



**Integral University, Lucknow**

Effective from Session: 2018-19												
Course Code	ES501	Title of the Course	Biodiversity Monitoring and Management	L	3	T	1	P	0	C	4	
Year	II	Semester	III									
Pre-Requisite	Natural Resource , Wildlife	Co-requisite										
Course Objectives	1.To understand and asses the biological resource. 2. To identify threats to the biodiversity. 3.To know various apparoaches to conserve Biological Resources.4.To know about sustainable management of resources through institutional and organizational mecanism 5.To conserve Biological Resources by implementing Policies, Programs and Acts.											
Course Outcomes												
CO1	Students will be able to analyse, understand and assess the biological resource.											
CO2	Students will be able to identify various threats to the biodiversity.											
CO3	Students will be able to Evaluate the various apparoaches to conserve Biological Resources.											
CO4	Students will be able to apply the knowlegde for sustainable management of resources through institutional and organizational framework.											
CO5	Students will be able to analyse to conserve Biological Resources by implementing Policies, Programs and Acts.											
Unit No.	Title of the Unit	Content of Unit									Contact Hrs.	Mapped CO
1	Assessment of Biological Resources	Types of Biodiversity, Function of Biodiversity–Mega-diversity zones and Biodiversity Hot Spots in India. Ecologically Sensitive Areas (ESA) in India. Concept of Biodiversity, Levels of Biodiversity.									8	CO1
2	Threats to Biodiversity	Natural and anthropogenic threats to biodiversity – Human-Animal conflict with special reference to elephants and tigers - IUCN Threat Categories – Red Data Book – Wildlife exploitation - Species extinctions. Susceptibility for Extinction, Endangered and endemic species of India – Impact of over-harvesting and Climate change on biodiversity - Causes and Impacts of Invasive species to biodiversity									8	CO2
3	Conservation Strategies	Current practices in conservation: Habitat or Ecosystem Approaches - Species-based Approaches - Social Approaches: Chipko Movement – In-situ conservation: Afforestation, Social Forestry, Agroforestry, Botanical gardens, Zoos, Biosphere Reserves, National Parks, Sanctuaries, Protected Area Network, Sacred Groves and Sthalavrikshas – Ex-situ conservation: Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks, Tissue Culture and Biotechnological Strategies.									8	CO3
4	Sustainable Management of Bio-resources	National Biodiversity Authority (NBA) – Functions of State Biodiversity Board (SBB) and Biodiversity Management Committee’s (BMC) – The role of WWF, FAO, UNESCO, UNDP and UNEP for biodiversity conservation – An elementary account on WTO, GAAT and TRIPS – Bio piracy rights of farmers, breeders and indigenous people – Biodiversity informatics with special reference to plant genetic resources.									8	CO4
5	Policies, Programmes and Acts for Conservation	Status and protection of species at National and International levels – Role of CITES and IUCN – Convention on Biological Diversity (CBD) – Nagoya Protocol – Man and Biosphere Programme (MAB) – Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002.									8	CO5
Reference Books:												
1-Chaudhuri AB and Sarkar DD (2003) Megadiversity Conservation, Flora, Fauna and Medicinal Plants of India’s Hot Spots. Daya Publishing House, New Delhi.												
2-Dadhich LK and Sharma AP (2002) Biodiversity –Strategies for Conservation, APH Publishing Corporation, New Delhi.												
3-Groombridge B (Ed.) (1992) Global Biodiversity Status of the Earths Living Resources. Chapman & Hall, London.												
4-Krishnamurthy KV (2003) An Advanced Textbook on Biodiversity – Principles and Practice, Oxford and IBH Publishing, New Delhi.												
e-Learning Source:												
<a href="https://archive.nptel.ac.in/courses/102/104/102104068/">https://archive.nptel.ac.in/courses/102/104/102104068/</a>												
<a href="https://onlinecourses.swayam2.ac.in/cec21_ge31/preview">https://onlinecourses.swayam2.ac.in/cec21_ge31/preview</a>												
<a href="https://www.digimat.in/nptel/courses/video/102104068/L02.html">https://www.digimat.in/nptel/courses/video/102104068/L02.html</a>												
<a href="https://freevideolectures.com/course/4369/nptel-wildlife-conservation/4">https://freevideolectures.com/course/4369/nptel-wildlife-conservation/4</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	2	1	2	1	1	2	2	2	-	-	-	-	3	1	2	1	1	-
CO2	2	1	1	1	1	2	2	2	-	-	-	-	2	1	1	3	2	-
CO3	3	1	1	1	1	2	2	2	-	-	-	-	2	1	3	1	1	-
CO4	1	2	1	2	1	2	3	2	-	-	-	-	2	1	2	1	1	-
CO5	1	2	1	1	1	2	2	2	-	-	-	-	2	1	3	1	1	-

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: 2018-19</b>							
<b>Course Code</b>	<b>ES502</b>	<b>Title of the Course</b>	<b>Environmental Laws</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>II</b>	<b>Semester</b>	<b>III</b>	<b>3</b>	<b>1</b>	<b>0</b>	
<b>Pre-Requisite</b>	Environment ,Ecosystem	<b>Co-requisite</b>					
<b>Course Objectives</b>	To study the Environmental protection. To study Environmental laws in India. To study the guidelines and rules for Environmental Protection. To study the importance of Environmental planning. To study major initiatives and policies from Ministry of Environment and Forests.						

<b>Course Outcomes</b>	
<b>CO1</b>	Students will be able to analyze understand and asses the environmental protection.
<b>CO2</b>	Students will be able to explain Environmental laws.
<b>CO3</b>	Students will be able to guidelines and rules for Environmental Protection.
<b>CO4</b>	Students will be able to analyse about importance of Environmental planning.
<b>CO5</b>	Students will be able to analyse major initiatives and policies from Ministry of Environment and Forests.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Environmental Protection	Duties and responsibilities of citizens for environmental protection, Subjects related to environment in the seventh schedule of the Constitution: Union list, State list and Common or Concurrent list, Scheme of labelling of environmental friendly products (eco-mark), Environmental Information Systems.	08	1
2	Environmental Laws in India (Application in current scenario)	Legal control of Environmental pollution in India with special reference to: Environment (Protection) Act 1986, Powers of Central Government under EPA, The Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981, Forest Conservation Act 1980, Wildlife (Protection) Act 1972, Public Liability Insurance Act 1991, National Environment Appellate Authority Act 1997, The National Green Tribunal Act 2010.	08	2
3	Guidelines and Rules for Environmental Protection	Guidelines for Common Effluent Treatment Plants (CETPs), Guidelines for eco-friendly sound management of e-waste 2008, The Biomedical waste (Management and Handling) Rules 1998, Hazardous Waste (Management and Handling) Rules 1989, The Municipal Solid Wastes (Management and Handling) Rules 2000, The Ozone Depleting Substances (Regulation and Control) Rules 2000.	08	3
4	Environmental Planning	Importance of planning ( Local, regional, state and national planning), Site and location with reference to Environmental Pollution, Economics of pollution control, Cost-benefit ratios.	08	4
5	Major Initiatives/Policies from MoEF	Central and State Pollution Control Boards: Powers and functions of pollution control boards - Penalties and procedure - National Policies for Environmental Protection in India: National River Conservation Plan, National Ganga River Basin Authority, Ganga Action Plan Phase I and II, Namami Gangey-National Mission for Clean Ganga, , National Green Tribunal, Capacity Building for Industrial Pollution Management, National Environmental Protection Authority, Green India Mission Environmental Clearances: National Environmental Assessment and Monitoring Authority.	08	5

**Reference Books:**

- Diwan P (1997) Environmental Administration - Law & Judicial Attitude, Vol. I, II. Deep & Deep Publishers, New Delhi.
- Gurudeep Singh (2005) Environmental Law in India, Mc Millan, New Delhi.
- Jariwala CM (2000) Complex Enviro-Technoscience Issues. 42 (1), Journal of Indian Law Institute. 29.
- Leelakrishnan P (1999) Environmental Law in India. Butterworths Publications, New Delhi.
- Naseem M (2011) Environmental Law in India, Wolters Kluwer Law and Business, The Netherlands.

**e-Learning Source:**

- <https://www.slideshare.net/kristyawansutriyanto/ppt-environmental-protection>
- <https://www.slideshare.net/HashTagJay/environment-protection-and-fundamental-rights>
- <https://www.slideshare.net/gauravhtandon1/environmental-law-and-regulations-i>
- <https://www.slideshare.net/fdjaipur/environmental-planning-213292282>
- <https://www.slideshare.net/nega2002/government-initiatives>

**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	PSO6
<b>CO1</b>	3	2	2	1	2	1	2	-	-	-	-	-	2	2	1	2	2	-
<b>CO2</b>	3	1	1	2	2	1	2	-	-	-	-	-	2	2	1	2	2	-
<b>CO3</b>	3	2	1	2	2	1	1	-	-	-	-	-	3	2	2	1	2	-
<b>CO4</b>	3	2	1	2	1	2	2	-	-	-	-	-	3	2	2	2	2	-
<b>CO5</b>	3	1	1	2	2	1	2	-	-	-	-	-	3	2	2	2	2	-

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: 2018-19</b>							
<b>Course Code</b>	<b>ES503</b>	<b>Title of the Course</b>	<b>Waste Resource Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>II</b>	<b>Semester</b>	<b>III</b>	<b>3</b>	<b>1</b>	<b>0</b>	
<b>Pre-Requisite</b>	Ecosystem, Environmental Pollution	<b>Co-requisite</b>					
<b>Course Objectives</b>	To bring the basic introduction about the waste among the students and its global scenario at national level. To enable students to know about the municipal solid waste and its various disposable methods and techniques. To develop clear thinking about hazardous and radioactive pollution and its advanced develop technology to control and manage this type of pollution. To develop attitude towards the issues arising from the biomedical and plastic pollution and its control methods at national and international levels. To create awareness program among students about safe, clean and renewable technology.						
<b>Course Outcomes</b>							
<b>CO1</b>	To bring the basic introduction about the waste among the students and its global scenario at national level.						
<b>CO2</b>	To enable students to know about the municipal solid waste and its various disposable methods and techniques.						
<b>CO3</b>	To develop clear thinking about hazardous and radioactive pollution and its advanced develop technology to control and manage this type of pollution.						
<b>CO4</b>	To develop attitude towards the issues arising from the biomedical and plastic pollution and its control methods at national and international levels.						
<b>CO5</b>	To create awareness program among students about safe, clean and renewable technology						

<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 waste	Wastes: Introduction, sources, characteristics, composition, and classification, waste generated per capita, Global scenario of wastes, Integrated waste management.	8	1
2	Municipal Solid Waste Management	Municipal solid waste–Sources, types, collection, storage, segregation and transportation, Waste processing and resource recovery, Reuse and recycling of paper, glass and rubber, Disposal methods–Incineration, pyrolysis, composting, sanitary landfills and aerobic and anaerobic digestion.	8	2
3	Hazardous Waste Management	Hazardous waste - Introduction, characteristics, Classification of hazardous waste, Handling of hazardous solid wastes (segregation, recovery of hazardous waste substances), Hazardous waste disposal techniques, Radioactive wastes: Sources, types of radioactive waste and its control and management.	8	3
4	Biomedical, Plastic & e-waste management	Biomedical wastes: Sources, types of biomedical wastes, Impacts of biomedical wastes on environment, Control measures of biomedical wastes. Plastic wastes: Sources, Facts & figures of plastic waste scenarios at National & International level, Effect of plastic wastes on environment, Control measures of plastic wastes. E-wastes: Sources, types of e-wastes–Impacts of e-wastes in environment - Control measures of e-wastes.	8	4
5	Energy Recovery from Wastes	Biomass Energy, Fuel pellets, gasification, biogas, and Bio-electro chemical systems, Microbial electrolysis cell, Microbial fuel cell, Production of methane, Hydrogen peroxide, ethanol, electricity.	8	5

**Reference Books:**

- 1-Bhide AD and Sunderson BB (1983) Solid Waste Management in Developed Countries, INSDOC, New Delhi.
- 3-Bhide and Sundaresan (2000) Solid Waste Management in Developing Countries – Indian National Scientific Documentation Center, New Delhi.
- 4-CPHEEO (2010) Technical EIA Guidance Manual for Common Municipal Solid Waste Management Facilities.
- 5-CPHEEO Manual on Solid Waste Management (2000)
- 10-George Tehobanaglou - Milary Theiren and Samuel A vigil (1993) Integrated Solid Waste Management, McGraw Hill Inc.
- Hester RE and RM. Harrison (2009) Electronic Waste Management, Design Analysis & Application, RSC Publishing, UK.

**e-Learning Source:**

- <https://www.youtube.com/watch?v=lnTHEmavvgM>
- [https://www.youtube.com/watch?v=Hs2x6\\_Hw4a8](https://www.youtube.com/watch?v=Hs2x6_Hw4a8)

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

**Effective from Session: 2018-19**

<b>Course Code</b>	<b>MT518</b>	<b>Title of the Course</b>	<b>Applied Statistics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	3rd	<b>Semester</b>	5th	3	1	0	
<b>Pre-Requisite</b>	Basic knowledge of statistics	<b>Co-requisite</b>					

**Course Objectives**  
 The purpose of this postgraduate course is to impart basic and key knowledge of statistics & probability. Students will be able to collect, analyse and interpret the data and able to examine the nature of data obtained from observations. They will also learn to test the hypothesis based on observations. They will also be able to correlate the data. After successful completion of course, the student will be able to explore subject into their respective dimensions.

**Course Outcomes**

<b>CO1</b>	Students will gain an understanding of basics of statistics. They will know about types of data and how to collect and represent them. They also learn how to present the data in simple & proper manner by many ways such as bar diagram, histogram, pie chart etc.
<b>CO2</b>	Students will be able to understand univariate data and their various central tendency measures as mean, median, mode. They will also know about different measures of dispersion such as mean deviation, standard deviation etc.
<b>CO3</b>	Students will gain an understanding of relation between variables in bivariate data. They learn how to find relation between them and also to represent then on graph by least square method and regression analysis. They also study regression of data involving three variables.
<b>CO4</b>	Students will create the own understanding and used to find probability of different types of events in different conditions. They will learn about types of hypothesis and also know about various test of significance and their use specially in analysis of variance.
<b>CO5</b>	Students will gain an understanding of different statistical softwares. Learn about their basics & uses. They understand data analysis using SPSS & R software.

<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>	<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	Unit I	Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Quantitative and qualitative data, Scales of measurement (nominal, ordinal, interval and ratio). Presentation of data: tabular and graphical including bar diagram, histogram, pie chart, frequency polygon and ogives.	8	1
2	Unit II	Central Tendency & its measures: Arithmetic mean, median, mode, geometric mean and harmonic mean. Quartiles and percentiles. Measures of Dispersion: range, quartile deviation, mean deviation (about mean and median), standard deviation, variance, coefficient of variation, measures of skewness.	8	2
3	Unit III	Bivariate data: Definition, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's coefficient of rank correlation, Least square method, Simple linear regression, multiple and partial correlations and regressions (For 3 variables only), Coefficient of determination.	8	3
4	Unit IV	Basic concepts of probability: Definitions (Classical, Empirical and Axiomatic), addition and multiplication theorems of probability. Testing of hypothesis: Null and alternative hypothesis, Type I & Type II errors, Level of significance, Degrees of freedom. t-test, Z-test, Chi-square test for independence of attributes, F-test and ANOVA (One way & two way).	8	4
5	Unit V	Statistical software: Data analysis using SPSS (Descriptive statistics, test of significance, post-hoc test). Basics of R software.	8	5

**Reference Books:**

- 1-Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of statistics, Vol. I & II, 8th Edn. The World Press, Kolkata
- 2-Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia
- 3-Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
- 4-Ahmad, QS, Ismail, MV and Khan, SA (2008): 'Topics n Business Mathematics and Statistics, Firewall media Pvt. Ltd, New Delhi.

**e-Learning Source:**

- <http://empslocal.ex.ac.uk/people/staff/dbs202/cag/courses/bergen2005/course.pdf>
- [https://web.williams.edu/Mathematics/sjmiller/public\\_html/BrownClasses/162/Handouts/StatsTests04.pdf](https://web.williams.edu/Mathematics/sjmiller/public_html/BrownClasses/162/Handouts/StatsTests04.pdf)
- <http://www.cimt.org.uk/cmmss/S1/Text.pdf>

<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>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	2	2	3	3	3	2	2	2	3	2	3
<b>CO2</b>	1	2	2	3	3	3	3	3	2	3	2
<b>CO3</b>	2	3	2	2	1	1	2	3	3	1	3
<b>CO4</b>	3	1	1	1	2	3	1	2	1	2	1
<b>CO5</b>	1	2	1	2	2	2	2	1	2	3	2

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

**Name & Sign of Program Coordinator**

**Sign & Seal of HoD**



**Integral University, Lucknow**

<b>Effective from Session:</b> 2019-2020							
<b>Course Code</b>	ES504	<b>Title of the Course</b>	Remote Sensing and GIS	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	<b>II</b>	<b>Semester</b>	<b>III</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Pre-Requisite</b>	Natural Resource, Biodiversity	<b>Co-requisite</b>					
<b>Course Objectives</b>	To develop the scientific knowledge about Remote Sensing and its application. To develop attitude towards the fundamental education of Satellite Remote Sensing. To develop clear thinking about the application of GIS in forest and environment among students. To develop attitude towards fundamental concept of GIS in environment management. To provide the rational and scientific thinking about the basics of Maps, Scales and Cartography.						

<b>Course Outcomes</b>	
<b>CO1</b>	The mapping and development of a database using GPS and GIS technologies in experimental studies.
<b>CO2</b>	Be able the students to develop attitude towards the fundamental education of Satellite Remote Sensing.
<b>CO3</b>	The development of state-of-the-art methodologies for optimizing the water supply networks, both in the design and in the operation phase, using multiple variables and criteria.
<b>CO4</b>	The detailed experimental verification of the computational results and the development of know-how for self-regulation of pumps and valves in order to satisfy the supply needs in conjunction with the uniform pressure distribution in the water supply network
<b>CO5</b>	The development of guidelines which could form the basis for Snow modeling.

<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	Remote Sensing: History of Remote Sensing, Principle of remote sensing , Aerial Remote Sensing, Satellite Remote Sensing, Space programme development in different countries, Limitations of Remote Sensing; Resolution, Definition and types; Remote sensing data types, cost and sources.	8	CO1
2	Aerial Remote Sensing	Aerial Remote Sensing, Aerial Photography, Characteristic of Electromagnetic spectrum and spectral range, Sensors, Agency involved for aerial photography, Cameras used, Types of Aerial Photography; Sources of energy; Measurement on Aerial photographs-Scale determination and Height measurements.	8	CO2
3	Basics of Maps	Introduction, Classification, Concept of scale, Fundamentals of Cartography, Numbering of topographical maps, Map Projection, Datum and Spheroid. Preparation of Thematic maps using aerial photographs: Elements of Photo Interpretation; Stereoscopes- Types & Functions; Area Calculation.	8	CO3
4	Satellite Remote Sensing	Types of Remote Sensing based on: Source of Energy; Platform. Types of Satellites. Types of Sensors. Characteristics of AVHRR, WIFS etc. Multispectral Scanners: Whiskbroom and Push broom scanners.	8	CO4
5	GIS AND GPS	Geographic Information System (GIS): Definitions and objectives, Fundamental concept of GIS with its application in environmental management, Principle of GIS, Basic requirements of GIS, Components of GIS, Data Structure, Data Types, Data models, Topology, Applications in Forestry and Environment Global Positioning System (GPS): Definitions, Types of GPS, Principle of GPS, Functions, GPS Segments, Applications in Forestry, Limitations.	8	CO5

<b>Reference Books:</b>	
1.	Estes JE and Senger LW (1973) Remote Sensing Techniques for Environmental Analysis, Hamilton Publication and Co., Santa Barbara, CA, USA.
2.	Kohl M, Magnussen SS and Marchetti M (2010) Sampling Methods, Remote Sensing and GIS Multiresource Forest Inventory, Springer, Berlin.
3.	Merril Eisenbud and Thomas Gessell (1997) Environmental Radioactivity from Natural, Industrial and Military Sources, 4 th edition, Academic Press, London
4.	Mesev V (2007) Integration of GIS and Remote Sensing, John Wiley & Sons, UK.
5.	Nayak S and Zlatanova S (2008) Remote Sensing and GIS Technologies for Monitoring and Prediction of Disasters, Springer, Berlin.
6.	Srikantaswamy S (2008) Essential of Remote Sensing, Gajanana Publications, Mysore.
<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=3fbEVytyJck">https://www.youtube.com/watch?v=3fbEVytyJck</a>	

<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	2	2	2	2	2	2	2	-	-	-	-	2	3	2	-	-	-
<b>CO2</b>	3	2	2	2	2	2	2	2	-	-	-	-	2	2	2	-	-	-
<b>CO3</b>	3	2	2	2	2	2	2	2	-	-	-	-	2	2	2	-	-	-
<b>CO4</b>	3	2	2	2	2	2	2	2	-	-	-	-	2	2	2	-	-	-
<b>CO5</b>	3	3	3	3	3	3	3	3	-	-	-	-	3	3	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: 2018-19</b>							
<b>Course Code</b>	<b>ES505</b>	<b>Title of the Course</b>	<b>Biodiversity &amp; Waste Management Lab.</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	II	<b>Semester</b>	IV	0	0	8	4
<b>Pre-Requisite</b>	Biodiversity, Pollution	<b>Co-requisite</b>					
<b>Course Objectives</b>	The purpose of this course is to impart basic and key knowledge of monitoring Flora and fauna and other Environmental Components, Wetlands, Waste Dumping Sites, rhizospheric and rhizoplane microbes, Hands on Experience of Vermicomposting, Natural resource assessment using Google Map, Remote Sensing and GIS along with analysis of soil microflora.						
<b>Course Outcomes</b>							
<b>CO1</b>	Develop in depth knowledge about environment, its components and monitoring of flora and fauna.						
<b>CO2</b>	Apply the scientific knowledge in understanding about waste disposal techniques, dumping sites and about significance of wetland conservation.						
<b>CO3</b>	Develop practical knowledge on study of rhizospheric and rhizoplane microbes and gain hands on experience on vermicomposting.						
<b>CO4</b>	Gain knowledge about natural resource management through use of remote sensing techniques.						
<b>CO5</b>	Develop practical knowledge on analysis of soil micro flora						
<b>Unit No.</b>	<b>Title of the Unit</b>	<b>Content of Unit</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>	
1	Monitoring of Environmental Components	Monitoring Flora and fauna and other Environmental Components.			8	CO1	
2	Wetlands & Waste Dumping Sites	Wetland field visit. Visit to waste dumping site.			8	CO2	
3	Rhizospheric & Rhizoplane microbes & Vermicomposting	Study of rhizospheric and rhizoplane microbes. Vermi-composting. Experimental demonstration – Hands on Experience.			8	CO3	
4	Natural Resource Management through Remote Sensing	Natural Resource Management assessment using Google Map, Remote Sensing and GIS			8	CO4	
5	Soil Microflora	Analysis of soil microflora by dilution plate method			8	CO5	
<b>Reference Books:</b>							
1-Desk Encyclopedia of Microbiology by Moselio Schaechter (Editor)							
2-Microbiological Media by Ronald M. Atlas							
3- <a href="https://www.researchgate.net/publication/344949960_Handbook_of_Vermicomposting_Technology">https://www.researchgate.net/publication/344949960_Handbook_of_Vermicomposting_Technology</a>							
<b>e-Learning Source:</b>							
<a href="https://core.ac.uk/download/pdf/61089.pdf">https://core.ac.uk/download/pdf/61089.pdf</a>							
<a href="https://byjus.com/biology/vermicomposting/">https://byjus.com/biology/vermicomposting/</a>							
<a href="https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf">https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf</a>							
<a href="https://core.ac.uk/download/pdf/61089.pdf">https://core.ac.uk/download/pdf/61089.pdf</a>							

<b>Course Articulation Matrix: (Mapping of COs with POs and PSOs)</b>																		
<b>PO-PSO CO</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
<b>CO1</b>	3	2	2	1	1	3	3	2	-	-	-	-	1	2	3	-	-	-
<b>CO2</b>	3	2	2	1	1	3	3	2	-	-	-	-	1	2	3	-	-	-
<b>CO3</b>	3	2	2	1	1	3	3	2	-	-	-	-	1	2	3	-	-	-
<b>CO4</b>	3	2	2	1	1	3	3	2	-	-	-	-	1	2	3	-	-	-
<b>CO5</b>	3	2	3	1	1	3	3	2	-	-	-	-	1	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: 2018-19</b>							
<b>Course Code</b>	<b>ES506</b>	<b>Title of the Course</b>	<b>Environmental Impact Assessment</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Year</b>	II	<b>Semester</b>	IV	3	1	0	4
<b>Pre-Requisite</b>	Pollution, Waste Management	<b>Co-requisite</b>					
<b>Course Objectives</b>	The purpose of this course is to impart basic and key knowledge of Environmental Impact Assessment. This will help in enhancing knowledge of Environmental Impact Assessment legislations, Environmental clearance procedure for Projects, Environmental Impact Assessment methodologies, Environmental Auditing, monitoring and ISO standards and its certification process. After successfully completion of course, the student will able to explore subject into their respective dimensions.						
<b>Course Outcomes</b>							
<b>CO1</b>	Students will be able to Analyse role of Environmental Impact Assessment legislations in making decisions and getting Environmental clearance for Projects.						
<b>CO2</b>	Students will be able to Evaluate the role of Environmental Impact Assessment methodologies in Environmental Impact Assessment Process.						
<b>CO3</b>	Students will be able to Evaluate the Importance of ISO standards and its certification process in relation to environmental protection mechanism.						
<b>CO4</b>	Students will be able to Analyse role of Environmental Auditing and monitoring in Environmental Impact Assessment Process.						

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction and Background	EIA, Relationship of EIA to sustainable development, scope and purpose of EIA; Key merits of environmental assessment in regulating the environment, Salient features of EIA legislation and other statutory obligations, Environmental decision making in India: Environmental clearance procedures and national requirements.	8	CO1
2	Assessment Framework	Methodological approaches and tools for key stages in EIA process: Screening (stage to determine the level of EIA, exclusion and inclusion criteria of projects, different approaches to screening) Scoping (scoping steps, guidance and tools, and stakeholder involvement), Impact prediction and evaluation (approach for baseline development and methods of impact identification-checklists, Matrices, Networks)	8	CO2
3	Methods and Tools For EIA	Introduction to various impact assessment methods: checklist, matrices, networks, indices and weight scaling techniques; their scope and limitations, Prediction and assessment of impact on the land, air, water, noise, biological and socioeconomic environments Mitigation: definitions measures including avoidance, reduction, rectification and compensation approaches, principles and concepts of offsets, type of offsets.	8	CO2
4	Environmental Auditing and Monitoring	Objectives and usefulness of Auditing, monitoring; EIA Types (monitoring, Baseline monitoring, Compliance monitoring; Mitigation monitoring), Ex ante and Post ante EIAs, introduction to national accreditation scheme, Requirement of EIA in India.	8	CO4
5	ISO Standards	ISO 9001, historical background, benefits and clause analysis, EMS and its benefits, formulating environment policy, Clause analysis of ISO 14001, explanation of PDCA cycle, Training need identification, communication, audit process. Attributes of an auditor and psychology of auditing, audit reporting, certification process and certification bodies, legislation pertaining to ISO 14001 documentation preparation of L/R, emergency	8	CO3

**Reference Books:**

1. Bregman JI (1999) Environmental Impact Statements. Lewis Publishers, London
2. Canter LW (1996) Environmental Impact Assessment. Mc Graw Hill, New York.

**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.wwfindia.org/downloads/session>

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	PSO4	PSO5	PSO6	PSO7
CO1	3	1	2	1	1	2	2	3	-	-	-	-	1	2	3	-	-	-
CO2	3	1	1	1	1	2	2	3	-	-	-	-	1	2	3	-	-	-
CO3	3	1	1	1	1	2	2	3	-	-	-	-	1	2	3	-	-	-
CO4	3	1	2	2	1	2	2	3	-	-	-	-	1	2	3	-	-	-
CO5	3	1	2	1	1	2	2	3	-	-	-	-	1	2	3	-	-	-

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

Name & Sign of Program Coordinator	Sign & Seal of HoD
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