DEREE COLLEGE SYLLABUS FOR: : **ES 3340 INTEGRATED METHODS IN ENVIRONMENTAL ANALYSIS I** **3/2/4**	
(Previously ES 3240 Integrated Methods in Environmental Analysis I) (Fall 2022)	**UK LEVEL: 5** **UK CREDITS:20**
PREREQUISITES:	ES 1000 Environmental Science: Ecosystems and Biodiversity, ES 1010 Environmental Science: Energy Resources and Pollution MA 2025 Applied Statistics for Sciences
CATALOG DESCRIPTION:	The course aims to cover basic methods and techniques needed in environmental science. Selected natural science methods and their basic principles and techniques are presented, with emphasis on interdisciplinary inquiry. Hands-on experience, laboratory and field work on some of the presented methods and techniques are offered.
RATIONALE:	Any systematic and effective environmental study and action requires the knowledge of scientific methodology. Environmental Studies is an interdisciplinary field, drawing from both natural and social sciences; therefore, its methodology should also be interdisciplinary, often using mixed-modes of inquiry. For technical aspects of environmental action, natural scientific methods, such as measurements of the concentration of chemicals and laboratory work, are required. Such methods will be discussed in this course. For behavioral and social aspects of environmental practices, social scientific, field-based empirical and text-based interpretive methods are needed; these are discussed in the course Integrated Methods in Environmental Analysis II. The course also discusses data analysis and presentation, as well as how research results are communicated, thus introducing students to the basics of scientific research. Students will have practical exposure to the methods discussed in this course through the field and lab component of the course.
LEARNING OUTCOMES:	As a result of taking this course, the student should be able to: 1. Discuss and utilize selected natural scientific methods and techniques related to environmental studies such as sampling techniques, identification of organisms, chemical analysis of air, water and soil, ecological analysis, demographics and geospatial methods. 2. Identify moral and ethical issues of scientific research and apply professional codes of conduct to their environmental research. 3. Demonstrate ability to collect, record, process, interpret and present data using appropriate methods and techniques. 4. Examine and analyse an environmental research topic based on natural science methodology.
METHOD OFTEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Class lectures, interactive learning (class discussions, group work), video presentations and case studies discussed in class. • Laboratory and field activities; field trips (include practical work and lab/field reports) • Exercises and primary source documents are assigned as homework, the answers and critical response to which are reviewed in class • Student projects and presentations • Office hours: students are encouraged to make full use of the office hours of their instructor, where they can ask questions, see

<table>
<tr><td></td><td>their exam paper, and/or go over lecture/lab material.
• Use of a Blackboard site, where instructors post course information, lecture notes, assignments, announcements, as well as additional resources.
• Group work, in the lab or field, and through the use of Blackboard online interactive tools for teaching and learning.</td></tr>
<tr><td>ASSESSMENT:</td><td>Summative:
<table><tr><td>Coursework:
It includes the following components: a) reports on practical work (25%); b) short research proposal or analysis of a scientific paper with focus on methodology (25%)</td><td>50%</td></tr><tr><td>Portfolio of short assignments (answers to critical thinking questions and exercises)</td><td>10%</td></tr><tr><td>Final examination (2-hour)</td><td>40%</td></tr></table>
Formative:
<table><tr><td>Critical response to selected questions during the semester – including a sample test</td><td>0</td></tr></table>
The coursework assessment tests learning outcomes 2, 3 and 4.
The final examination tests learning outcomes 1 and 2.
The portfolio of short assignments tests learning outcomes 1 and 2.

The formative tests aim to prepare students for the final examination and for the coursework components.</td></tr>
<tr><td>INDICATIVE READING:</td><td>REQUIRED READING:
• Jones, A., Duck R., Reed, R. and Weyers. J. 2000. Practical Skills in Environmental Science, Prentice Hall

RECOMMENDED READING:
• Haynes, R. 1982. Environmental Science Methods, first published by Chapman and Hall Ltd.
• Watts, S. and Halliwell, L.1996. Essential Environmental Science: Methods and Techniques. first published by Routledge
• Weyers, J. Reed, R. Jones, A. 2012. Practical Skills in Biology. 5th Edition, Pearson
• Reed, R., Holmes, D., Weyers, J. and Jones, A. 2012. Practical Skills in Biomolecular Sciences. 4th edition, Pearson
• Vodopich D.S. 2010. Ecology Laboratory Manual, McGraw Hill.
• Additional selected readings on environmental science methods and research (scientific articles, reports, protocols)</td></tr>
<tr><td>INDICATIVE MATERIAL:
(e.g. audiovisual, digital material, etc.)</td><td>REQUIRED MATERIAL:N/A

RECOMMENDED MATERIAL:
On Line Protocols_Videos_ES methods.docx posted on Blackboard.</td></tr>
<tr><td>COMMUNICATION REQUIREMENTS:</td><td>In all presentations using proper English, written or spoken.</td></tr>
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SOFTWARE REQUIREMENTS:	Word, Powepoint, Excel
WWW RESOURCES:	US Environmental Protection Agency: www.epa.gov European Environment Agency: www.eea.europa.eu/ European Commission - Environment: https://ec.europa.eu/environment/index_en Laboratory resources: • LabXchange: https://www.labxchange.org/explore • Lab Tutorials in Biology: http://labtutorials.org/ • JoVE Faculty Resource Center: http://www.jove.com/ • Cold Spring Harbor Laboratory – DNA Learning Center: http://www.dnalc.org/ • Journal of Biological Methods - Protocol Online: http://www.protocol-online.org/ • Cold Spring Harbor Protocols: http://cshprotocols.cshlp.org/ • Current Protocols: http://www.currentprotocols.com/WileyCDA/ • Protocols Online: http://protocolsonline.com/category/essentials/ • Protocol Exchange / Nature Portfolio: http://www.nature.com/protocolexchange/ Additional web resources specific for each method are posted on Blackboard.
INDICATIVE CONTENT:	1. The scientific method and the investigative approach • The scientific method • Measurements and observations • Experimental design and project work 2. Elements of scientific research • Analysis and presentation of data – Use of statistics • Information technology and resources • Communication of the research results 3. Analytical laboratory techniques used in life and environmental sciences • Use of radioactive isotopes, centrifugation, chromatography, electrophoresis, gravimetry, volumetric analysis, optical methods and basic spectroscopy, electroanalytical methods etc. 4. Methods for research on biological materials • Sampling, manipulating and identifying sampled biological materials (e.g. naming and classifying organisms, using microscopes, preparing specimens for light and electron microscopy, culture systems and growth measurement, including homogenization and fractionation of cells and tissues) 5. Ecological analysis and demographics • Sampling strategies • Population characteristics (e.g. density/cover, life tables) • Community parameters (e.g. species diversity) 6. Methods for research on aquatic environments • Sampling water and manipulating sampled materials • Analysis of aquatic environments 7. Methods for research on atmospheric quality • Sampling air and manipulating sampled materials • Measuring atmospheric variables and analysis 8. Geospatial methods • Surveying • Remote sensing

	• Geographic Information Systems • Maps 9. Methods for research on Earth materials (soil, sediments, rocks and fossils) • Sampling soils, sediments, minerals, rocks and fossils, • Manipulating and identifying sampled materials • Analysis of soils and sediments 10. Environmental Impact Assessment **LAB OUTLINE**: Indicative lab and field activities • Principles of laboratory and field work • Analytical laboratory techniques used in life and environmental sciences • Light & Electron Microscopy use for observation of biological specimen • Sampling, handling and analyzing biological materials (tissue and cell fractionation, microscopic observations and cell culture plates) • Population abundance and species diversity in a plant community • Analysis of an aquatic environment • Analysis of geological materials • A weather station - Measurement of atmospheric variables • GIS and remote sensing • Extracting information from maps • Statistical processing of data • Exercise on scientific writing and referencing