

Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year (New format)	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Asst Prof Lam Weng Ngai
Course Author Email	wengngai.lam@ntu.edu.sg
Course Title	Introductory Statistics and Numerical Thinking
Course Code	ES2305
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	MH1802 Calculus for the Sciences; OR MH1800 Calculus for the Sciences I; OR MH1801 Calculus for the Sciences II; OR MH1100 Calculus I; OR MH1101 Calculus II; OR CY1201 Calculus of One Variable; OR CY1202 Calculus of Several Variables; OR CY1601 Mathematics I; OR CY1602 Mathematics II
Co-requisites	NA
Pre-requisite to	ES3307 Experimental Design & Analysis for Ecology
Mutually exclusive to	BS1008 Bioinformatics and statistics; MH3511 Data analysis with computer
Replacement course to	NA
Remarks (if any)	Students can opt to take this course or the combination of BS1008 & MH3511 to meet the requirements for the Ecology or Society specialisation tracks

Course Aims

This course aims to equip you with (1) the foundational knowledge in statistics and statistical tools that are commonly employed in environmental sciences; (2) the ability to think numerically about data in environmental sciences and the world around you; (3) the proficiency in coding and executing statistical analyses in R. The course is a core module for ASE students specializing in ecology or society. It is designed for students of environmental science and those with little to no mathematics or statistics background. Concepts and skills taught in the module are generalizable, and especially useful in the data age we are now living in. The course will help to prepare you to conduct undergraduate research in environmental sciences (e.g., URECA, FYP), and more importantly, equip you with the ability and confidence to think and interact meaningfully with data around you in everyday life.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Apply numerical thinking to issues in daily life and scientific research
ILO 2	Interpret, produce and caption commonly used figures in environmental sciences
ILO 3	Describe differences in commonly encountered types of data
ILO 4	Conduct basic to intermediate statistical analyses in R and interpret results meaningfully

Course Content

- Descriptive/summary statistics, basic principles and concepts in statistics
- R programming language
- Data analysis, interpretation, and presentation
- T-test
- ANOVA
- Non-parametric tests
- Multiple linear regression (linear models)

Reading and References (if applicable)

Crawley MJ (2012) The R Book. John Wiley & Sons, Ltd. DOI:10.1002/9781118448908

Zuur AF, Ieno EN, Elphick CS (2010) A protocol for data exploration to avoid common statistical problems. *Methods in Ecology and Evolution*, 1(1): 3-14. DOI: 10.1111/j.2041-210X.2009.00001.x

Karban R (2014) *How to Do Ecology: A Concise Handbook - Second Edition*. Princeton University Press.
<https://www.jstor.org/stable/j.ctt6wpzz6>

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they become available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Introduction to numerical thinking, data types, and R	1, 3, 4	In-person	Practicum	Crawley 2012 Chp 1 Getting started; Chp 2 Essentials of the R language; Chp 4 Dataframes
2	T-test and descriptive statistics	2, 4	In-person	Practicum	Crawley 2012 Chp 8 Classical tests
3	Exploratory data analysis	1, 2, 3, 4	In-person	Practicum, Assignment 1, Quiz 1	Zuur et al. 2010
4	ANOVA: part 1	4	In-person	Practicum Assignment 2	Crawley 2012 Chp 11 Analysis of variance
5	ANOVA: part 2	4	In-person	Practicum Quiz 2	Crawley 2012 Chp 11 Analysis of variance
6	Non-parametric tests: Mann-Whitney, Kruskal-Wallis, Chi-squared tests	3, 4	In-person	Practicum Assignment 3	Crawley 2012 Chp 8 Classical tests
7	Figures in R, back-of-the-envelope calculations	2	In-person	Practicum Assignment 4, Quiz 3	
8	Linear regression and correlation analysis	4	In-person	Practicum	Crawley 2012 Chp 10 Regression
9	Multiple linear regression: part 1	4	In-person	Practicum Quiz 4	Crawley 2012 Chp 10 Regression
10	Multiple linear regression: part 2	4	In-person	Practicum Assignment 5	Crawley 2012 Chp 10 Regression
11	Final group project proposal writing	1, 2, 3, 4	In-person	Group discussion Quiz 5, Assignment 6	Karban 2014 Ch5 Using Surveys to Explore Patterns
12	Model selection and miscellaneous topics	1, 2, 3, 4	In-person	Free time for group discussion	

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
13	Final group presentations, Final quiz	1, 2, 3, 4	In-person	Group presentations	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Practicum	R is a language and is best learnt through practice. Lectures (2-hour duration) will be followed up (on a separate day of the week) by weekly practicums based around the topic presented in the lecture (1-hour duration). During practicums, you will receive immediate feedback and assistance with coding. This approach supports ILO4.
Case study-based assignments	All assignments will be conducted as case studies. This approach will help you to apply skills learnt in the module to everyday life (ILO1). By forcing you to transfer learning from lectures based on examples from environmental science research to applications based on non-science case studies, these case studies will strengthen your skills of application (ILO4)
Group research project	In the final assignment, you will be required to work together on a small group research project. The experiential learning process of planning, collecting, analysing, interpreting, and presenting your data will strengthen skills associated with all ILOs.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Assignment(Individual assignments (assignments 1-5))	1, 2, 3, 4		25		Individual	Analytic	Extended Abstract
2	Continuous Assessment (CA): Test/Quiz(Quizzes)	1, 2, 3, 4		25		Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Assignment(Group Assignment)	1, 2, 3, 4		25		Team	Analytic	Extended Abstract
4	Continuous Assessment (CA): Test/Quiz(Final Quiz)	1, 2, 3, 4		25		Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

1. Individual assignments

Five individual assignments totalling 25% of the course grade (5% each). Assignments will be based on a lecture topic taught the week before. You will be given a real-world scenario, data from that scenario, and a data analysis/visualization task to complete. You will submit the assignment in R markdown, presenting codes, outputs, and interpretations of them. The real-world scenario provided will be based on the lives of two imaginary friends, Jayden and Joleena, who seek your help in a small nature-tech business venture. The assignments in this module represent key tasks that you help Jayden and Joleena with, as their business and lives progress. This real-world applied assessment method is a tried-and-tested method of instruction for mathematics/statistics-type content, and is shown to help learners to better apply course content to real life, as well as retain knowledge of the content better in the long term.

2. Quizzes

Five multiple choice question (MCQ) quizzes totalling 25% will be given at regular intervals during the course (see planned schedule). Quizzes will examine both recall and understanding of all topics taught in the course.

3. Group assignment

A group assignment involving study design, data collection, data analysis, and presentation of results. You are

required to conduct an actual ecological study to evaluate the impact of one technology/practice (of your choice) on one taxon (of your choice).

4. Final quiz

Multiple choice questions based on all topics taught in the course.

Formative Feedback

You will receive continuous feedback from lecturer and TAs during weekly practicums. Practicums will generally involve writing R codes to execute analyses taught during lectures, and then interpreting and presenting these in class.

You will also receive feedback while planning and proposing a study for the final group assignment (assignment 6) in week 11.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Collaboration	Basic
Communication	Basic
Digital Fluency	Basic
Problem Solving	Basic
Sense Making	Advanced

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project discussions and practicums.

Policy (Absenteeism)

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer, Ms Christina Tee, or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. If you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

Last Updated Date: 19-03-2026 14:46:01

Last Updated By: Ang Samantha