Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-24							
Course Code	**B150501T/ES314**	**Title of the Course**	**Environmental Microbiology and Biotechnology**	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	V	**4**	**0**	**0**	**4**
Pre-Requisite	10+2 with Physics, Chemistry & Biology	**Co-requisite**	Nil				
Course Objectives	This syllabus provides a comprehensive understanding of environmental microbiology and biotechnology, covering foundational concepts, practical techniques, and real-world applications.						

Course Outcomes

CO1	Get an idea about the historical events in microbiology and biotechnology
CO2	Know concepts related with of microbial ecology and interaction, create a knowledge and understood role of microbes in nutrient cycling, get an idea regarding microbes and their relation with environment
CO3	Know the basic concepts and application of biotechnology in environmental management
CO4	Students will be able to know the molecular techniques involved in environmental microbiology
CO5	Able to explore various uses of microbes for degradation of waste material and ethics in research and application

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Microbiology and Biotechnology	Overview of Microbiology and Biotechnology, Historical development and milestones, Scope and importance in environmental applications	8	CO1
2	Fundamentals of Environmental Microbiology	Microbial diversity in natural environments, Microbial ecology and interactions, Biogeochemical cycles	8	CO2
3	Microbial Physiology and Metabolism	Bacterial structure and function, Metabolic pathways in microorganisms, Microbial growth and control	8	CO2
4	Environmental Biotechnology: Principles and Applications	Basics of biotechnological processes, Applications of biotechnology in environmental management Case studies of successful biotechnological interventions	8	CO3
5	Environmental Microbial Techniques	Sampling and analysis of environmental microorganisms, Microbial identification methods, Molecular techniques in environmental microbiology	8	CO4
6	Bioremediation and Waste Treatment	Principles of bioremediation, Microbial degradation of pollutants, Applications in waste treatment and cleanup	6	CO5
7	Industrial and Agricultural Biotechnology	Microorganisms in industrial processes, Agricultural applications of biotechnology, Genetically modified organisms (GMOs) and their impact	8	CO5
8	Ethical, Legal, and Social Issues in Environmental Biotechnology	Ethical considerations in biotechnological research and applications, Legal frameworks and regulations, public perception and societal impact	6	CO5

Reference Books:

1-Subba Rao NS (2004) Soil Microbiology. 4th Edition, Oxford & IBH Pubilshing Co. Pvt. Ltd., New Delhi.
2-Subba Rao NS (1995) Biofertilizers in Agriculture and Forestry. 3rd Edition, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
3-Robert LTate (1995) Soil Microbiology. 1st Edition, John Wiley & Sons, Inc. New York.
4-Atlas RN & Bartha R (1998) Microbial Ecology, 4th Edition, Benjamin Cummings.
5-Jogdand SN (2004) Environmental Biotechnology. Reprinted & Published by Himalaya Publishing House, Mumbai.
6-Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.

e-Learning Source:

https://onlinecourses.nptel.ac.in/noc21_ce07/preview
https://archive.nptel.ac.in/content/storage2/courses/pmrf/105107173/noc22-ce15_week2.pdf
https://www.pdfprof.com/PDF_Image.php?idt=7868&t=27
https://www.nitttrc.edu.in/nptel/courses/video/105107173/lec2.pdf

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

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

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

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

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024							
Course Code	**B150502P/ ES315**	**Title of the Course**	Environmental microbiology Lab	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	V	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Physics, chemistry, biology	**Co-requisite**	Nil				
Course Objectives	These lab experiments provide hands-on experience in fundamental techniques of microbiology, allowing students to develop practical skills and understand the relevance of environmental microbiology						

Course Outcomes

CO1	Apply the scientific knowledge to know the rules and regulation while working in lab and the protocol of sterilization of an instrument.
CO2	Develop practical knowledge about difference between prokaryotic and eukaryotic cells
CO3	Gain knowledge about the general instructions, Microbiology laboratory and its discipline
CO4	Develop knowledge of preparation of medium for culture

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	To know the rules and regulation while working in lab and the sterilization techniques of an instrument	15	CO1
2	Study of cell	To observe the difference between prokaryotic and eukaryotic cells	15	CO2
3	Fundamental of Microbiology	Handling of microscopes, Calibration and measurement of microscopic objects.	15	CO3
4	Media preparation	To know the method of estimation of pH and media preparation for culture	15	CO4

Reference Books:

1-Cappuccino, J. C. and Sherman, N. (1992). Microbiology: A laboratory manual, Addison
2-Wesley Pub. Co Benson HJ (1994).

e-Learning Source:

1-chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ijsr.net/archive/v4i11/NOV151021.pdf

2-https://chem.libretexts.org/Courses/Brevard_College/CHE_104%3A_Principles_of_Chemistry_II/07%3A_Acid_and_Base_Equilibria/7.07%3A_pH_Calculations_pH_measurement_and_pH_estimation

3-https://pharmastate.academy/dos-donts-in-microbiology lab/#:~:text=Avoid%20coughing%2C%20sneezing%20and%20yawning,unwanted%20articles%20along%20with%20you.

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

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

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

Department of Environmental Science
Integral University, Lucknow

Effective from Session: 2023-2024							
Course Code	**B150503T/ ES316**	**Title of the Course**	**Introduction to Physical Environment**	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	V	**4**	**0**	**0**	**4**
Pre-Requisite	10+2 Physics, Chemistry, Biology	**Co-reuisite**	Nil				
Course Objectives	Focusing on the basic physics involved in meteorology and its components, the course aims to develop an understanding of biophysics with energy-budget, radiation-physics, and radioactivity perspectives. Relevant topics related to air pollution, energy fluxes, and radioactivity in the environment (including applications) will develop a holistic overview of the physics involved in the environment, thereby enabling students to apply the concepts of physics in identifying and practicing the field of environmental science.						

Course Outcomes	
CO1	Define the core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.
CO2	Conceptualize meteorology and climatology to differentiate them correctly. Know basic atmospheric elements, their function within the climate system, as well as it's physical and chemical characteristics.
CO3	Develop skills and be able to comprehend the physics involved in the ecological structure and functions with an energy perspective;
CO4	Demonstrate knowledge of atmospheric sciences focusing on wind, clouds, precipitation, storms, radiative balance and climatic change;
CO5	Exhibit conceptual skills and demonstrate knowledge of radiation physics and techniques of physics in environmental analysis;

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introductory Meteorology**	Introduction, Importance of Meteorology, Basic Metrics, Scientific Notation, Science of Meteorology. The Atmosphere: Origin of the Earth's Atmosphere, Composition of the Atmosphere, Vertical Structure of the Atmosphere, Ozone Layer, Upper Atmosphere	7	CO1
2	**Physical processes**	The Earth in Space, Earth and Sun, Earth-Sun Relationships, Cause of the Seasons, Solar Energy, Greenhouse Effect, Energy Budget of the Earth	6	CO2
3	**Pressure, Density, and Wind**	Pressure Defined, Measurement of Pressure, Vertical Pressure Gradient, Hydrostatic Approximation, Horizontal Pressure Gradient, Isobars and Wind Speeds, Types of winds and Measurement of Wind, Geostrophic Wind, Gradient Wind, Effect of Friction.	6	CO3
4	**Phases of Water**	Humidity Defined, Capacity and Saturation, Dew Point, Vapor Pressure and the Boiling Point, Humidity Parameters, Measurement of Humidity.	6	CO4
5	**Atmospheric Dynamics**	Atmospheric Stability, Environmental Lapse Rate, Dry Adiabatic Lapse Rate, First Criteria for Stability, Most Adiabatic Lapse Rate, Full Stability Criteria, Inversions and Stability. Clouds and Precipitation, Cloud Microstructure, cloud Measurement, Cloud Classification, Formation of Precipitation, Types of Precipitation.	7	CO5
6	**Atmospheric Circulation**	Atmospheric Circulation Systems, Scales of Atmospheric Motion, Global Scale Circulation, Cyclones and Anticyclones, Monsoon Circulation, Small Scale Circulations, Mid-Latitude Low-Pressure Systems, Air-Masses, Development and Evolution of the Wave Cyclone, Upper Atmosphere.	10	CO5
7	**Measuring Instruments and Techniques**	Barometer, hygrometer, anemometer, rain gauge, evaporimeter, thermometry, altimeter, upper air measurement, measuring solar and earth radiation, chart recorder, data logger, conventional measurements of pressure, temperature, humidity, wind, precipitation, visibility, clouds, soil temperature and humidity. Ocean temperature, salinity, wave, height, currents, self-recording instruments radiosondes, radiometer sondes, ozonesonde, LIDARS, SODARS, RADARS: the concept of the amplifier, oscillator, receiver, working principle of radar, different types of radar, radar antenna, PPI display, radar network of IMD, components of radar, the function of radar components, Doppler weather radar, Doppler principle.	10	CO5
8	**Analysis and forecast**	Reading a Weather Map, Observation, Analysis and Prediction, Organization of the National Weather Service, Long-Range Forecasts.	08	CO5

Reference Books:

Physics of the Atmosphere and Climate, Murry L. Salby, Cambridge University Press, 2012.

Introduction to Environmental Physics: Planet Earth, Life and Climate, Peter Hughes & N.J. Mason, CRC press, 2001.

Environmental Physics, Clare Smith, Psychology Press, 2001

James R. Holton and Gregory J. Hakim, An Introduction to Dynamic Meteorology, Academic Press, 2012.

e-Learning Source:

MOOC

SWAYAM

Department of Environmental Science
Integral University, Lucknow

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

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

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-2024							
Course Code	**B150504T/ ES317**	**Title of the Course**	**Pollution and Human Health**	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	V	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 Botany, chemistry, physics	**Co-requisite**	Nil				
Course Objectives	This course will enable that students to understand environmental problems, looking at causal linkages between pollution sources, exposure pathways and impacts to environmental quality and human health. Students will identify the complex relationships between environmental factors and human health, taking into account multiple pathways and interactions, will be assessed in a broader spatial, socioeconomic and cultural context. Students will learn how to assess pollution sources, study exposure pathways and fate, and evaluate consequences of human exposure to pollution and its impacts to environmental quality. Providing the evidence base to support decision and policy making, students should be able to understand pollution problems, consider ways to respond to them, and propose appropriate solutions/actions to reduce (protect, mitigate or prevent) pollution risks when necessary						

Course Outcomes	
CO1	Have gained awareness of current forms of environmental pollution and an overview of both their causes and consequences to natural, economic and social systems.
CO2	Students understands the fundamental principles governing the interactions between those systems (i.e. transport of pollutants in the environment)
CO3	Have been exposed to learning examples of good practice of technologies and options used to remediate reduce/eliminate pollution of the environment.
CO4	Be able to analyse, synthesise, and evaluate evidence to understand problems and accordingly select control measures and techniques concerning atmospheric, water or terrestrial challenges.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Environmental Pollution	Environmental pollution, types of environmental pollutants, basis and challenges of environmental pollution	6	CO1
2	Air pollution	Air Pollution- natural and anthropogenic sources, Types of air pollutants, effects of air pollutants- acid rain, green house effect and global warming, air pollution control measures.	8	CO1
3	Water Pollution	Sources of surface and ground water pollution, water quality parameters and standards, effect of water contaminants on human health, Water remediation techniques.	8	CO2
4	Water Treatment Methods and Strategies	Water treatment: Waste water treatment technologies- Primary , secondary and tertiary treatments	8	CO3
5	Soil Pollution	Soil pollution: Sources- Industrial, Domestic, Agricultural (Pesticides, heavy metals, industrial effluents, waste disposal), Effects of soil pollutants on plants, animals and ground water.	8	CO4
6	Thermal pollution	Thermal pollution: causes, effects and control measures	6	CO4
7	Noise Pollution	Noise Pollution: Sources, sound pressure levels, decibels, intensity and duration, effects of noise pollution on human and animals, noise permissible standards, noise control measures.	8	CO5
8	Radioactive pollution	Radioactive pollution: Sources, radioactive elements, effects of radiation on surrounding environment, Radioactive waste disposal methods	8	CO5

Reference Books:

1.Khopkar SM (1993) Environmental Pollution Analysis

2.Saxena HM (2011) Environmental Geography

3. Rao CS (1993) Environmental Pollution Control

e-Learning Source:

1-https://www.frontiersin.org/articles/10.3389/fpubh.2020.00014/full

2-https://www.hindawi.com/journals/jeph/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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO6	PSO7
CO1	2	1	1	1									2	2	2	2		
CO2	2	1	1	1									2	2	2	2		

CO 3	2	1	1	1									2	2	2	2		
CO 4	2	1	1	1									2	2	2	2		
CO 5																		

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

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

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-24							
Course Code	**ES150505T/ES318**	**Title of the Course**	**Energy and its Management**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	V	**4**	**0**	**0**	**4**
Pre-Requisite	10+2 with science	**Co-requisite**	Nil				
Course Objectives	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.						

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

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
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, energy subsidies and environmental costs.	8	CO2
3	Energy, Ecology and theenvironment	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.	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 bileteral ties of India with its neighbors.	6	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, need of energy efficiency, energy conservation and sustainability, action strategies for sustainable energy mix and management from a future perspective.	8	CO5
6	Solar Radiation And Its Measurement	Sun as source of energy, nature of its radiation, heat budget of the earth, earth's temperature and atmosphere. Solar radiation measurements.	6	CO1
7	Environmental Aspects Of Energy And Protocols	Concept of sustainable development, Concern over climate change, UNFCC, IPCC, Kyoto protocol: emission trading, Joint implementation, CDM case studies. Environmental policy of the government of India and the working of Ministry of Environment and Forests	8	CO3
8	Ecofriendly Technologies	Various applications of eco-friendly biosensors, biogas, bioethanol and biofuel Development and application of eco-friendly and cost-effective tools in environmental pollution management and agricultural activities, Green design, building and infrastructure .	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. l 67-82.

4-Oliver, J. 2013. Dispelling the Myths about Canada's Energy Futilre, 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://www.youtube.com/watch?v=EM1IyIyr-Zc

https://www.youtube.com/watch?v=-RSrviqvAmY

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

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

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

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

Integral University, Lucknow
Department of Environmental Science

Effective from Session: 2023-24							
Course Code	**B150506P/ES319**	**Title of the Course**	**Energy Lab**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	V	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 Physics, Chemistry, Botany	**Co-requisite**	Nil				
Course Objectives	This course provides students with a working knowledge of utilization and importance of non-conventional energy resources						

Course Outcomes	
CO1	Students will able to calculate the efficiency of Solar photovoltaic panel (PV) by I-V curve.
CO2	Students will able to determine the power generated by Wind turbine using I-V curve w.r.t. distance of rotor generator from the source of wind
CO3	Students will learn about Biogas production by Anaerobic Digester.
CO4	Students will able about the Synthesis and determination of Biodiesel from vegetable oil by transesterification method.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Calculation of Efficiency of PV panel	To calculate the efficiency of Solar photovoltaic panel (PV) by I-V curve	15	CO1
2	Determination of Power generation	To determine the power generated by Wind turbine using I-V curve w.r.t. distance of rotor generator from the source of wind	15	CO2
3	Biogas Production	Biogas production by Anaerobic Digester	15	CO3
4	Synthesis and Determination of Biodiesel	Synthesis and Determination of Biodiesel from vegetable oil by transesterification method	15	CO4

Reference Books:

- W. Kurge: ISO 14001 Certification – Environmental Management System, Prentice Hall, 1995
- Power plant engineering, P.K. Nag, McGraw-Hill
- Rai, G.D. Non Conventional Energy Sources. Khanna Publishers, New Delhi. 1998.
- Flowler, John M., "Energy and the Environment", 2nd Edition, McGraw Hill, New York, 1984.
- Carless, Jennifer, "Renewable Energy: A Concise Guide to Green Alternative", Walker, New York, 1993.

- W. Kurge: ISO 14001 Certification – Environmental Management System, Prentice Hall, 1995
- Power plant engineering, P.K. Nag, McGraw-Hill

e-Learning Source:

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

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

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

Integral University
Department of Environmental Science

Effective from Session:2023-2024							
Course Code	**B150509R/ ES320**	**Title of the Course**	**Internship/Apprenticeship, (Research Project I)**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	V	**0**	**0**	**0**	**3**
Pre-Requisite	10+2 Physics, Chemistry, Biology, Computer Science	**Co-requisite**	Nil				
Course Objectives	Upon finishing the course students will be able to come up with a gain of professional work in industry and research project experience.						

Course Outcomes	
CO1	To apply theoretical concepts learned in degree course work to a practical situation
CO2	To obtain experience with relevant materials and methodologies.
CO3	Achieve/complete assigned target(s)/ task(s) given by the person to whom the intern or apprentice is reporting (Supervisor)

Unit No.	**Title of the Unit**	**Content of unit**	**Mapped CO**
1	Internship/Apprenticeship (Research Project I)	Students are encouraged to undergo summer/winter in plant training in a suitable industry, consultancy, research laboratory, institute, Protected Areas etc. so as to get firsthand experience of corporate environmental management and of natural habitat. Candidates will write a field project report on issues related to Environmental Science under the guidance of their respective guides. Each student will work independently on the topic. The field project must consist of a review of the literature and produce a deep insight of the subject based on personal research. Field project work will be initiated at the start of Semester. The students will undertake fieldwork in terms of the collection of data and surveys. The field project will have to be submitted for appraisal and acceptance by the University. The students should submit their field project report in the following format: Chapter I: Introduction with Aims and Objectives: A background with historical information and a review of existing material or data on the subject along with the aims and objectives of the study. Chapter II: Methodology with Material and Methods: Description of the issue, methodology adopted for the study. Chapter III: Experimental: Presentation of data collected and detailed analysis of results. Chapter IV: Result and Discussion: Discussion on the data and results obtained and Presentation of method suggested to solve the problem. Chapter V: Summary and Conclusions: A summary of the dissertation and important conclusions drawn at the end of the investigation. Bibliography or References: A list of references cited in the text. The Field Project Report should be typed on A4 size bond paper with 1.5 line spacing. Illustrations and photographs should be of high quality. The report should be flawless without any spelling mistakes or grammatical errors. Students will have to submit their field project report one month Before the practical examination at the end of Semester. The field work report will carry 100 marks (Internal marks 20 and External marks 80). Assessment of the report will be done at the end of the year. Students have to present a Power Point Presentation. Assessment of the field work shall be done by the external examiner appointed by HOD, Integral University.	CO1,2,3,

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

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

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

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