COLLEGE OF ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

CHEMICAL ENGINEERING DEGREE PROGRAMMES

PART TWO OF TWO
(MODULE AND COURSE STRUCTURE)

2017/18
WELCOME

We would like to extend a very warm welcome to all students for the 2017/18 academic year and in particular, to those joining the College for the first time.

The University offers an enviable range of facilities and resources to enable you to pursue your chosen course of study whilst enjoying university life. In particular, the College of Engineering offers you an environment where you can develop and extend your knowledge, skills and abilities. The College has excellent facilities, offering extensive laboratory, workshop and IT equipment and support. The staff in the College, many of whom are world experts in their areas of interest, are involved in many exciting projects, often in collaboration with industry. The College has excellent links with industry, with many companies kindly contributing to the College’s activities through guest lectures and student projects. We have close links with professional engineering bodies and this ensures that our courses are in tune with current thinking and meet the requirements of graduate employers. All the staff are keen to provide a supportive environment for our students and we hope that you will take full advantage of your opportunities and time at Swansea.

We hope that you will enjoy the next academic session and wish you every success.

Professor Stephen GR Brown
Head of the College of Engineering

Professor Cris Arnold
Deputy Head of College and
Director of Learning and Teaching

Professor Johann Sienz
Deputy Head of College and
Director of Innovation and Engagement

Professor Dave Worsley
Deputy Head of College and
Director of Research

CHEMICAL ENGINEERING PORTFOLIO DIRECTOR:
Dr Paul Melvyn Williams (paul.melvyn.williams@swansea.ac.uk)
Room C205, Engineering Central

YEAR 1 CO-ORDINATOR:
Dr Daniel Curtis (d.j.curtis@swansea.ac.uk)
Room C203, Engineering Central

ADMINISTRATIVE SUPPORT:
Should you require administrative support please visit the Engineering Reception, open Monday – Friday 8:30am – 5:00pm and speak with a member of the Student Information Team who will be happy to help.
IMPORTANT INFORMATION :

IMPORTANT – EG-101
Please be aware that at Year 1 there is one module where a student is unable to redeem their failure by a standard resit examination/coursework – EG-101.
Failure of this module will mean that the student must repeat the module(s) or repeat the year (subject to progression regulations). Failure to attend classes and activities related to this module will mean that you fail the module; hence you repeat the module/year (subject to progression regulations).

IMPORTANT – EG-100; EG-160; EG-189 & EG-190
These modules are assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework. The re-sit (supplementary) is 100% exam based.
## Year 1 (FHEQ Level 4) 2017/18
### Chemical Engineering
- BEng Chemical Engineering[H831,H835]
- BEng Chemical Engineering with a year in Industry[H832]
- MEng Chemical Engineering[H801]

Coordinator: Dr DJ Curtis

<table>
<thead>
<tr>
<th>Semester 1 Modules</th>
<th>Semester 2 Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EG-100</strong></td>
<td><strong>EG-101</strong></td>
</tr>
<tr>
<td>Chemical Process Principles</td>
<td>Chemical and Environmental Engineering Laboratory</td>
</tr>
<tr>
<td>10 Credits</td>
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<tr>
<td>Dr DJ Curtis</td>
<td>Dr DJ Curtis/Dr N Battikh/Dr S Sarp</td>
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<tr>
<td><strong>CORE</strong></td>
<td><strong>CORE</strong></td>
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<tr>
<td><strong>EG-103</strong></td>
<td><strong>EG-160</strong></td>
</tr>
<tr>
<td>Heat Transfer</td>
<td>Fluid Mechanics 1</td>
</tr>
<tr>
<td>10 Credits</td>
<td>10 Credits</td>
</tr>
<tr>
<td>Dr A Orbaek White</td>
<td>Prof MF Webster/Dr L Zhang</td>
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<td><strong>CORE</strong></td>
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<td><strong>EG-111</strong></td>
<td><strong>EG-190</strong></td>
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<tr>
<td>Chemical Engineering Skills</td>
<td>Engineering Analysis 2</td>
</tr>
<tr>
<td>10 Credits</td>
<td>10 Credits</td>
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<tr>
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<td>Prof P Rees/Mr A Egwebe/Dr PD Ledger</td>
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<tr>
<td><strong>EG-169</strong></td>
<td><strong>EGA102</strong></td>
</tr>
<tr>
<td>Environmental Awareness for Engineers</td>
<td>Process Analysis and Design</td>
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<td>10 Credits</td>
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<td>Dr MS Barrow/Dr RC Butterfield</td>
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<td><strong>EGA109</strong></td>
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<tr>
<td>Engineering Analysis 1</td>
<td>Introductory Organic Chemistry</td>
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<td>Prof HN Mcmurray</td>
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<td><strong>EGA114</strong></td>
<td><strong>EGA110</strong></td>
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<tr>
<td>Chemical Engineering Science</td>
<td>Instrumental and Analytical Chemistry</td>
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<td>10 Credits</td>
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<tr>
<td>Dr MJ Carnie</td>
<td>Prof S Margadonna/Dr CME Charbonneau</td>
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Total 120 Credits
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| **EG-103**       | **EG-160**       |
| Heat Transfer    | Fluid Mechanics 1 |
| 10 Credits       | 10 Credits       |
| Dr A Orbaek White | Prof MF Webster/Dr L Zhang |
| **CORE**         | **CORE**         |

|                  |                  |
| **EG-111**       | **EG-190**       |
| Chemical Engineering Skills | Engineering Analysis 2 |
| 10 Credits       | 10 Credits       |
| Dr RC Butterfield/Dr N Battikh | Prof P Rees/Mr A Egwebe/Dr PD Ledger |
| **CORE**         | **CORE**         |

|                  |                  |
| **EG-169**       | **EGA102**       |
| Environmental Awareness for Engineers | Process Analysis and Design |
| 10 Credits       | 10 Credits       |
| Dr B Sandnes     | Dr MS Barrow/Dr RC Butterfield |
| **CORE**         | **CORE**         |

|                  |                  |
| **EG-189**       | **EGA109**       |
| Engineering Analysis 1 | Introductory Organic Chemistry |
| 10 Credits       | 10 Credits       |
| Dr PD Ledger/Dr DR Daniels/Dr I Sazonov | Prof HN Mcmurray |
| **CORE**         | **CORE**         |

|                  |                  |
| **EGA114**       | **EGA110**       |
| Chemical Engineering Science | Instrumental and Analytical Chemistry |
| 10 Credits       | 10 Credits       |
| Dr MJ Carnie     | Prof S Margadonna/Dr CME Charbonneau |
| **CORE**         | **CORE**         |

|                  |                  |
| **Total 120 Credits** |                  |

Coordinator: Dr DJ Curtis
EG-100 Chemical Process Principles

Credits: 10 Session: 2017/18 Semester 1 (Sep-Jan Taught)

Module Aims: The module provides basic intellectual tools for analysis and design of chemical (and biochemical) processes. The module will cover flows of material and energy to and from a variety of processes and production of complete mass and energy budgets and estimates of process efficiency. Some hazards related to release and exposure to flammable materials in relation to their properties (especially vapour pressure) will be covered. Only a basic level of chemical knowledge is required and the module is suitable for Process and Environmental Engineering students.

Pre-requisite Modules:
Co-requisite Modules:
Incompatible Modules:

Format: Lectures: 20 hours
Example classes
and tutorials: 10 hours
Private study: 70 hours

Lecturer(s): Dr DJ Curtis

Assessment: Examination 1 (80%)
Assignment 1 (5%)
Assignment 2 (5%)
Assignment 3 (5%)
Assignment 4 (5%)

Assessment Description: The written examination is of the closed book type.

Four group assignments will be undertaken in which students will work on problems associated with the material covered in the lectures. Marks will be awarded for both the accuracy of the submitted work and students individual engagement with their group (assessed through peer review).

Moderation approach to main assessment: Universal second marking as check or audit

Failure Redemption: An opportunity for students to redeem failures will be available within the rules of the University

Assessment Feedback: Students will work in groups to complete the four coursework elements of the course. Attempts at assessed coursework will be returned within 3 weeks of submission with a mark and identification of where mistakes were made. Model answers will be available for students to examine and compare with their own attempts. A review of student performance in the examination will be available via the University feedback system.

Module Content: Principles and characteristics of non-reactive batch and continuous processes and their representation using block diagrams and flowsheets.

Material balances on chemically non-reactive and reactive systems (involving the use of conservation of atoms or chemical reaction stoichiometry).

Simple energy balances on chemically non-reactive systems, involving thermal properties that may be a function of temperature.

Application of energy balances to physical and chemical processes, forms of energy, states of matter.

Acquisition and use of enthalpy data associated with heating/cooling, phase changes and chemical reaction, application of Hess's law and Van't Hoff's method.

Vapour pressure of pure compounds, mixtures and solutions. Vapour liquid equilibria (VLE) of solutions.

Application of Dalton's & Raoult's laws for estimation of bubble and dew points temperatures and equilibrium compositions.

Distillation of mixtures and solutions. Analysis using temperature composition and VLE diagrams, and the concept of the ideal stage of separation.

Hazards of flammable materials in relation to their volatility.
**Intended Learning Outcomes:** Upon completion of this module students should be able to:

- identify and articulate the key features of continuous, batch and semi-batch processes.
- apply the principles of conservation of mass and energy in the analysis of non-reactive and reactive processes.
- use and interpret physical and thermodynamic property data presented in a variety of forms.
- draw and interpret block flow diagrams.
- use the principles of vapour-liquid-equilibrium to perform basic chemical engineering calculations.
- use trial and error approaches to calculations.


**Additional Notes:** Lecture notes, examples, tutorial assignments (coursework) and other resources are available to students on Blackboard (including the basic chemical knowledge required to complete the module).

This module is available to visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

The module is a CORE module for the Chemical & Environmental Engineering Degree Schemes.

'This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you must pass the examination component (with at least 40%). If you fail to achieve a mark of at least 40% in the exam the module mark will only reflect the exam mark and you will have to resit the exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important that you fully engage with the course and complete all group coursework.

Resits are examined by supplementary exam only and the module mark is based solely on the resit exam (100%) except where it is considered a "first attempt".
### EG-101 Chemical and Environmental Engineering Laboratory

**Credits:** 10  
**Session:** 2017/18 Semester 2 (Jan - Jun Taught)

**Module Aims:** The Chemical and Environmental Engineering Laboratory module is designed to give relevant experimental experience to benefit both chemical and environmental engineers. This module aims to develop skills in acquisition, processing, error analysis, and interpretation of experimental data; to develop skills in presentation and communication of experimental and technical information; and to provide practical exposure to topics presented in lecture based modules.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**  
Lectures 6 hours  
Laboratory work 15 hours  
(including 1 hour safety induction and 1 hours report writing workshop)  
Directed private study 70 hours

**Lecturer(s):** Dr DJ Curtis, Dr N Battikh, Dr S Sarp

**Assessment:** Assignment 1 (100%)

**Assessment Description:** Assessment: Lab notebooks (assessed every teaching and learning week of the semester); technical reports (assessed before Easter Break and in May)

**Moderation approach to main assessment:** Second marking as sampling or moderation

**Failure Redemption:** Due to the nature of the module (lab work), IT IS NOT POSSIBLE to REDEEM a failure in this module

**Assessment Feedback:** Students receive continuous feedback during the lab sessions while they carrying out their experiments, and written feedback in their lab notebooks every week.  
They also receive written feedback of their first technical report, so they can improve for the second report.

**Module Content:** Basic concepts, terms and measures of error; combination (propagation) of errors, influence of dominant source of error.  
Graphs - Error bars, fitting data using least squares principle. Logarithmic plots. Interpretation of graphs and common pitfalls. [3]  
Handling units in Numerical Calculations - why numbers and units need to be processed together, presentation of example calculations. [1]  
Conducting and Recording of Experiments - Experimental planning and conduct. Presentation of data, Laboratory notebooks, Readability of text. [2]  
Practical work: Experiments - selected from: applied physical chemistry, combustion energy, heat transfer, fluid and particle mechanics, fluid mixing, liquid/solid separation, liquid/vapour separation.

**Intended Learning Outcomes:** After completing this module you should be able to:  
(i) demonstrate how to interpret engineering/experimental data;  
(ii) understand principles and characteristics of operation of a variety of instruments and sensors;  
(iii) identify and distinguish systematic and random sources of error, and estimate the combined random errors;  
(iv) establish the units of the result of a calculation;  
(v) effectively and efficiently collect experimental data, maintain complete records of laboratory work in lab notebook;  
(vi) prepare technical reports to prescribed formats, present sample calculations, tables and graphs; manage, manipulate and present data using IT facilities.

**Reading List:** Pentz, Mike, Handling experimental data / Mike Pentz and Milo Shott; edited by Francis Aprahamian, Open University Press, 1988.ISBN: 0335158978  

**Additional Notes:** Not available to visiting and exchange students.  
Penalty for late submission of work: ZERO TOLERANCE.  
Due to the nature of the module (lab work), IT IS NOT POSSIBLE to REDEEM a failure in this module
EG-103 Heat Transfer

Credits: 10 Session: 2017/18 Semester 1 (Sep-Jan Taught)

Module Aims: The module is designed to provide a basic understanding of heat transfer in Chemical Engineering. Subjects will include: conduction, convection (forced and natural) and radiation. Students will be given a basis for the more advanced study of the subject in other modules. Students will be introduced to process equipment used in industry that deal with heat transfer.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format:
- Lectures 20 hours
- Example classes 5 hours
- Directed private study 75 hours

Lecturer(s): Dr A Orbaek White

Assessment:
- Examination 1 (90%)
- Coursework 1 (10%)

Assessment Description: Exam 90%

Four tutorials 10%

Moderation approach to main assessment: Universal second marking as check or audit

Failure Redemption: Supplementary exam.

Assessment Feedback:
- Students complete two tutorials, which are marked and returned to the students in a timely fashion. Review classes cover materials relevant to each assignment and model answers are issued.
- A closed Facebook group will be used to disseminate information, to interact with, and engage with students. This can be a mechanism for them to submit questions and receive feedback.

Module Content:
- Conduction: Fourier's law, one-dimensional conduction, composite materials, thick cylinders, insulation
- Convection: Free and forced convection, introduction to dimensional analysis, non-circular conduits; internal flow and external flow over banks of tubes: heat transfer (average coefficients) and pressure drop
- Radiation: Mechanism, Stefan-Boltzmann law, emissivity, radiation into a large enclosure, heat transfer coefficient.
- Energy and heat. Units of measure, conversion between units
- Problems involving multiple heat transfer mechanisms
- Heat Exchangers: Counter and co-current flow, log mean temperature difference, types of heat exchanger and applications, double-pipe exchangers. Shell and tube exchanger: construction, temperature correction factor (1-2 exchangers)
- Insulation: economic and critical thickness for heat loss
- Liquids and vapours: Enthalpy, the steam table, boiling and condensation of liquids
- Review: a review class will be given to foment understanding which will be assessed by practice assignments

Intended Learning Outcomes: Intended Learning Outcomes: On completion of this module students should:
- be able to understand the physical phenomena present in heat transfer processes
- be able to calculate or estimate heat transfer coefficients
- be familiar with the procedures and the design of heat transfer equipment


Additional Notes: Available to visiting and exchange students.
Penalty for late submission of work: ZERO TOLERANCE.
EG-111 Chemical Engineering Skills

Credits: 10 Session: 2017/18 Semester 1 (Sep-Jan Taught)

Module Aims: In this module you will be introduced to computer aided drawing packages in which you will produce drawings of engineering items to British Standards. You will also develop necessary ICT skills in Word and Excel to enable you to convey information in the form of technical reports, with an emphasis on the presentation and layout of these reports to convey the required information. You will also develop skills in engineering problem solving using Excel applied to a range of practical engineering problems. There is an emphasis on ethical design by engineers throughout. You will also develop skills to improved your employability by working towards the first part of the Swansea Employability Award, and have an understanding of academic integrity and its importance as a professional engineer.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Lectures & seminars: 10 hours; Practical work in computer laboratory: 20 hrs; Directed private study: 70 hrs.

Lecturer(s): Dr RC Butterfield, Dr N Battikh

Assessment: Assignment 1 (25%) Assignment 2 (15%) Assignment 3 (10%) Report (50%)

Assessment Description: Assignment 1: CAD Drawing Assignment & Academic Integrity Quiz Assignment 2: Engineering Ethics Assignment Assignment 3: Excel & VBA Assignment Technical Report: Produce a report on a relevant engineering topic which utilises and showcases the skills developed within the module.

Moderation approach to main assessment: Second marking as sampling or moderation

Failure Redemption: Failure redemption in the form of a report worth 100%

Assessment Feedback: Students will be given continuous feedback, guidance, instruction and support during practical sessions.

Module Content: Computer Aided Drawing Skills: Have an appreciation of available CAD software packages. Be able to interpret engineering drawings. Be able to use appropriate software to communicate representations of engineering processes and process items.

Effective use of Word for report writing: This includes report structure, layout and formatting of Figures & Tables, and effective referencing & citation of published work. Have an understanding of how to develop report templates using Word.

Effective use of Excel: How to present data, perform iterative calculations with goal seek and solver, generate simple computer programs using Excel VBA programming.

Roles and responsibilities of professional engineers. Have an appreciation of engineering ethics and the role this has for the professional engineer.

Intended Learning Outcomes: 1. Model, select and apply appropriate engineering judgement and numerical techniques to solve engineering problems

2. Communicate engineering data and detailing using visual means, and apply IT skills for systematic problem-solving.

3. Evaluate the ethical implications of engineering design and practice.

4. To be aware of and working towards completing the first part of the Swansea Employability Award
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<tr>
<td></td>
<td>BS 8888: 2013 - Technical product documentation and specification, British Standards Online.</td>
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<td></td>
<td>BS EN ISO 10628 - 2: 2012 - Diagrams for chemical and petrochemical industry - Part 2: Graphical symbols, British Standards Online.</td>
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<td>BS 1646 parts 1 to 4 - Symbolic representation for process measurement control functions and instrumentation, British Standards Online.</td>
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<tr>
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<td>BS ISO 14617 Parts 1 to 12 - Graphical symbols for diagrams, British Standards Online.</td>
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<tr>
<td>Additional Notes:</td>
<td>The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.</td>
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<td>The PC classes are there to support the learning outcomes associated with the module. Attendance to these PC classes will be monitored.</td>
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EG-160 Fluid Mechanics 1

Credits: 10 Session: 2017/18 Semester 2 (Jan - Jun Taught)

Module Aims: The module provides an introduction to the methods that can be employed by engineers for the analysis of basic problems involving stationary and flowing fluids.

Pre-requisite Modules:

Co-requisite Modules: EG-189

Incompatible Modules:

Format: Lectures and examples 33h
Directed private study 44hr
Preparation for assessment 23hr

Lecturer(s): Prof MF Webster, Dr L Zhang

Assessment:
Assignment 1 (20%)
Examination (80%)

Assessment Description:
Assignment: This will test understanding of all subject areas covered up to the assignment, involving topics of basic fluid properties, including viscosity, hydrostatic pressure and hydrostatic forces on submerged surfaces. This will take the form of an individual randomly generated Blackboard test.

Examination. This CLOSED BOOK examination will test understanding of all the material presented in the course. Adhering to the University Examination Guidelines, an appropriate calculator may be used. It is a requirement to pass the examination component to pass this module.

This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

Moderation approach to main assessment: Universal second marking as check or audit

Failure Redemption: A supplementary written examination will be set which will form 100% of the mark.

Assessment Feedback:
Electronic feedback for Assignments within 5 days of the deadline for Assignment completion.
Electronic feedback on the class examination performance following the relevant Examination Board meetings in June.

Module Content:
Introduction to Fluid Mechanics. Basic characteristics of fluids. Hydrostatic pressure and its measurement [3h]
Forces exerted by a fluid at rest on both planar and curved submerged surfaces [9h]
Conservation of mass, energy and momentum in a moving fluid and applications [9h]
Laminar and turbulent flow in pipes. Moody chart and the Colebrook correlation. Pipeline systems [9h]
Revision [3h]

Intended Learning Outcomes: By the end of the module, the student should be able to:

• determine how to calculate hydrostatic forces on both planar and curved surfaces (assessed by assignment and written examination)

• identify the nature of viscosity and its role in the creation of shear forces (assessed by assignment and examination)

• identify the application of and distinguish between the fundamental conservation principles of mass, energy and momentum to fluid mechanics (assessed by assignment and written examination)

• distinguish between different classes of pipe flow and produce solutions to problems involving simple pipe systems with major and minor losses due to friction (assessed by written examination)
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<td>Failure to sit the examination, or to submit assigned work by the specified deadline, will normally result in a mark of 0% being recorded.</td>
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<td>This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.</td>
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<td>The student cohort will be split into three groups.</td>
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<td>The groups will be clearly defined on the timetable.</td>
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<td>The syllabus, Blackboard site, examination and assignments for both these groups will be identical.</td>
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**EG-169 Environmental Awareness for Engineers**

**Credits:** 10 Session: 2017/18 Semester 1 (Sep-Jan Taught)

**Module Aims:** The module focuses on the environmental impacts of human activity, industry, and energy consumption. With the global population soaring past 7 billion in an increasingly industrialized world, human activity is now affecting energy and material balances on a global scale. The next generation of engineers must appreciate the environmental impacts of current technology in order to engineer better solutions for the future.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:** EG-108

**Format:**
- Lectures: 20 hours (10 weeks of teaching and learning)
- Directed private study: 80 hours

**Lecturer(s):** Dr B Sandnes

**Assessment:**
- Examination 1 (80%)
- Assignment 1 (10%)
- Assignment 2 (10%)

**Assessment Description:**
- Examination: 80 % of total mark. Multiple choice questions. 2 hours, closed book.
- Assignment 1: 10 % of total mark. Online Blackboard test. 1 hour, open book, individual assessment.
- Assignment 2: 10 % of total mark. Online Blackboard test. 1 hour, open book, individual assessment.

**Moderation approach to main assessment:** Universal second marking as check or audit

**Failure Redemption:** A supplementary examination will form 100% of the module mark.

**Assessment Feedback:** Automatic feedback on online tests. Discussion of difficult concepts in lectures.

**Module Content:**
- The biophysical environment.
- The Big Picture: A brief history of Earth. Earth as a system.
- Energy: Consumption and resources.
- Fossil fuels, unconventional hydrocarbon resources.
- Renewable energy technologies.
- Sustainable development, Life Cycle Analysis, Environmental Impact Assessment.
- Pollution: Land, water, air.
- Climate Change.
- Case studies: Deepwater Horizon disaster, Fracking

**Intended Learning Outcomes:** After completing the module students should be able to:

- Identify the major environmental issues facing society, and the role of engineers in protecting the environment.
- Describe the role of fossil and renewable energy resources in society, and determine both power output capacity and potential environmental impact of different energy technologies.
- Determine pollution concentration and transport using mass balance principles.
- Identify the drivers for climate change, feedback mechanisms in the climate system, and potential future impacts of global warming.
- Demonstrate knowledge of key sustainability concepts such as Sustainable Development, Life Cycle Assessment and Environmental Impact Analysis.

(All learning outcomes will be assessed by assignments and final closed book examination)


**Additional Notes:** Available to visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
**EG-189 Engineering Analysis 1**

**Credits:** 10 Session: 2017/18 Semester 1 (Sep-Jan Taught)

**Module Aims:** This module (in combination with engineering analysis 2) provides the essential grounding in mathematical analysis techniques for engineering students. This module ensures that all students have a suitable level of analytical skills for subsequent engineering modules.

**Pre-requisite Modules:** 

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**  
- Lectures 30 hours  
- Directed private study 70 hours

**Lecturer(s):** Dr PD Ledger, Dr DR Daniels, Dr I Sazonov

**Assessment:**  
- Examination 1 (65%)  
- Coursework 1 (5%)  
- Coursework 2 (10%)  
- Coursework 3 (10%)  
- Coursework 4 (10%)

**Assessment Description:** Examination:  
A closed book 2 hour examination will take place in January (worth 65% of the final mark).

Coursework:  
4 electronic online tests with randomised coefficients will be set during the semester. There will be an opportunity to practice similar exercises before attempting each test. These tests make up the coursework element of the course (worth 35% of the final mark). Each test is an individual piece of coursework.

Specific rules for passing this module:  
This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

**Moderation approach to main assessment:** Universal second marking as check or audit

**Failure Redemption:** A supplementary examination will form 100% of the module mark.

**Assessment Feedback:** A feedback form for the examination will be available electronically.

Feedback will be provided electronically for each of the assessed tests.

**Module Content:** Module content:  
- Number systems: numbers, algebra and geometry.  
- Functions: inverse and composite functions, polynomial functions, rational functions, circular functions, exponential, logarithmic and hyperbolic functions, continuous and discontinuous functions.  
- Introduction to complex numbers: The number j, real and imaginary components, Cartesian form, complex conjugate and polar form.  
- Differentiation: basic ideas and definition, elementary functions, rules of differentiation, parametric and implicit differentiation, higher derivatives, optimum values.  
- Integration: basic ideas and definition, definite and indefinite integrals, techniques of integration, integrals of partial fractions, integration by parts, integration by substitution.  

**Intended Learning Outcomes:** On successful completion of this unit students will be expected, at threshold level, to be able to:  

Demonstrate knowledge of the fundamentals of mathematics, which underpin their engineering degree. (Evaluated in the MyMathLab continuous assessments and the examination).

Demonstrate a comprehension of the fundamentals of mathematics, which underpin their engineering degree, through the use of the following specific techniques: manipulate algebraic expressions, differentiation (including optimisation of functionals), integration, matrices and Gauss elimination (Evaluated in the examination).
**Reading List:** James, Glyn, Modern engineering mathematics, 2015.ISBN: 1292080736

**Additional Notes:** AVAILABLE TO visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.
**EG-190 Engineering Analysis 2**

**Credits:** 10 Session: 2017/18 Semester 2 (Jan - Jun Taught)

**Module Aims:** Module Aims: this module (in combination with Engineering Analysis 1) provides further grounding in mathematical analysis techniques for Engineering students. The module extends the understanding into more complex analytical methods, focusing on complex numbers, multi-variable functions, series and sequences and differential equations.

**Pre-requisite Modules:**
- EG-189

**Co-requisite Modules:**
- EG-189

**Incompatible Modules:**

**Format:**
- Lectures 20 hours
- Tutoring classes 10 hours
- Directed private study 70 hours

**Lecturer(s):** Prof P Rees, Mr A Egwebe, Dr PD Ledger

**Assessment:**
- Examination 1 (65%)
- Coursework 1 (5%)
- Coursework 2 (10%)
- Coursework 3 (10%)
- Coursework 4 (10%)

**Assessment Description:**
**Examination:** A closed book 2 hour examination will take place in May/June (worth 65% of the final mark).

**Coursework:**
4 electronic online tests with randomised coefficients will be set during the semester. There will be an opportunity to practice similar exercises before attempting each test using homework exercises. These tests make up the coursework element of the course (worth 35% of the final mark). Each test is an individual piece of coursework.

**Specific rules for passing this module:**
This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

**Moderation approach to main assessment:** Universal second marking as check or audit

**Failure Redemption:** A supplementary examination will form 100% of the module mark.

**Assessment Feedback:** A feedback form for the examination will be available electronically.

**Module Content:**
- Vectors: Physical meaning, components in Cartesian, cylindrical and spherical coordinates, magnitude, scalar product, cross product, equations of lines and planes.
- Further complex numbers: manipulation of complex numbers, Cartesian, polar and exponential forms, Euler's formula, relationship between trigonometric and hyperbolic functions, De Moivre's theorem.
- Ordinary differential equations: classification of differential equations, solutions to first order ODE's including separable, linear and more specialised types. Solution to second order ODE's with constant coefficients.
- Functions of more than one variable: visualisation, partial differentiation, integrate lines, surfaces and volumes. Sequences and Series: review of arithmetic and geometric sequences and series, limit of a sequence, infinite series and tests of convergence, binomial series, power series of common functions.

**Intended Learning Outcomes:** On successful completion of this unit students will be expected, at threshold level, to be able to:

Demonstrate knowledge of the mathematics, which underpin their engineering degree. (Evaluated in the MyMathLab continuous assessments and the examination).

Demonstrate a comprehension of the mathematics, which underpin their engineering degree, through the use of the following specific techniques: work with complex numbers, manipulate vectors (in Cartesian, cylindrical and spherical coordinates), perform partial differentiation, integrate lines, surfaces and volumes, solve first and second order differential equations and expand real functions into series (Evaluated in the examination).
**Reading List:**

**Additional Notes:** AVAILABLE TO visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.
### EGA102 Process Analysis and Design

**Credits:** 10  
**Session:** 2017/18 Semester 2 (Jan - Jun Taught)

**Module Aims:** This module requires students to tackle a variety of problems often working as part of a team. The module is constructively aligned with fundamental content delivered in EG100 (Chemical Process Principles) and EGA114 (Chemical Engineering Science). The module also introduces more advanced theory related to material balances involving recycles and basic separation processes. Students are required to interrogate and apply taught concepts, analyse process engineering scenarios and synthesize a viable manufacturing solution. The main component within the module consists of a design project which forms the basis of a group report. The report shall address multiple aspects ranging from process flow diagrams, applied theory (and energy balance calculations using spreadsheets), independent research of material properties and select unit operations.

**Pre-requisite Modules:**  
**Co-requisite Modules:** EG-100

**Incompatible Modules:**

**Format:**  
- Project Support Classes (20 hours)  
- Office surgeries and Directed private study 80 hours

**Lecturer(s):** Dr MS Barrow, Dr RC Butterfield

**Assessment:**  
- Assignment 1 (5%)  
- Group Work - Project (60%)  
- Assignment 2 (15%)  
- Assignment 3 (5%)  
- Group Work - Presentation (15%)  

**Assessment Description:** Assignment 1 is a group assignment, problem solving and flow sheeting components  
Assignment 2 is an individual assignment, calculations on Material Balances using MS Excel  
Assignment 3 is an individual assignment, vapour pressure and/or energy calculations using MS Excel

**Project - Design project, multiple components**  
**Presentation - Group exercise**

**Moderation approach to main assessment:** Second marking as sampling or moderation

**Failure Redemption:** An opportunity for an individual to redeem failure may be possible but is not assured - the major item of assessment is the team project and a supplementary component equivalent to this ~ 3 month, multi-author component is not provided for individuals. Specific details will be issued and explained at the beginning of the module.

**Assessment Feedback:** Feedback, guidance, instruction and support is provided by the lecturer throughout the semester during the support classes.

**Module Content:** Key content includes,

1) Material balances on reactive steady processes with recycles, bypasses and purges.
2) Simple analysis of fractionating columns.
3) The philosophy of process design and an introduction to the components and standards of process flow sheets
4) Use of standard software packages for solving engineering problems and simple technical drawing.

**Intended Learning Outcomes:** There are many experience-based learning outcomes associated with this module including practical experience of;

- Using spreadsheets to solve material balances involving recycles with associated circular references, energy balances and modeling input – output relationships.
- Using Block Flow and Process Flow Diagrams to accurately convey information.
- Exposure to team work scenarios, organisation and time management.
- Exposure to the potential complexities of a design environment and acting on own initiative, critique, evaluation and judgement-based decision making when faced with several viable solutions.
- Conducting independent research on both chemical databases and wider theory to inform the design process.
- Communication of methods and results through report writing and technical presentation to an audience.
|---|---|
| Additional Notes: | Not available to visiting students.  
Attendance is monitored. The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of coursework. Guidance, instruction and supporting materials will be posted on the Blackboard system and reviewed during project classes. Support and Feedback is available from the lecturer during PC classes and Office hours. |
EG109 Introductory Organic Chemistry

Credits: 10  Session: 2017/18  Semester 2 (Jan - Jun Taught)

Module Aims: The module deals with the basic principles of organic chemistry, and the reactions of simple aliphatic and aromatic hydrocarbons. Two aspects which are particularly emphasised are the stereochemistry of organic compounds and the mechanisms of organic reactions. Kinetics of reactions with reference to organic chemistry is also covered.

Pre-requisite Modules:
Co-requisite Modules:
Incompatible Modules:

Format: Lectures 22 hours
        Practical classes / Example classes/ Tutorials 12 hours
        Directed private study 72 hours

Lecturer(s): Prof HN McMurray

Assessment: Examination 1 (65%)
             Laboratory work (25%)
             Coursework 1 (10%)

Assessment Description: Lectures & practical classes. Assessed by a combination of end-of-module examination (65%), problem papers (10%) and continuously assessed practical (25%).

Moderation approach to main assessment: Universal second marking as check or audit

Failure Redemption: Supplementary exam in August worth 65% of the marks; 35% for practical and coursework marks will be added (unchanged) to the supplementary exam mark.

Assessment Feedback: Individual and group feedback on laboratory work provided during laboratory sessions. Individual marked laboratory reports returned to students. Feedback on module coursework given in lectures and by Blackboard. Generic feedback on exams provided via College exam feedback procedures.

Module Content: - Safety - Laboratory safety and safety issues in organic chemistry
- Structure and bonding in organic compounds - representation of organic molecules, abbreviations for alkyl and aryl groups, charges on organic structures, resonance hybrids.
- Hybridisation, sigma and pi bonding - hybridisation and bonding in methane, ethane, ethene, and ethyne, comparison of bond lengths and bond strengths.
- Mechanisms of organic reactions - radical, polar and pericyclic mechanisms, electronic and steric effects, homolytic & heterolytic bond cleavage, polar covalent bonds, electronegativity, stabilities of carbocations.
- Conformations of alkanes and cycloalkanes - conformations of ethane and butane, torsional (eclipsing) strain, bent bonds in cyclopropane and cyclobutane, ring strain in cycloalkanes.
- Conformations of cyclohexane - chair and boat conformations of cyclohexane, equatorial and axial bonds, 1,3-diaxial interactions, mono- and di-substituted cyclohexane derivatives.
- Stereoisomerism - distinction between configuration and conformation, relationship between optical activity & chirality, plane & centre of symmetry as criteria of chirality, enantiomeric excess, nomenclature.
- Fischer projection formulae.
- Radical substitution - halogenation of alkanes - comparison of F2, Cl2, Br2 and I2, reactivity of primary, secondary and tertiary C-H bonds, effect of temperature on reactivity and selectivity.
- Electrophilic addition - addition of HBr and H2O, regioselectivity of addition, Markownikoff's rule, addition to dienes and alkenes. Stereoselective addition of Cl2 and Br2, halohydrin formation, syn and anti addition, hydroboration, epoxidation, hydrogenation, oxidation and ozonolysis.
- Radical addition - radical addition reactions including polymerisation.
- Acidity of alkenes - examples in organic synthesis.
- Conjugated unsaturated systems - Diels Alder reaction, stability of aromatic hydrocarbons, aromaticity, Huckel's rule, resonance energy, nonbenzenoid aromatic compounds.
- Electrophilic substitution - halogenation, nitration and sulfonation, Friedel Crafts alkylation and acylation.
- Effect of substituent groups on electrophilic substitution
- Applications of organic chemistry
  Kinetics, SN1 and SN2 reactions.
**Intended Learning Outcomes:** After completing this module you should be able to:
- demonstrate the basic principles of organic chemistry (structure, bonding and reactivity) and be familiar with the reactions of simple aliphatic and aromatic hydrocarbons;
- appreciate the importance of stereochemistry (configuration and conformation) in understanding the structure and reactivity of organic compounds, and be able to rationalise the outcome of organic reactions in terms of curly arrow mechanisms;
- perform basic organic and analytical chemistry practicals
- understand chemistry from a fundamental perspective; apply knowledge to practical situations.


**Additional Notes:** Available to visiting and exchange students.
Penalty for late submission of work: ZERO TOLERANCE.
**Module Aims:** This module deals with the principles and practice of analytical chemistry and gives an introduction to a number of important instrumental techniques in analytical chemistry for both qualitative and quantitative analysis including: gravimetric, titrimetric separation and spectroscopic techniques.

**Pre-requisite Modules:**
**Co-requisite Modules:**
**Incompatible Modules:**

**Format:** 2 lectures per week for 10 weeks  
4 hours practicals per week for 2 weeks

**Lecturer(s):** Prof S Margadonna, Dr CME Charbonneau

**Assessment:**  
- Examination 1 (70%)  
- Laboratory work (15%)  
- Laboratory work (15%)

**Assessment Description:** Examination: 2 hour exam, typically requiring answers to three out of four equal weight questions.

Laboratory work: Two 4hrs laboratory sessions involving 1) the analysis of a solution of zinc, requiring analytical results and a written report; 2) the analysis of Fe and organic compounds contained in spinach using UV-Vis and chromatography techniques, and practical results and understanding to be assessed in the form a lab report.

**Moderation approach to main assessment:** Universal second marking as check or audit

**Failure Redemption:** The practical component of this module is NOT REDEEMABLE. However the exam component IS REDEEMABLE via a supplementary examination.

The resit mark will be therefore be made up as follows:  
30% practical mark (previously obtained)  
70% Resit exam

**Assessment Feedback:** Individual and group feedback on laboratory work provided during laboratory sessions.  
Individual marked laboratory reports returned to students.  
Generic feedback on exams provided via College exam feedback procedures.

**Module Content:** Introduction to chemical analysis and analytical methods. General approach; sources and types of errors in analytical chemistry; reporting results, error estimates and significant figures.  
Gravimetric analysis: principles, methods and applications.  
Titrimetric analysis: principles, methods, and applications.  
UV-Vis spectroscopy: principles and applications.  
Chromatography: basic principles and applications.  
Fluorescence spectroscopy: principles and applications.  
Atomic absorption and emission spectroscopy: principles and applications.  
Infrared spectroscopy: principles and applications.  
Analytical and chromatographic separations: principles, methods and applications.

**Intended Learning Outcomes:** On successful completion of this module students should have knowledge of a range of analytical techniques from classical gravimetric and volumetric analysis through to modern spectroscopic and separation methods. Students should also understand the principles of analytical chemistry including the estimation and propagation of errors. Students should have acquired practical experience of analytical chemistry.


**Additional Notes:** Not available to visiting and exchange students.

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## EGA114 Chemical Engineering Science

**Credits:** 10  
**Session:** 2017/18  
**Semester 1 (Sep-Jan Taught)**

### Module Aims:
This module will introduce fundamental principles of thermodynamics, physical chemistry and mass transfer relevant to the course including: gas behaviour; properties of pure substances and mixtures; laws of thermodynamics and their applications to energy and state calculations; phase equilibria; diffusive and convective mass transfer; mass transfer coefficients and double film theory.

### Pre-requisite Modules:

### Co-requisite Modules:

### Incompatible Modules:

### Format:
- Lectures and example classes 30 hours
- Private study 70 hours

### Lecturer(s):
Dr MJ Carnie

### Assessment:
- Examination 1 (80%)
- Coursework 1 (10%)
- Coursework 2 (10%)

### Assessment Description:
The following assessments are all course requirements.
(i) Course work 1 comprises of an assessed class test on any aspect of the module covered to that point.
(ii) There will be 2 further compulsory class tests to enable students to monitor their progress.

### Moderation approach to main assessment:
Universal second marking as check or audit

### Failure Redemption:
A supplementary examination will form 100% of the module mark.

### Assessment Feedback:
**Assessment feedback:**
The Coursework 1 class test will be marked by the lecturer and returned to students. General feedback will be given to the class.
The other class tests will be peer reviewed in class and general feedback given by the lecturer.
Model answers will be available for students to examine and compare with their own attempts.
General feedback on student performance in the exam is given via the University feedback system.

### Module Content:
**Units and dimensions:**
- Convert between different unit systems i.e. SI, imperial, US units;
- Dimensional Analysis (check validity of equations for dimensional consistency, derivation of expressions from first principles);
- Thermodynamics:
  - Ideal Gas behaviour; Revision of Boyle's law, Charles' law, Avogadro's law, Dalton's law, Amagat's Law, Ideal Gas Law;
  - Properties of pure substances and solutions; Equations of state: van der Waals, Redlich-Kwong; Energy and the first law of thermodynamics; Heat engines and the Carnot cycle;
- Thermochemistry:
  - Standard states, Hess' law of summation, heat's of formation, combustion and solution, relate H and U for chemical change, H and as a function of temperature, van't Hoff Box);
- Mass transfer:
  - Molecular diffusion in fluids (diffusion coefficients, Fick's law);
  - Eddy or turbulent diffusion; Mass-transfer coefficients; Interphase mass transfer.
**Intended Learning Outcomes:** After completing this module students should be able to:

Demonstrate knowledge and understanding of:

- The Ideal Gas Law and Cubic Equations of State
- The First Law of thermodynamics;
- The concepts of state and non-state functions; enthalpy, internal energy, work and heat;
- Heat effects;
- The physical mechanisms of mass transfer;
- Two-film theory and essential features of other theories for mass transfer between phases.

Demonstrate an ability to:

- Use conversion factors and convert between different units and unit systems, imperial, SI and USA units;
- Conduct dimensional analysis of equations;
- State and apply equations for ideal gases undergoing isochoric, isobaric, isothermal and adiabatic processes;
- Understand, describe and perform calculations around simple heat cycles, e.g. Carnot cycle;
- Calculate heats of formation, reaction and combustion.
- Define key terms and describe the process of combustion;
- Perform heat and mass balances for combustion processes.
- Apply Fick's law to calculate mass fluxes;
- Estimate diffusion coefficients in fluids and calculate mass transfer coefficients;

**Reading List:**


**Additional Notes:** Available to visiting and exchange students.

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DISCLAIMER

The College has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The College reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules.

You are advised to contact the College directly if you require further information.

The 2017/18 academic year begins on 25 September 2017

DATES OF 2017/18 TERMS

25 September 2017 – 15 December 2017
08 January 2018 – 23 March 2018
16 April 2018 – 15 June 2018

SEMESTER 1

25 September 2017 – 26 January 2018

SEMESTER 2

29 January 2018 – 15 June 2018