MODULE DESCRIPTOR 2019/20

CL218 Chemistry and Materials Science

Registrar: Prof. Vernon Phoenix	**Taught To (Programme):** BEng/MEng Civil Engineering, Civil & Environmental Engineering	
Other Lecturers Involved: Dr Andrea Hamilton	**Credit Weighting: 20**	**Semester: 1 and 2**
Assumed Pre-requisites: none	**Compulsory**	**Academic Level: 2**

Class Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
30	20	25	25	-	100	200

Class Aim(s)

This class aims to

To provide practical insights to fundamental chemistry and materials science and their roles in a wide range of civil and environmental engineering applications.

Learning Outcomes

On completion of the class the student is expected to be able to show

- LO1 demonstrate a working knowledge of fundamental principles of chemistry and materials science.
- LO2 identify aspects of chemistry and materials science that link to the engineering properties and behaviour of materials.
- LO3 apply fundamentals of chemistry and materials science to solve engineering problems.

Syllabus

The class will teach the following:

Chemistry Material properties, use of the periodic table; chemical formulas, chemical reaction equations; bonding; equilibrium chemistry and the concept of pH; electronegativity and redox chemistry; free radical chemistry

Chemical Thermodynamics Laws of Thermodynamics (First Principles); chemical equilibrium; gas behaviour (ideal gas law); effects of temperature and pressure; phase changes; reactivity and activation energy

Materials Science Mineralogy; Crystallinity, defects, and impacts on material properties; Structural materials (e.g. steel, concrete, glass, polymers, etc); Geomaterials (e.g. rocks, soils and its constituent, etc);

Integration Applications Cement; Corrosion; Chemistry of the environment (pollution-environment interactions and remediation) and specific cycles/systems; Pollution and its impacts on development; Public health issues

Assessment Criteria

For each of the Course Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 demonstrate a working knowledge of fundamental principles of chemistry and materials science.
C1 understand concepts from chemistry and materials science relevant to civil and environmental engineering
C2 link fundamental phenomena of chemistry and materials science to complex phenomena.
C3 apply theoretical principles of chemistry and materials science to complex, open-ended problems in civil and environmental engineering.

LO2 identify aspects of chemistry and materials science that link to the engineering properties and behaviour of materials.
C1 develop a working knowledge of how basic principles affect complex engineering phenomena
C2 link complex engineering behaviour to fundamental science
C3 demonstrate this knowledge in the application of appropriate tests to engineering materials

LO3 apply fundamentals of chemistry and materials science to solve engineering problems.
C1 identify materials of interest to civil and environmental engineering and their fundamental physical properties
C2 determine the key aspects of fundamental chemistry and materials science that affect these materials
C3 apply this knowledge to explain how these materials are manufactured (including historic technologies) and manipulated by their environment.

The standards set for each criterion per Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessments.

Principles of Assessment and Feedback (*https://www.strath.ac.uk/staff/policies/academic/*)

Please state briefly how these are incorporated in this module.
1. Marking criteria are outlined clearly in laboratory and assignment instructions and multiple opportunities for questions are available, either in class or through electronic correspondence. Each marking sheet is taken directly from this handout.
2. Expectations in terms of time and effort are outlined clearly in the presentation of each assignment.
3. Feedback sheets given to students provide high quality information to students that allow them to compare their work to the expectations for each assignment and reflect on improvements for future.
4. Opportunities are provided to students to close gaps between current and desired performance by the prompt return of marks and feedback on the class test and mini-quizzes.
5. Students work on small, regular, tutorials and mini-quizzes with prompt feedback.
6. Laboratory work encourages interaction between peer groups and with the instructor.
7. A computer-based class test is provided to support student self-assessment and reflection.
8. Laboratory activities and assignments allow students the opportunity to apply what they have learned.
9. Departmental policy is to carry out mid-term class assessments and provide feedback to students.
10. Interdisciplinary laboratory activities support the development of learning communities by allowing students from different interests and background the opportunity to interact with each other.
11. Frequent, regular and positively-worded feedback provides a positive and encouraging atmosphere for student learning.
12. Anonymous mid-year feedback surveys and interaction with students in small groups will be used to adapt teaching practices and resources accordingly.

Recommended Reading

Dean, John R., Alan M. Jones, David Holmes, Rob Reed, Jonathan Weyers, and Allan Jones (2011) Practical Skills in Chemistry, Second Edition [online] Available at *http://www.dawsonera.com/depp/reader/protected/external/AbstractView/S9780273731191* [free access via Suprimo]

Moore, John T. (2004) Chemistry Made Simple. New York: Broadway Books.

Roussak, O.V. and H. D. Gesser (2013) Applied Chemistry: A Textbook for Engineers and Technologists [online] Available at *http://link.springer.com/book/10.1007/978-1-4614-4262-2/page/1* [free access via Suprimo]

Sawyer, Clair N., Perry L. McCarty, and Gene F. Parkin (2002) Chemistry for Environmental Engineering and Science, Fifth Edition. London: McGraw-Hill Inc.

Ashby, M. F. and Jones, D. R. H, Engineering Materials 2: An Introduction to Microstructures, Processing and Design: v. 2 (International Series on Materials Science and Technology), third edition. Oxford: Butterworth-Heinemann.

PLEASE NOTE:
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

Resit Arrangements

Resit examinations will follow the August diet. Resit coursework or laboratories will be by arrangement.

Approved

Programme Director Signature:

Date of Last Modifications: 14/08/2019

Assessment and Feedback Schedule

Class Code	CL218	Class Title	Chemistry and Materials Science

Brief Description of Assessment

Assessment for this 20 credit course includes 2 exams (sem 1 and sem 2), 1 outdoor assignment with a group report (sem1), weekly mini-quizzes (sem1), 1 laboratory with group report (sem2) and 1 online class test (sem2), all of which contribute to the final grade. Semester 2 also includes weekly in class tutorial questions and tutorial worksheets with answers which do not contribute to the final grade but give the students further opportunities to practice what they've learned.

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

Semester 1

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Exam		25	Individual												x
In-lecture mini-quizes		12	Individual	H/S/F	H/S/F	H/S/F	H/S/F	H/S/F		H/S/F	H/S/F	H/S/F			
Outdoor assignment with group report		13	Group					H					S		F

Semester 2

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Exam	LO1 – LO3	40	Individual												x
Laboratory group 1	LO3	5	Group					H		S		F			
Laboratory group 2	LO3	5	Group						H		S		F		
Class test (4)	LO1-LO2	5	Individual, online.						T(4), F						

.Mapping Module Learning Outcomes to AHEP

Module Learning Outcome	**Engineering Council AHEP competencies: Knowledge, Understanding and Ability**
LO1 demonstrate a working knowledge of fundamental principles of chemistry and materials science.	Knowledge and understanding of scientific principles and methodology within chemistry and materials necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
LO2 identify aspects of chemistry and materials science that link to the engineering properties and behaviour of materials.	Ability to apply and integrate knowledge and understanding of other engineering disciplines (i.e. materials science and chemistry) to support study of their own engineering discipline. Knowledge of characteristics of particular materials, equipment, processes, or products Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
LO3 apply fundamentals of chemistry and materials science to solve engineering problems.	Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects. Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
<add rows as appropriate>	

JBM Programme Threads

Thread	Primary	Secondary	Contributory
Design			
Health, Safety & Risk Assessment			**Risk assessment for field work for group campus corrosion report in semester 1.**
Sustainability	**LO1, 2,3** **Semester 1:** **Understanding and balancing equations for pollution generation and remediation and carbon footprint of cement; assessed in final exam.** **Carbon negative cement and balancing equations for its production (assessed in miniquiz)** **semester 2:** **laboratory plus assignment on water transport and deterioration of building materials (rising damp).**		
Maths for Engineers		**LO1, 2, 3** **Semester 1:** **Ideal gas law and Gibbs free energy calculations (assessed in miniquiz and exam).** **Semester 2calculating water flow and height of rise in masonry (laboratory, tutorial 1 and exam)**	
Industrial Engagement			

Digital Technologies			