The University of Edinburgh
School of GeoSciences

MEarthPhys Geophysics

Year 5

2017/18 Course Information

Contents

Introduction

This handbook describes the courses taught in year 5 of the MEarthPhys degree programmes in Geophysics.

Geophysics is the study of the Earth's internal structure and dynamics through the use of physics and mathematics.
You will learn the fundamental physical principles and mathematical techniques underpinning the subject, and their application to fields as diverse as oil and gas exploration, environmental monitoring and protection, and mitigation of natural hazards. You will gain an understanding of the inner workings of our planet. The programme includes two individual projects, a large final-year research project and an international field course.
Our geophysics programmes are unique in Scotland. The University has one of the largest groupings of geophysicists in Europe, offering unrivalled courses that cover practical applications of physics and mathematics in the geosciences.

This handbook includes details of timetables for each course, the number of credits you are expected to achieve in year 5 of your degree programme and details of learning outcomes for each course.

The details contained in the handbook are correct at the time of publishing.

Should you have questions and/or problems with a specific course, you should contact the course organiser in the first instance. Matters of a general programme nature should be addressed to your Degree Programme Convenor, Dr Eliza Calder.

Dr Eliza Calder
MEarthPhys Coordinator

MEarthPhys – Year 5

During year 5 of the MEarthPhys Geophysics degree programme half of your year will consist of work on an independent research project. You will also complete high-level compulsory and option courses from the School of GeoSciences, including scientific computing skills.

You will be expected to take all of those courses that are compulsory for your degree, plus 30 credits of Earth Science level 10 or 11 optional courses. The major component of your fifth year is the Geoscience Research Project, which counts for 40 of the 120 credits and is the major work of your Integrated Masters year.

The fifth year is the final year of your MEarthPhys degree years and carries the same assessment weighting as the fourth year. The results of your fourth-year and fifth-year assessment will therefore contribute 40% each of the marks used in deciding your Honours Degree result, with the third-year making up the final 20%. Students who have progressed to the MEarthPhys 5th year must have achieved the equivalent of a BSc 2:1 degree grade (60% and above). Synopses of individual courses are given in this handbook.

Students in year 5 are assessed through continuous assessment, however, there is much more onus on self-study and research than in previous years of your degree programme.

Your course choices

Students in year 5 of the MEarthPhys degree programme are required to pass at least 80 credits (from 120) and an average mark of 40% in each of the third, fourth and fifth years in order to progress to be awarded the MEarthPhys degree. Those 5th year MEarthPhys students who do not achieve 80 credits and 40% average in the 5th year, will be awarded a BSc Honours degree.

You will study 90 credits of compulsory courses in the fifth year, including Frontiers in Earth Science, Project Design and Literature Analysis and Scientific Computing Skills. The remaining 40 credits of compulsory courses will be your Research Project. You are required to choose 30 credits of Earth Science level 10 or 11 optional courses to complete the 120 credits of your fifth year studies. Details of optional courses can be viewed on the DRPS.

Course summary

The table below contains brief details of each course in year 5 of the MEarthPhys Geophysics degree programme table. Further details of each course are found later in this guide.

MEarthPhys Geophysics Compulsory courses

Code	Course Name	Course Organiser	Course Secretary	Period	Credits
GESC11001	Project Design and Literature Analysis	Dr Eliza Calder	Susie Crocker	Semester 1	20
GESC11002	Geoscience Research Project	Dr Eliza Calder	Susie Crocker	Full Year	40
GESC11003	Frontiers in Earth Science	Prof Dick Kroon	Susie Crocker	Semester 2	10
EASC11005	Scientific Computing Skills	Dr Hugh Pumphrey	Sarah Thomas	Semester 1	20

MEarthPhys Geophysics Optional courses

Details of optional courses are available by viewing the relevant Degree Programme Table on the University Degree Regulations and Programmes of Study (DRPS) page. The School of GeoSciences DPT's are found here: http://www.drps.ed.ac.uk/17-18/dpt/utmepgeoph1f.htm#dpt-year-5

Contact details for Course Organisers and Course Secretaries are included in the detailed descriptions of each course, found later in this guide.

Key Dates

The table below details key University and School dates throughout the 2017/18 academic year. These dates are correct at the time of publishing and may be subject to change.

2017

11th-17th September	Welcome Week
18th September	Start of Teaching Block 1
20th October	End of Teaching Block 1
23rd October	Start of Teaching Block 2
8th November	Student Staff Liaison Committee meeting
1st December	End of Teaching Block 2
8th – 21st December	Examinations
21st December	End of Semester 1
22nd December	Winter Teaching Vacation starts

2018

12th January	Winter Teaching Vacation ends
15th January	Start of Teaching Block 3
7th February	Student Staff Liaison Committee meeting
16th February	End of Teaching Block 3
19th – 23rd February	Flexible Learning Week
26th February	Start of Teaching Block 4
6th April	End of Teaching Block 4
9th April	Spring Teaching Vacation starts
20th April	Spring Teaching Vacation ends
25th April	End of Semester 2
30th April – 25th May	Examinations
28th May	Summer Teaching Vacation starts
30th June	Graduations start
TBC	School of GeoSciences graduation ceremony
14th July	End of Graduations

Compulsory Course Information

GESC11001 Project Design and Literature Analysis

Course Organiser:	Eliza Calder	**Other Key Staff:**	Massimo Bollasina
Course Secretary:	Susie Crocker	**Course location:**	Kings Buildings
Credits available:	20	**SCQF Level:**	11

Summary

This course will allow students to reflect on a subject area of their choice, become familiar with the important and current literature on the subject, and design a research project on the topic of their choice. This course will run alongside 'Research Methods and Transferable Skills' to provide a complementary introduction to research skills required to plan and execute novel scientific research. Students will be introduced to on-line scientific databases used for researching scientific literature and the skills required to identify potential areas for research. Students will use these skills in tandem with training in the use of various analytical and experiment techniques to formulate their independent research project. Students will present their research project proposals to each other (and other members of the School) at a one-day workshop, as well as write a detailed literature review and project proposal in the form of a NERC research proposal.

The course is delivered in the form a group tutorial session, where discussion amongs students and staff is expected.

Course description and syllabus

Provisionally 12-2pm Fridays (Semester 1), although sessions will be arranged once the schedules of individuals involved have been determined.

The planned topics to be covered and staff member responsible are listed below, although because this is a group tutorial type class, and individual projects and needs vary substantially, the schedule may vary somewhat.

22 Sep – Introduction to Masters year – Eliza Calder
29 Sep – Reading scientific papers – Eliza Calder
6 Oct – Web of Science – Massimo Bollasina
13 Oct – How to write a proposal I – Eliza Calder
20 Oct - How to write a proposal II - Eliza Calder
27 Oct - How to write a proposal III - Massimo Bollasina
3 Nov – The importance of an abstract - Massimo Bollasina
10 Nov – Developing your own abstracts - Massimo Bollasina
17 Nov – Preparing a poster - Massimo Bollasina
24 Nov – Preparing a talk – Eliza Calder
1 Dec – Final Presentation Day – Eliza Calder, Massimo Bollasina and Project Supervisors.

Further Course Information

https://path.is.ed.ac.uk/courses/GESC11001_SS1_SEM1
http://www.drps.ed.ac.uk/17-18/dpt/cxgesc11001.htm

Learning Outcomes

On completion of this course students will be able to:
1. Students will be able to design a research project with testable hypotheses and achievable goals.
2. Students will be able to interrogate and critically assess existing scientific literature for work still to be done.
3. Students will be able to set their research in the broader context of work in their field of interest.
4. Students will have a detailed, thorough and up-to-date understanding of one particular area of research in the geosciences, as well as an appreciation of the range of research conducted in modern geoscience.

Opportunities for feedback
This course comprises small group meetings that will be hosted around the discussion of research-related topics. There will be the opportunity for feedback throughout the semester through direct discussion with course organiser. Formal written feedback will be provided on the literature reviews and0research proposals and on the proposal presentation.

Assessment details
Written Exam: 0%, Course Work: 100 %, Practical Exam: 0%.

1. **Literature Review** (30% of the PDLA = 6 credits): Due Week 5, 20th Oct 2017, 1pm.
2. **Proposal Presentation** (20% of the PDLA = 4 credits): Week 11 (27th Nov-1 December).
3. **Research Project Proposal** (50% of the PDLA = 10 credits): Due 8 December 2017, 1pm.

Literature Review: An outline of the proposed area of research, which describes the main debates and controversies, and contains a reference list of approximately 30 to 40 recent relevant publications. The literature review does not have to include a detailed description of methods that will be used in the project, but should explain briefly how your work will fit into the context of previous work. Maximum 9 x A4-pages of text (including references, but excluding figures and tables).

Project Proposal and Presentation: The project proposal will describe the background to the student's independent research project, work to be conducted as part of the project, and how this work will be performed (scientific methodology). Students will be given guidance on how to plan their individual research projects, structure their proposals and will present their research plans (including research background and available scientific literature) to each other and their supervisors at a planned event. This will provide students with an opportunity to critically assess each other's research topics, as well as gain some appreciation for the breadth of scientific research conducted in the Earth Sciences. Maximum 8 x A4-pages of text (including references, figures and tables).

http://www.ed.ac.uk/student-administration/exams/regulations/common-marking-scheme

Assessment deadlines
1. **Literature Review**: Due Week 5, 20th Oct 2017, 1pm.
2. **Proposal Presentation**: Week 11 (27th Nov- 1st December).
3. **Research Project Proposal**: Due 8 December 2017, 1pm.

Assessment and Feedback information
Link to the Taught Assessment Regulations
All details related to extensions procedures and late penalties can be found in the School of GeoSciences General Information Handbook 2017-18 (to be added to Geosciences webpage in due course).

Pre-requisite courses
N/A

Timetable
https://browser.ted.is.ed.ac.uk/generate?courses%5B%5D=GESC11001_SS1_SEM1&period=YR

Semester:	Semester 1
Lectures:	Friday 12.10 -14:00 Computer Room 143
Practical class:	n/a
Tutorial:	n/a

Recommended reading

Students are expected to read widely on their selected topic area. Additional generic papers in how to conduct research or write proposals etc will be provided throughout the semester.

http://www.ed.ac.uk/files/atoms/files/accessible_and_inclusive_learning_policy.pdf

Contacts

Course Organiser
Eliza Calder
Email: eliza.calder@ed.ac.uk
Tel: 0131-650-4910

Course Secretary
Susie Crocker
Email: Susie.Crocker@ed.ac.uk
Tel: 0131-651-7126

GESC11002 Geoscience Research Project

Course Organiser:	Eliza Calder	**Other Key Staff:**	
Course Secretary:	Susie Crocker	**Course location:**	Kings Buildings
Credits available:	40	**SCQF Level:**	11

Summary

This course represents an independent research project carried out by integrated masters student during Semester 1 and 2 of their 5th year.

Course description

Students will undertake an independent research project on an area of their choice in the field of Geoscience. They will draw on skills acquired in courses on Research Methods and Transferable Skills and Project Design and Literature Analysis to ensure that the project is well designed and achievable.

Further Course Information

https://path.is.ed.ac.uk/courses/GESC11002_SS1_YR
http://www.drps.ed.ac.uk/17-18/dpt/cxgesc11002.htm

Learning Outcomes

On completion of this course students will be able to:
1. Undertake research in a Geoscience topic, producing detailed work of an original and high quality.
2. Demonstrate a critical understanding of the principal and specialised theories associated with their chosen topic which will be informed by recent developments.
3. Apply a range of standard and specialised techniques to achieve their objectives.
4. Write a scientific report on their research which is accurate, appropriately illustrated, argued and referenced.
5. Present this work in a range of appropriate formats and will communicate their findings with peers and more senior members of the department.

Opportunities for feedback

The Course Organiser (Calder) will hold an open door policy throughout the year for MEarthSci / MEarthPhys students requiring general information and feedback about the undertaking of a research project. The CO will also provide general feedback on the advancement of the project through the Project Design and Literature Analysis course. Written feedback will be provided on the project proposals and seminars.

Research Project Supervisors will provide specific information and feedback on scientific aspects of the projects and will provide general feedback during planning of the project and ongoing consultation throughout the project. It is anticipated that valuable feedback would also be available from interactions within the wider research group such as through discussion amongst supporting postdoctoral staff and postgraduate students. Written feedback will be given on the literature review, draft project proposal and project report.

Assessment details

Written Exam: 0%, Course Work: 100 %, Practical Exam: 0%.

Project seminar and poster (30%)
Research Project (70%)

Written Research Project (70%)

Written Project reports should provide a concise and accurate summary of project work conducted during the Integrated masters year (5th year) and conclusions that can be drawn from this work, and should place the student's work within the broader context of other research conducted in the field. It is expected that project reports should be around 6000 words, excluding abstract, figure captions, tables, references and any appendices. Project reports will be submitted in early May, and will be prepared in the form of a short scientific paper, as would be submitted to an international Geosciences journal. Suggested formatting for the report is double spaced text, with figures tables and captions embedded in the body of the text. One inch

margins and font size 12 are recommended, text size for the reference list can be smaller, but should still be easily legible.

Project Seminar and Poster (30%)
Research seminars will take the form of short 15-minute presentations of the type given at international scientific conferences (5 minutes extra will be allocated for questions and discussion at the end of each talk) and a poster. An abstract of up to 350 words (for the main text), to include the project title, your name and the name of your supervisor is to be submitted one week before the seminars). The presentation should be aimed at an audience with a wide range of scientific backgrounds. Seminars and project posters will be presented at the Integrated Masters Seminar day, which will be open to all School of GeoSciences students and staff. The poster, usually A0 in size and orientated vertically, will be displayed both during the seminar day, and usually for a few days afterwards. The seminars and posters will provide students with the opportunity to view each other's completed project results, as well as give staff the opportunity to provide final feedback on the project analysis and results before the written reports are submitted.

http://www.ed.ac.uk/student-administration/exams/regulations/common-marking-scheme

Assessment deadlines

Project seminar and poster (30%):
(prepared for the *Integrated Masters Seminar Day* provisionally set as 27th April 2018).

Research Project (70%): due one week later – provisionally 4th May 2018, 1pm.

Assessment and Feedback information
Link to the Taught Assessment Regulations

All details related to extensions procedures and late penalties can be found in the School of GeoSciences General Information Handbook 2017-18 (to be added to Geosciences webpage in due course).

Pre-requisite courses
N/A

Semester:	Full Year
Lectures:	n/a
Practical class:	n/a
Tutorial:	n/a

Syllabus
Work will be independent and undertaken alone or in small groups. The class will only meet together for one introductory lecture early in Semester 2 and for assessed presentations. Students are expected to communicate, or meet with CO on an as-needed basis.

Recommended reading
Students are expected to read widely on their own selected topic area

http://www.ed.ac.uk/files/atoms/files/accessible_and_inclusive_learning_policy.pdf

Contacts

Course Organiser
Eliza Calder
Email: Eliza.Calder@ed.ac.uk
Tel: 0131-650-4910

Course Secretary
Susie Crocker
Email: Susie.Crocker@ed.ac.uk
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GESC11003 Frontiers in Earth Science

2017-18 course information still to be confirmed.

EASC11005 Scientific Computing Skills

Course Organiser:	Hugh Pumphrey	**Other Key Staff:**	N/A
Course Secretary:	Sarah Thomas	**Course location:**	Kings Buildings
Credits available:	20	**SCQF Level:**	11

Summary

MEarthPhys students undertake a major 5th year project in Geophysics and/or meteorology, spread over two semesters. These projects can be drawn from a diverse range (reflecting staff research interests). Many involve interfacing with existing software for analysing data, using a variety of programming languages. Building on such existing software is often essential to meaningful progress in the research project. No programming language has been identified as a standard that all students can be taught and that would serve for all potential projects. Furthermore, the only language that students have been taught so far is an interpreted data-analysis language. A professional scientist should also have been exposed to traditional compiled languages (C, Fortran etc.) and should understand some of the differences between the two types of language. Some, but not all, students will therefore be faced with a significant need to gain skills in programming as well as learning the geophysics/meteorology relevant to their project. This course is intended to ensure due credit is available to students for achieving that up-skilling in scientific computing, while allowing all project work to be assessed on a common basis (i.e., assuming no limitations arising from difficulty in acquiring computing skills). Students will thus take this course as a means of gaining the scientific computing skills that are necessary to the performance of their level 11 research project, i.e., they will follow an individually agreed approach to learning the programming language necessary for their project. The approach to learning could include auditing or taking courses within the University where relevant and available (in which case credits would not be double counted). More commonly, a number of reasonably demanding tasks will be devised requiring data reading, data manipulation and programming of mathematical operations. Each student will develop code in both a compiled language and a data-analysis language in order to achieve their agreed tasks in their particular programming environments, the scale of the tasks being intended to require ~200 hours of effort. Where the student's project does not require both a compiled and a data-analysis language, the languages to be used will be selected by the CO. As well as providing students with scientific computing experience explicitly on their transcript, the student experience should be enhanced in that students will not be dissuaded from choosing projects requiring mature computing skills.

Course description

Note that this schedule is for illustrative purposes only. Material covered will vary from year to year depending on the requirements of the students for their research project, the availability of IS-provided training courses etc.

- Week 1: The nature of computing. What is a computer, and how does it work? Data formats. ASCII text vs raw binary vs self-describing binary (HDF, NetCDF etc). Formative exercise handed out.
- Week 2: Languages. Compiled vs interpreted. Getting started with a compiled language First assessed exercise handed out.
- Week 3: No class: instructor on 4th-year field course
- Week 4: Presentation of data. Caption vs legend. Colour scales etc. Deadline for formative feedback exercise. Second exercise handed out.
- Week 5: More on Languages. Styles: procedural vs functional vs object-oriented. Documenting of code. It isn't just the comments. How good structure leads to readability.
- Week 6: Packaging of code. What to do with a source tar file. How to make one. How code is packaged up in the languages of choice (e.g. R packages)
- Week 7: University-run Fortran 95 course. (This was in week 7 in 2016-17. Hopefully this year it will be earlier in the semester.)
- Week 8: Scientific typesetting. LaTeX versus word processors.
- Week 9: Graphics formats, and how to hack them. Images vs vector graphics. How to avoid your figures getting in a mess once they are in a document.
- Week 10: Other stuff we do with computers (GIS?)
- Week 11: Deadline for second assessed exercise.

Further Course Information

https://path.is.ed.ac.uk/courses/EASC11005_SS1_SEM1
http://www.drps.ed.ac.uk/17-18/dpt/cxeasc11005.htm

Learning Outcomes
On completion of this course, the student will be able to:

1. Understand the difference between a compiled language and an interpreted language, and appreciate which class of languages is suited to which sorts of problems.
2. Achieve tasks involving data handling, mathematical manipulation, and data visualisation, in one of Matlab, IDL, Python/numpy/matplotlib, R, PerlDL (or another interpreted data-analysis language).
3. Achieve tasks involving numerical analysis/modelling in one of C, Fortran, Java or another compiled language.
4. Use strategies for structuring and testing scientific computing code.
5. Write code which is appropriately commented and documented.

Opportunities for feedback

- A short exercise will be set and marked near the start of the semester for feedback purposes only
- Weekly classes will consist of small-group discussions allowing verbal feedback.
- The first assessed exercise is set and marked early enough in the semester to provide useful feedback for the second exercise.

Examples of feedback can be found here: http://www.ed.ac.uk/schools-departments/geosciences/teaching-organisation/staff/feedback-and-marking

Assessment details
Written Exam: 0%, Course Work: 100 %, Practical Exam: 0%.

http://www.ed.ac.uk/student-administration/exams/regulations/common-marking-scheme

Assessment deadlines
TBC

Assessment and Feedback information
http://www.ed.ac.uk/files/atoms/files/tar17-18.pdf
All details related to extensions procedures and late penalties can be found in the School of GeoSciences General Information Handbook 2017-18.

Pre-requisite courses
Students MUST have passed: Computational Modelling for Geosciences (EASC09035)

Timetable

Semester:	Semester 1
Lectures:	
Practical class:	
Tutorial:	

Syllabus

Recommended reading

Accessible and Inclusive Learning Policy

Contacts

Course Organiser
Hugh Pumphrey
Email: Hugh.Pumphrey@ed.ac.uk
Tel: 0131 650 6026

Course Secretary
Sarah Thomas
Email: Sarah.Thomas@ed.ac.uk
Tel: 0131-650-8510

Optional Course Information

Students of the Geophysics degree supplement their compulsory courses with a number of optional courses.

Year 5 students can choose their 20 credits of optional courses from Earth Science level 10 and 11 courses within the School of GeoSciences.

For information on the courses available, students should check, in the first instance, the Geology Degree Programme Tables on the Degree Regulations and Programme Schedules (DRPS) page: http://www.drps.ed.ac.uk/14-15/dpt/drps_geo.htm, where you will find lists of applicable optional courses and their course descriptions.

Students may also find the University PATH software helpful when selecting which optional courses to take. This software can be launched through your MyEd page https://www.myed.ed.ac.uk and will assist you in finding out which courses fit in your timetable and require prerequisite study. Your Personal Tutor should register you on any optional courses and can give you advice on which courses would be best-suited to your study plan.

Degree Programme Table

Geophysics (MEarthPhys) (UTMEPGEOPH1F)

Useful links

The below links are for pages which give details of policies and guidance within and outside of the School of GeoSciences, including Special Circumstances, Assessments and Examination diets.

School of GeoSciences Teaching Organisation:
http://www.ed.ac.uk/schools-departments/geosciences/teaching-organisation

School of GeoSciences policies and forms:
http://www.ed.ac.uk/schools-departments/geosciences/teaching-organisation/to-form-policy

College of Science and Engineering:
http://www.ed.ac.uk/schools-departments/science-engineering

Academic Services:
http://www.ed.ac.uk/schools-departments/academic-services