MODULE SPECIFICATION

Academic Year (student cohort covered by specification)	2023-24
Module Code	2464
Module Title	Modelling & the Dynamics of Infectious Diseases
Module Organiser(s)	Prof Richard White, Dr Emilia Vynnycky and Dr Lara Goscé
Faculty	Epidemiology & Population Health
FHEQ Level	Level 7
Credit Value	**CATS:** 15 **ECTS:** 7.5
HECoS Code	100402 : 101335
Term of Delivery	Term 2
Mode of Delivery	For 2023-24 this module will be delivered by predominantly face-to-face teaching modes. Where specific teaching methods (lectures, seminars, discussion groups) are noted in this module specification these will be delivered by predominantly face-to-face sessions. There will be a combination of live and interactive activities (synchronous learning) as well as recorded or self-directed study (asynchronous learning)
Mode of Study	Full-time
Language of Study	English
Pre-Requisites	This module builds on and consolidates many of the themes covered in the module on the Epidemiology of Infectious Disease (2437), and attendance at that module (or equivalent knowledge) is beneficial, but not required. Students will need to have an understanding of basic epidemiology. Students will benefit from reading the first chapter of the book "An Introduction to Infectious Disease Modelling" by E Vynnycky and RG White before the start of the module. They may also find it helpful to work through the exercises in the basic maths chapter of this book or through the maths refresher that will be posted on Moodle before the module. Familiarity with the spreadsheet package Excel is important (those with no experience should attend introductory courses).

	Training in the modelling package Berkeley Madonna is provided. Specialist mathematical training is not required as the emphasis is on developing a conceptual understanding of the basic methods and their practical application. Students who have attained the equivalent of a good high school mathematics training have generally been able to benefit from the module.
Accreditation by Professional Statutory and Regulatory Body	None
Module Cap (indicative number of students)	40–70 (numbers may be capped due to limitations in facilities or staffing)
Target Audience	The module aims to bring a conceptual understanding of mathematical models and their applications in infectious disease research to individuals who have some prior mathematical training (equivalent to UK A-level). It is also suitable for individuals with a more advanced background in mathematical disciplines who wish to obtain an understanding of the broad range of applications of mathematical models in infectious disease epidemiology and who may wish to specialize in this area in the future.
Module Description	This module provides an introduction to the use of mathematical modelling of infectious diseases. It provides students with an introduction to the theory of infectious disease modelling, illustrates applications of models in infectious disease research and determining the impact of interventions and provides the skills to develop and apply simple models of infectious diseases and interpret infectious disease data.
Duration	5 weeks at 2.5 days per week
Timetabling slot	Slot D1
Last Revised (e.g. year changes approved)	July 2023

Programme(s) This module is linked to the following programme(s)	**Status**
MSc Epidemiology	Recommended
MSc Veterinary Epidemiology	Compulsory

Module Aim and Intended Learning Outcomes

Overall aim of the module
The overall module aim is to: • introduce students to key methods for setting up models of the transmission dynamics of infectious diseases and their application.

Module Intended Learning Outcomes
Upon successful completion of the module a student will be able to: 1. Understand the basic methods for setting up deterministic and stochastic infectious disease models and identify appropriate model structures/key epidemiological parameters to describe the dynamics of infectious diseases. 2. Describe some of the host and pathogen factors determining variation in infectious diseases over time and adapt simple models to incorporate these factors 3. Design simple mathematical models to apply to infectious disease epidemiological data, incorporating appropriate control strategies and analyse and interpret the results. 4. Critically read modelling papers to identify their strengths and limitations

Indicative Syllabus

Session Content
The module is expected to cover the following topics: • Basic methods and motives for developing infectious disease models • Analysis and applications of seroprevalence data: methods for elucidating age (and time-) dependent transmission; application for designing models for predicting the impact of control strategies • Additional methods and dynamics - stochastic and network modelling, model-fitting and sensitivity analyses • Applications of modelling

Teaching and Learning

Notional Learning Hours

Type of Learning Time	**Number of Hours**	**Expressed as Percentage (%)**
Contact time	60	40
Directed self-study	35	23
Self-directed learning	25	17

Assessment, review and revision	30	20
Total	**150**	**100**

Student contact time refers to the tutor-mediated time allocated to teaching, provision of guidance and feedback to students. This time includes activities that take place in face-to-face contexts such as lectures, seminars, demonstrations, tutorials, supervised laboratory workshops, practical classes, project supervision as well as where tutors are available for one-to-one discussions and interaction by email.

The division of notional learning hours listed above is indicative and is designed to inform students as to the relative split between interactive and self-directed study.

Teaching and Learning Strategy

The teaching and learning strategy is structured as follows:

- **Lectures and computer practicals**. The teaching is delivered through a combination of lectures, computer practical sessions, and material from a distance-learning module. Practical sessions follow directly after lectures, ensuring that students have the opportunity to apply the concepts and methods covered by lecture content. The practicals provide students with "hands on" experience in building and interpreting modelling results, using data sets drawn from research work of staff in the faculty. Students are provided with detailed solutions to the tasks set in practical sessions, enabling them to check their understanding of the material.
- **Review sessions**. Two optional review lectures (in weeks 1 & 2) cover the material from the previous weeks' lectures and questions raised by students.
- **Paper discussion**. Students will review and critique a recent modelling paper to further consolidate understanding of the applications of models to current and real-world data.
- **Assessments.** The assessment task take the form of a group presentation assessment, where students fit a model to data and discuss the implications of testing interventions and an MCQ exam where students demonstrate a consolidation of their learning across the whole module. Both assessments take place at the end of the module.

Assessment

Assessment Strategy

The assessment for this module has been designed to measure student learning against the module intended learning outcomes (ILOs) as listed above. The grade for summative assessment(s) only will go towards the overall award GPA.

The assessment for this module will be online.

Summative Assessment

Assessment Type	**Assessment Length (i.e. Word Count, Length of presentation in minutes)**	**Weighting** (%)	**Intended Module Learning Outcomes Tested**
Group Work	10-minute group presentation	20	1,2,3,4
Timed Test (in-module test e.g. MCQ)	Around 1.5 hours	80	1,2

Resitting assessment
Resits will accord with the LSHTM's Resits Policy For individual students resitting a group assessment there will be an approved alternative assessment as detailed below.

Assessment being replaced	**Approved Alternative Assessment Type**	**Approved Alternative Assessment Length** (i.e. Word Count, Length of presentation in minutes)
Group Work	Timed Test (in-module test, e.g. MCQ)	Around 1.5 hours

Resources

Indicative reading list

Epidemiology of infectious diseases:

1. RM Anderson (ed) (1982) The population dynamics of infectious diseases: theory and applications. Chapman and Hall.
2. RM Anderson and RM May (1991) Infectious diseases of humans: dynamics and control, Oxford University Press (paperback version published in 1991)
3. J Giesecke (1994) Modern Infectious Disease Epidemiology. Edward Arnold Press

Further mathematical/modelling texts:

1. D Brown and P. Rothery (1993). Models in biology: mathematics, statistics and computing. Chichester, John Wiley and Sons.
2. G Eason, CW Coles, G Gettinby (1992) Mathematics and statistics for the biosciences. Ellis Horwood.
3. P Farrington (2009) Modelling epidemics. Milton Keynes. Open University
4. MJ Keeling and P Rohani (2007) Modeling infectious diseases in humans and animals. Princeton University Press.
5. SP Otto and T Day (2007) A biologist's guide to mathematical modeling in ecology and evolution. Princeton University Press.

Teaching for Disabilities and Learning Differences

The module-specific site on Moodle gives students access to lecture notes and copies of the slides used during the lecture. Where appropriate, lectures are recorded and made available on Moodle. All materials posted on Moodle, including computer-based sessions, have been made accessible where possible.

LSHTM Moodle is accessible to the widest possible audience, regardless of specific needs or disabilities. More detail can be found in the Moodle Accessibility Statement which can also be found within the footer of the Moodle pages. All students have access to "SensusAccess" software which allows conversion of files into alternative formats.

Student Support Services can arrange learning or assessment adjustments for students where needed. Details and how to request support can be found on the LSHTM Disability Support pages.