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

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	AY2023-2024
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Assoc Prof Wang Xianfeng
Course Author Email	xianfeng.wang@ntu.edu.sg
Course Title	INTRODUCTION TO GEOCHEMISTRY
Course Code	ES3003
Academic Units	3
Contact Hours	39
Research Experience Components	

Course Requisites (if applicable)

Pre-requisites	ES1003 E2S2 Solid Earth
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course is designed to introduce you the principles of chemistry related to geology and their applications to understand processes taking place on and within the Earth. The aim is to provide you with a powerful toolbox and the related skills, more than a static bank of knowledge. You will become familiar with the principles of geochemistry, including analytical chemistry, governing equations and typical applications in the Earth Systems Sciences (e.g., atmosphere, hydrosphere, biosphere, solid earth, anthroposphere). You will learn to organize and present geochemical data, including writing a report on a problem of your choice. With this set of tools and knowledge, you will have the mind skills and technical know-hows to answer a range of practical problems, including some that may not have been addressed in the class.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Become familiar with the basic principles and tools of geochemistry;
ILO 2	Practice problem solving with application of governing equations to investigate main geochemical processes;
ILO 3	Formulate questions about the dynamics within Earth System Sciences;
ILO 4	Develop intellectual flexibility and critical thinking to identify the most useful geochemical tool to address some geological and environmental problems;
ILO 5	Perform geochemical research which involves hands-on acquisition, data analysis and interpretation;

Course Content

This course is divided into two parts: In Part (i) lecture classes, you will be introduced to the basic principles and tools of geochemistry. You will learn about the large scale processes occurring in the geosphere, hydrosphere, biosphere, atmosphere and anthroposphere on the Earth, using major and trace element geochemistry, and stable and radiogenic isotopes. You will also learn processes such as element and isotope fractionation, element transport and mixing as well as radiogenic isotopes and their application for geochronological purposes.

In Part (ii) tutorial classes and individual time, you will work closely with our research fellows and undertake hands-on data collection via geochemistry analytical instruments and data analysis.

Reading and References (if applicable)

This is course aims to encourage you to think critically, and solve practical problems with a series of tools. The following books will be used as the main references/textbooks:

1- White, W.M. (2013) Geochemistry. Wiley-Blackwell. 1st edition, 660pp. ISBN: 978-0-470-65668-6;
2- Albarede F. (2009) Geochemistry: An Introduction. Cambridge University Press. 2nd edition, 342pp. ISBN: 978-0-521-7069-3.
3- Van Loon G.W. and Duffy, S.J. (2017) Environmental Chemistry: A Global Perspective. Oxford University Press. 4th edition, 585pp. ISBN: 978-0-19-874997-4.
4- Jacob D.J. (1999) Introduction to Atmospheric Chemistry. Princeton University Press.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Universe, element formation, Earth	1,2,4	White: Chap. 10; Albarede: Chap. 1, 12	In-person	
2	Basic thermodynamics	1,2,4	White: Chaps. 2,4	In-person	
3	Kinetics and fluxes	1, 2,4	White: Chap. 5; Albarede: Chap. 1, 12	In-person	
4	Radiogenic isotopes and geochronology	1,2,4	White: Chap. 8; Albarede: Chap. 4	In-person	
5	Major stable isotopic systems	1, 2,4	White: Chap. 9; Albarede: Chap. 3	In-person	
6	Earth's differentiation, magmatic rocks	1,2,4	White: Chap. 7; Albarede: Chap. 2	In-person	
7	Medical and forensic geochemistry	1, 2,4	White: Chap. 9; Albarede: Chap. 13	In-person	
8	Aquatic geochemistry, element source and sinks	1,2,4	White: Chap. 6; Albarede: Chap. 7; Duffy: Chap. 9	In-person	
9	Carbonate equilibria	1, 2,4	White: Chap. 6; Albarede: Chap. 9; Duffy: Chap. 11	In-person	
10	Atmospheric geochemistry, gas species and radiative balance of the Earth	1, 2,4	Duffy: Chap. 8; Jacob: Chap. 7	In-person	
11	Photochemistry of atmospheric gas species	1,2,4	Duffy: Chap. 3; Jacob, Chap. 9, 10	In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	Oxidation-reduction geochemistry	1, 2,4	White: Chap. 3; Albarede: Chap. 7	In-person	
13	Research project presentations	1, 3, 4, 5		In-person	Presentations

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Lectures will pass on the theoretical knowledge required to understand the different components of principles and tools of geochemistry.
Tutorial and Research Activities	Tutorial sessions will introduce you to the principles of individual geochemical instruments. You will also get hands-on research experiences on these instruments with peers, and work with experts in the field.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Report/Case study(Research project report)	1,3,4,5	Knowledge, Intellectual flexibility and critical thinking, problem solving, passion and communication	40	Individual		
2	Continuous Assessment (CA): Presentation(Group project Presentations)	1,3,4,5	Intellectual flexibility and critical thinking, formulating questions, passion and communication	30	Team		
3	Continuous Assessment (CA): Assignment(Weekly assignments)	1, 2, 4	Knowledge, Intellectual flexibility and critical thinking, formulating questions, and problem solving	30	Individual		

Description of Assessment Components (if applicable)

Formative Feedback

Following tutorial classes, you will receive direct written feedback (normally in a week) on your weekly assignments. In this way the lecturer and you can monitor progress. You will also be given written feedback on your group projects.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level

Course Policy

Policy (Academic Integrity)

Policy (General)

(1) General
You are expected to complete all assigned readings and activities, attend all classes punctually and take all scheduled assignments, reports and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed.

Policy (Absenteeism)

(2) Absenteeism
In-class activities make up a significant portion of your course grade. 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.

Policy (Others, if applicable)

Last Updated Date: 12-06-2024 03:15:54

Last Updated By: Siti Nur Amirah Binte Suhari