MODULE TITLE	**Mathematics of Climate Change**	**CREDIT VALUE**	**15**
MODULE CODE	**MTH3030**	**MODULE CONVENER**	**Dr Mark Williamson (Coordinator)**

DURATION: TERM	**1**	**2**	**3**
DURATION: WEEKS	**11**	**0**	**0**

Number of Students Taking Module (anticipated)	**170**

DESCRIPTION - summary of the module content

This module will provide a background in the mathematics underlying human-induced climate change. It will provide you with a good general understanding of the climate system, against which to assess the likely role of anthropogenic forcing factors. You will learn to apply a range of mathematical methods, including differential equations, calculus and the use of small parameters to approximate and simplify climate system problems. Topics of study will include observations of climate change, the greenhouse effect, regimes of atmospheric absorption, climate feedbacks, climate tipping points and geoengineering.

Prerequisite module: MTH1002 Methods or equivalent

AIMS - intentions of the module

Climate change is a high-profile subject that is often covered in the media. However, debate about climate change is often presented in a polarized way, divided along political or ideological lines. In contrast, there is now an urgent need to develop a new generation of thinkers capable of objectively analyzing the evidence for climate change and its causes, and the options for dealing with it (including mitigation, adaptation and geoengineering). Mathematically-minded people are especially sort after by organizations such as the Met Office-Hadley Centre in Exeter. This module aims to develop the skills required to meet these needs, by providing a strong-background in the science surrounding the climate change issue to mathematically-minded undergraduates.

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module, you should be able to:

Module Specific Skills and Knowledge:

1 demonstrate a good general understanding of the climate system, and human-induced climate change;

2 use simple climate models to demonstrate this understanding.

Discipline Specific Skills and Knowledge:

3 demonstrate the application of a range of mathematical methods, including differential equations, calculus and the use of small parameters to approximate and simplify climate system problems.

Personal and Key Transferable/Employment Skills and Knowledge:

SYLLABUS PLAN - summary of the structure and academic content of the module

- definition of climate and the climate system;

- observations of climate change and climate variability;

- the greenhouse effect;

- energy balance models of the climate system;

- climate feedbacks: water vapour, snow/sea ice albedo, ocean circulation, cloud cover, carbon cycle;

- atmospheric radiation and the vertical structure of climate;

- human-forcing of the climate system;

- predictions of future climate change.

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	33.00	**Guided Independent Study**	117.00	**Placement / Study Abroad**	

DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled learning and teaching activities	33	Lectures/example classes
Guided independent study	117	Lecture and assessment preparation; wider reading

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
In-class problem sheets	5 x 1 hour	1,2,3	Verbal

SUMMATIVE ASSESSMENT (% of credit)

Coursework	20	**Written Exams**	80	**Practical Exams**	

DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of Credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Coursework 1 – based on questions submitted for assessment	10	15 hours	All	Annotated script and written/verbal feedback
Coursework 2 - based on questions submitted for assessment	10	15 hours	All	Annotated script and written/verbal feedback
Written exam - closed book	80	2 hours (Summer)	All	Written/verbal on request, SRS

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-reassessment
Written Exam*	Written exam (2 hours)	All	August Ref/Def period
Coursework*	Coursework	All	August Ref/Def period

*Please refer to reassessment notes for details on deferral vs. Referral reassessment

RE-ASSESSMENT NOTES

Deferrals: Reassessment will be by coursework and/or written exam in the deferred element only. For deferred candidates, the module mark will be uncapped.

Referrals: Reassessment will be by a single written exam worth 100% of the module only. As it is a referral, the mark will be capped at 40%.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

ELE – http://vle.exeter.ac.uk

Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Salby, M. L.	Physics of the Atmosphere and Climate	2nd	Cambridge University Press	2012	978-1139005265	[Library]
Set	North, G. R., and Kim, K-Y.	Energy Balance Climate Models [ePDF edition]		Wiley	2017	978-3-527-68383-3	[Library]
Set	North, G. R., and Kim, K-Y.	Energy Balance Climate Models [ePub edition]		Wiley		978-3-527-68381-9	[Library]
Set	North, G. R., and Kim, K-Y.	Energy Balance Climate Models [print edition]		Wiley	2017	978-3-527-41132-0	[Library]
Set	Intergovermental Panel on Climate Change	AR5 Climate Change 2013 - the physical science basis		Cambridge University Press	2014	978-1107415324	[Library]

CREDIT VALUE	15	**ECTS VALUE**	7.5
PRE-REQUISITE MODULES	MTH1002		
CO-REQUISITE MODULES			
NQF LEVEL (FHEQ)	6	**AVAILABLE AS DISTANCE LEARNING**	No
ORIGIN DATE	Tuesday 10 July 2018	**LAST REVISION DATE**	Thursday 26 January 2023
KEY WORDS SEARCH	Climate; mathematics; climate change; mathematical modelling.		