil Conservation and its Management	Soil, Types of soil, Soil erosion, Soil conservation techniques, Land conservation strategies, Bio-fertilizers, Organic farming, Bioremediation, Waste land Reclamation.	8	CO4
5	Planning and environmental management	Urban planning and its environmental aspects from historical and contemporary perspectives, benefits of environmental management, introduction to green buildings, urban governance, political complexity of applying ecological science to urban policy and planning, smart cities	8	CO5
6	Solid waste Management	Different techniques used in collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques.	8	CO6
7	Introduction to Agro-ecology and Agro-forestr	Basic Terms: Agriculture, Ecology, Environment, Agro-ecology, Forestry and Agro-forestry, Silviculture, Agronomy, Tree Improvement.	8	CO7

**Reference Books:**

2-Odum, E. P., (1971) Fundamentals of Ecology, W. B., Saunders Company, Philadelphia\

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

4-Gliessman, S. R.2002. Agroecosystem Sustainability: Developing Practical Strategies. CRC Press

5-Campbell J. B., 2007: Introduction to Remote Sensing, Guildford Press.

5-Johnson, D.L. 2006. Land Degradation (2nd edition). Rowman& Littlefield Publishers.

6-Asnani, P. U. 2006. Solid waste management. India Infrastructure Report 570.

7-Bagchi, A. 2004. Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.

**e-Learning Source:**

5. <https://www.dnr.sc.gov/geology/pdfs/education/Geologic%20Time.pdf>

6. <https://ncert.nic.in/textbook/pdf/fess201.pdf>

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

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HOD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES308</b>	<b>Title of the Course</b>	<b>Ecological Economics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	III	<b>Semester</b>	VI	3	1	0	4
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	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.						

<b>Course Outcomes</b>	
<b>CO1</b>	Students will be able to Analyse the role of ecological economics in influencing demand and Supply in Markets and environmental policy.
<b>CO2</b>	Students will be able to Evaluate costs and benefits of pollution control by adopting market based instruments for controlling Environmental pollution.
<b>CO3</b>	Create an Understanding among Students about how guiding principles of Sustainable developmental help in facing global challenges of Sustainable Development
<b>CO4</b>	Students will be able to Analyse importance of strategies of global sustainability in developing instruments for implementing Sustainability.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction to Ecological Economics	Scope and Importance of Ecological Economics, Economics and Environmental Policy, the market mechanisms and choices, benefits of Environmental protection: Demand and supply, market Price and Quality: Environmental Externalities and the problem of Social cost. Valuation of Ecosystem services, Value Addition in Agriculture Crops, Agricultural Marketing.	8	CO1
2	Ecological Cost Benefits and Environmental Protection	Economic Analysis of Climate change, Benefits of controlling of Green House Gasses, Cost of Controlling Green House Gasses, Carbon Trading and CDM mechanisms. Measuring the Cost and Benefits of Pollution control, Overview of Cost Benefit Analysis, Economic Principles of Cost Benefit Analysis, Measurement of Economic Value of Environment, contingent valuation method, Travel Cost Methods, Hedonic Market Methods, Market Based Instruments for Pollution Control, Systems of Integrated Environmental accounting, Green Accounting.	8	CO2
3	Economic Sustainability	Definition and Dimensions of Sustainability, Global Challenges of Sustainable Development, The Ecological Foot Print, Global Environmental Monitoring and Assessment, Guiding Principles of Sustainable Development, National Sustainable Development Strategies, Sustainability Indicators, Models of Sustainability, Environmental Sustainability Index, Global Action and Sustainable Development, Education for Sustainability.	8	CO3
4	Strategies of Global Sustainability	An Economic perspective to Sustainability, Strategies for Global Sustainability, Instruments for implementing Sustainability-Finding Right Prices, the Hardwick - Sorrow rule, Critical Rental Capital, Safe minimum Standard, Steady State Principles. Policy Implications for implementing Sustainability.	8	CO4
5	Economic Solutions to Environmental Programs	Social Cost and Benefits of Environmental Programmes, Marginal Social benefit of Abatement, Marginal Social Cost of Abatement, pollution control, Policies for Controlling Air and Water Pollution, Disposal of Toxic and Hazardous Waste –Standards vz. emission charges, environmental subsidies, modelling and emission charges, polluter pays principle, pollution permit Trading system.	8	CO2

**Reference Books:**

- 1- Bhattacharya, R.N. 2001. An Economic perspective , Oxford University Press.
- 2.-Environmental Economics and Sustainability, Jose G Varghas- Hernandez, Monowar Alam Khalid. Pawan Kumar Bharti, 2018. Discovery Publishing House Pvt. Ltd. ISBN 978-93-86841-37-7 Pg 202.
- 3-Hanley, Nick and Roberts C.J.2002, Issues in Environmental Economics, Black well Publishers, U.K
- 4-Ward F. A. 2006, Environmental and Natural Resource Economics, Pearson Prentice Hall, New Jersey.

**e-Learning Source:**

- 1-[https://www.soas.ac.uk/cedep-demos/000\\_P570\\_IEEP\\_K3736-Demo/module/pdfs/p570\\_unit\\_01.pdf](https://www.soas.ac.uk/cedep-demos/000_P570_IEEP_K3736-Demo/module/pdfs/p570_unit_01.pdf)
- 2-[https://www.sfu.ca/~wainwrig/Econ400/documents/Econ\\_460\\_Lecture-Notes-part\\_One-10-3.pdf](https://www.sfu.ca/~wainwrig/Econ400/documents/Econ_460_Lecture-Notes-part_One-10-3.pdf)
- 3- <https://ocw.mit.edu/courses/economics/14-42-environmental-policy-and-economics-spring-2011/lecture-notes/>
- 4- <https://nptel.ac.in/courses/109107171/>

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

PO-PSO CO	POs												PSOs					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	1	1	1	3	-	-	-	-	-	3	1	3	2	2	-
CO2	3	1	2	1	2	3	3	-	-	-	-	-	3	1	3	2	2	-
CO3	3	1	2	1	2	3	3	-	-	-	-	-	3	1	3	2	2	-
CO4	3	1	2	1	3	3	3	-	-	-	-	-	3	1	3	2	2	-

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

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

<b>Effective from Session: 2019-20</b>							
<b>Course Code</b>	<b>ES309</b>	<b>Title of the Course</b>	<b>Environment and Society</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>VI</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	<b>This course provides students the knowledge and understanding of environmental issues and social inequalities</b>						

<b>Course Outcomes</b>	
<b>CO1</b>	To develop the social and cultural attitude towards the environment.
<b>CO2</b>	To develop attitude among students on the issues arising from anthropogenic activities.
<b>CO3</b>	To develop clear thinking about inequalities of class, gender, race and the rehabilitation of the project affected people.
<b>CO4</b>	To develop attitude towards the issues arising from the development of urbanization and technological development and its impact on environment.
<b>CO5</b>	To enable students to participate as a volunteer on various environmental issues

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction	Social and cultural construction of 'environment'; environmental thought from historical and contemporary perspective in light of the concepts of Gross Net Happiness and Aldo Leopold's Land Ethic	8	CO1
2	Environmental Issues	Significant global environmental issues such as acid rain, climate change, and resource depletion; historical developments in cultural, social and economic issues related to land, forest, and water management in a global context; interface between environment and society.	8	CO2
3	Environment and Social Inequalities	Inequalities of race, class, gender, region, and nation-state in access to healthy and safe environments; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs). environmental ethics, issues and possible solutions.	8	CO3
4	Urbanization and Environment	Production and consumption oriented approaches to environmental issues in Indian as well as global context; impact of industry and technology on environment; urban sprawl, traffic congestion and social-economic problems; conflict between economic and environmental interests.	8	CO4
5	Community participation	State, corporate, civil society, community, and individual-level initiatives to ensure sustainable development; case studies of environmental movements (Appiko Movement, Chipko Movement, Narmada Bachao Andolan); corporate responsibility movement; appropriate technology movement; environmental groups and movements, citizen groups; role played by NGOs; environmental education and awareness.	8	CO5

**Reference Books:**

- 1-Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004.
- 2-Understanding Environment. Sagar Publication India Pvt. Ltd., New Delhi.
- 3-Elliot, D. 2003. Energy, Society and Environment, Technology for a Sustainable Future. Routledge Press.
- 4-National Research Council (NRC). 1996. Linking Science and Technology to Society's Environmental Goals National Academy Press

**e-Learning Source:**

- 1-<https://www.britannica.com/topic/environmentalism/History-of-the-environmental-movement>
- 2-chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ncert.nic.in/textbook/pdf/lebo116.pdf
- 3-Fundamentals of Environmental Studies, <https://www.jkcprl.ac.in/download/11567250727.pdf>
- 4-Environmental Science, Tom Theis and Jonathan Tomkin, OpenStax CNX, National Digital LibraryOf India.

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

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-2020</b>							
<b>Course Code</b>	<b>ES310</b>	<b>Title of the Course</b>	<b>Health Safety and Environment</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>III</b>	<b>Semester</b>	<b>VI</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	This course provides students with a working knowledge of Health safety measures while working in the Industry or in any factory.						

Course Outcomes	
<b>CO1</b>	To understand the safety measures while working in Industrial workplace.
<b>CO2</b>	Be able to Permissible industrial exposure limits.
<b>CO3</b>	To understand the safety measures by participating in training programs.
<b>CO4</b>	To understand about the Industrial Hygiene.
<b>CO5</b>	Be able about the use of Personal protective equipment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Concept of Industrial Safety & Principles of accident Prevention	Need and Importance of Industrial Safety, concepts & Principles of accident prevention, Definition : Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error, oversight, mistakes etc., Classification of hazards, Accident Prevention: Theories/Models of accident occurrences, Plant safety inspection.	8	CO1
2	Permissible industrial exposure limits & safety at workplace	Short term and long-term effects of exposure- preventive and control measures. Factory internal and external security, Security of Vulnerable Area/Vulnerable Point, Safe use of various types of hand tools, Plant layout for safety, National Building code part VIII, Importance of first aid at workplace.	8	CO2
3	Safety management training & awareness	Meaning and objectives, Importance and steps in developing safety training programs, Roles of safety department and safety specialists in the organization- Staff or line, Responsibilities of plant managers, foremen, supervisors, Employee participation in safety, Role of trade union in safety, health and environment, Motivation & awareness for safety.	8	CO3
4	Industrial hygiene & occupational health	Chemical Hazards: Introduction to chemical hazards, dangerous properties of chemicals, dust, gases, fumes, mist, vapors, smoke and aerosols, Industrial hygiene & common occupational diseases, Occupational Health services at the place of employment, Occupational physical Health Hazards, Adverse health effects of noise, vibration, thermal radiation, X-ray, ultra -violet radiation, ionizing and non- ionizing radiations	8	CO4
5	Personal protective equipments	Personal protective equipments & need for personal protective equipments, Assessment of workload based on human physiological reaction, physical fitness, physiological fatigue and reset allowance, Physiological test for assessment of occupational health. Case studies like Bhopal Gas Disaster, Chernobyl Nuclear Disaster, Three Mile Island Accident, Fukushima Nuclear Accidents, etc.	8	CO5

**Reference Books:**

- 1-Dan Peter. Techniques safety Management, Mc Graw Hill Book Co. New York, 1978.
- 2-Frank P Lees-Loss of prevention in process Industries, Vol. 1 and 2, Butterworth- Heinemann Ltd., London(1991)
- 3-R.K. Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna Publishers, New Delhi (2006).
- 4-Industrial Safety – National Safety Council of India

**e-Learning Source:**

Es accident prevention method / what is 5Es in Hindi #safetyvideo | safety - YouTube  
<https://www.bing.com/videos/search?q=Permissible+Exposure+Limits+-+Bing+video&docid=603515550181189467&mid=6DA8BEE7330838FEA2356DA8BEE7330838FEA235&view=detail&FORM=VIRE>  
 Industrial Hygiene: Regulations and Identification - YouTube

**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
	<b>CO1</b>	1	1	1	1	2	1	1	-	-	-	-	-	2	1	2	1	3
<b>CO2</b>	1	1	1	1	2	1	1	-	-	-	-	-	2	1	2	1	3	-
<b>CO3</b>	1	1	2	1	2	1	1	-	-	-	-	-	2	1	2	1	3	-
<b>CO4</b>	2	1	1	1	2	1	1	-	-	-	-	-	2	1	2	1	3	-
<b>CO5</b>	1	1	1	1	2	1	1	-	-	-	-	-	2	1	2	1	3	-

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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**Integral University, Lucknow**

<b>Effective from Session: 2019-2020</b>							
<b>Course Code</b>	ES311	<b>Title of the Course</b>	Energy and Environment	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	III	<b>Semester</b>	VI	3	1	0	4
<b>Pre-Requisite</b>	10+2 Physics, Chemistry & (Maths/ Biology)	<b>Co-requisite</b>					
<b>Course Objectives</b>	To understand the Introduction and history related to different forms of energy. To provide knowledge of Energy resources and its demand as respect to historical and current perspectives. To develop knowledge of Energy consumption and its impact on environment. To provide knowledge of Policies for uses of energy. To provide deep knowledge of sustainable use of energy.						

<b>Course Outcomes</b>	
<b>CO1</b>	Be able to describe history related to different forms of energy.
<b>CO2</b>	Be able to Illustrate Energy resources and its demand as respect to historical and current perspectives.
<b>CO3</b>	Be able to explain Energy consumption and its impact on environment
<b>CO4</b>	Be able to make connections of Policies for uses of energy
<b>CO5</b>	Have an enhanced knowledge of sustainable use of energy.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Introduction	Defining energy, forms and importance, energy use from a historical perspectives, Discovery of fire, discovery of locomotive engine and fossil fuels, electrification of cities, Oil wars in Middle east, advent of nuclear energy, Sources and sinks of energy.	8	CO1
2	Energy resources and Demands	Global energy resources, renewable and non renewable resources, Energy use scenarios in rural and urban setups, Global energy demand, historical and current perspectives, energy demand and use in domestic, industrial, agricultural and transportation sector, generation and utilization in rural and urban environments, changes in demand in major world economies, energy subsidies and environmental costs.	8	CO2
3	Energy, ecology and the environment	Energy production as driver of environmental change, energy production, transformation and utilization associated environmental impacts (Chernobyl and fukushima nuclear accidents, construction of dams, environmental pollution), energy over consumption and its impacts on the environment, economy and global change.	8	CO3
4	Politics of energy policy	Political choices in energy policy globally and in the Indian context (Historical and contemporary case studies), domestic and international energy policy, energy diplomacy and bilateral ties of India with its neighbors.	8	CO4
5	Our Energy Future	Current and future energy use patterns in the world and in India, evolution of energy use over time, alternative sources as green energy (biofuels, wind energy, solar energy, geothermal energy, ocean energy, nuclear energy), need of energy efficiency, energy conservation and sustainability, action strategies for sustainable energy mix and management from a future perspective.	8	CO5

**Reference Books:**

1-McK ibbeli, B. 2012.Global Warming's Terrifying New Math, Rolling Stone Magazine.

2-Rowlands, I.H. 2009. Renewable Electricity.'The Prospects for Innovation and Integration in Provincial Policies in Debora L. Van Nijnatteii and Robert Boardmanl (eds), Canadian.

3-Environmental Policy and Politics: Prospects for Leadership and Innovation, Third Edition. Oxford University Press, pp. 1 67-82.

4-Oliver, J. 2013. Dispelling the Myths about Canada's Energy Futlire, Policy: Canadian Politics and Public Policy, June-July.

5-Malton, K. 2006. Myths, Pitfalls arid Oversights, Renewable Energy Policy and Politics: A Handbook for Decision Making- Earth Scan.

**e-Learning Source:**

[https://docs.google.com/document/d/1ud7CjOPqPqTj\\_4nvdj8uZFHsXWCPh03J/edit?usp=sharing&ouid=114555250431858417199&rtpof](https://docs.google.com/document/d/1ud7CjOPqPqTj_4nvdj8uZFHsXWCPh03J/edit?usp=sharing&ouid=114555250431858417199&rtpof)

<https://www.youtube.com/watch?v=EM1Iylyr-Zc>

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

[https://www.youtube.com/watch?v=tFo\\_0eEtIYY](https://www.youtube.com/watch?v=tFo_0eEtIYY)

<https://www.youtube.com/watch?v=jR87ZIUUDUFU>

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

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

<b>Name &amp; Sign of Program Coordinator</b>	<b>Sign &amp; Seal of HoD</b>
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