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
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

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

YEAR 4 CO-ORDINATOR:
Dr Matt Barrow (m.s.barrow@swansea.ac.uk)
Room C206, 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 – EGCM89 and EGC401
Please be aware that at Year 4 there are two modules where a student is unable to redeem their failure by a standard resit examination/coursework – EGCM89 and EGC401. Failure of these modules will mean that the student may not attain a MEng degree (subject to final year regulations). Failure to attend classes and activities related to these modules will mean that you fail the module; hence you may fail to get a MEng degree (subject to final year regulations).
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<td>Mr CD Jones/Dr YK Ju-Nam/Dr PM Williams</td>
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<td><strong>Total 120 Credits</strong></td>
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**Module Aims:** This module provides an introduction to some important techniques of optimisation that may be used across a broad range of engineering disciplines. The focus is on understanding the methods through hand calculation rather than the use of particular software packages. Numerical examples are employed to illustrate concepts and potential applications.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**
- Timetabled lectures and example classes 30 hours;
- Directed private study 70 hours

**Lecturer(s):** Dr C Giannetti

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

**Assessment Description:** Exam - written exam 80%
- Coursework - 20%

**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:**
- Examination - Standard College of Engineering exam feedback form.

**Module Content:** Indicative syllabus content:
1. Statement of optimisation and reliability problems.
2. Lagrange multipliers
3. One-Dimensional Minimisation Methods. Direct and indirect methods: unrestricted search; dichotomous search; golden section method; quadratic interpolation; Newton's procedures.
4. Extrema of functions of several variables.
5. Multidimensional Minimisation Problems - direct methods such as: Taxi-cab; conjugate search procedure
6. Multidimensional Minimisation Problems - indirect methods such as: Steepest descent method; Newton's method.
7. Linear Programming - the Simplex Method

**Intended Learning Outcomes:** The student should:
- Understand and be able to set up and carry out the necessary calculations for univariate unimodal optimisation problems
- Be able to use search techniques to determine the optima of unconstrained multivariable systems
- Understand and be able to set up and carry out the necessary calculations for Linear Programming problems

**Reading List:**

**Additional Notes:** This module assumes good mathematical skills and students will be expected to demonstrate a good understanding of partial differentiation, Taylor series expansion and matrices.

Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded. The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

Additional notes: Office hours, lecture notes and other teaching materials will be posted on Blackboard.
EG-M11 Biochemical Engineering II

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

**Module Aims:** This module builds up from EG-203 (Biochemical Engineering I) and describes more advanced topics in the production and optimisation of biological materials and processes. Optimisation methods of bioprocesses are described, and how these are exploited in the commercial situation. Topics such as mixed cultures, genetically modified micro-organisms, biofouling and biocorrosion, specialised biological separation processes (e.g. chromatography, gel electrophoresis), biosafety, and Hazard Analysis and Critical Control Points (HACCP) are discussed in detail. The principal products of such processes are investigated to illustrate the current and future technology of these systems with an emphasis on modern biotechnology methods. The impact of the use of such techniques on quality management, safety assessment and regulatory environment are reviewed.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**
- Lectures 20 hours
- Example classes 5 hours
- Private study 70 hours

**Lecturer(s):** Dr JJ Ojeda Ledo

**Assessment:**
- Examination 1 (100%)  
- Assessment Description: Written examination 100%, closed book  
- 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:** Questions from students will be answered during class, and office hours allocated weekly for this module.

**Module Content:**
- Biocatalysts inhibition and immobilisation:  
  Models of more complex enzyme kinetics, Effects of pH, temperature and insoluble substrates, Diffusional limitations in immobilised systems, Electrostatic and steric effects. Biocatalysis in oil refining.

- Production systems:  
  Deviations from ideality in cell growth, The logistic equation, Strategy to recover and purify products in the food and pharmaceutical industry, ultrafiltration, microfiltration, chromatography, electrophoresis.

- Biocatalysts and Biocatalyst Optimisation:  
  Molecular biology and biological information, Structure and function of nucleic acids and proteins, Protein synthesis, Mutation and genetic recombination, Genetic manipulation and genetic engineering, Screening and organism selection, Guidelines for using host-vector systems, Considerations in plasmid design.

- Mixed cultures:  
  Major classes of interactions in mixed cultures, Mixed cultures in nature, Mathematical models describing mixed-culture interactions, Industrial utilisation of mixed cultures.

- Biofilms, biofouling and biocorrosion:  
  Steps in biofilm formation, biofilms in industrial environments, Anti-fouling approaches, Monitoring, Control strategies, Surface modification.

- Safety in biotechnology:  
  Bio-hazards; Risk assessment; Containment; Quality management and process validation. Hazard Analysis and Critical Control Points (HACCP) in the food industry.
**Intended Learning Outcomes:** On completion of this module, students should:

- Be familiar with the characteristics of different types of biocatalysts and their uses: genetically engineered microorganisms, how biological information is stored, utilised and manipulated, deviations from ideality, immobilisation techniques and diffusion effects.
- Understand the use of mixed cultures in batch and continuous reactors, and the major interactions between different populations of microorganisms.
- Be familiar with the principles of biofilm formation and biofouling, and how to monitor and control them.
- Demonstrate knowledge on the range of optimisation and advanced separation processes available, and their applications.
- Understand the potential hazards and precautions required to reduce the risks associated with microorganisms.
- Summarise, present and discuss scientific findings and express ideas in a logical and coherent manner.


**Additional Notes:** Lecture notes are available in Blackboard
Module Aims: This module aims to give students practical experience in either the industrial setting or the research environment. Either two day placements in industry or two day research placements within the College of Engineering are conducted. The industrial placements are determined by interview with the companies involved or College staff. A range of research projects will be offered by the College staff. The module aims to reinforce and deepen material taught previously in the undergraduate environment and broaden practical skills learnt during the previous years. The module will provide an opportunity to apply to industrial/research problems the knowledge obtained within the undergraduate course. The module will also give experience in teamwork, communication, presentation and planning skills plus where appropriate the experience of the management structures and practices of industrial organizations or research projects.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Research - Tutorial sessions and lab instruction; Industrial - Tutorial sessions and site visits

Lecturer(s): Mr CD Jones, Dr YK Ju-Nam, Dr PM Williams

Assessment: Project (100%)

Assessment Description: Conduct of project [10%]
This is assessed by the project supervisor.

Project Report [60%]
The project report will be an 8 to 10 pages document (approx. 8000 word equivalent). It takes the form of a research paper for Research Projects and an industrial report for Industrial Placements.

Competence and Commitment Report [10%] Pass/Fail
Part of the assessment of this module will involve a competence and commitment report.

Oral Presentation [20%]
This will take the form of a power point presentation to an audience.

Moderation approach to main assessment: Universal non-blind double marking

Failure Redemption: There is no way to redeem a failure in this module.

Assessment Feedback: Students will receive feedback continuously throughout the module from their project supervisor.

Module Content: Industrial Placements:
Placements are assigned in consultation with the technical staff at the firms participating in the scheme. This may involve an interview before the student attains a placement. Industrial placements are not guaranteed. Each student/group will be involved in a variety of projects/jobs depending on the placement. While on site, students are encouraged to take part in any training sessions made available by the firm. The academic supervisor will endeavour to visit the students in their place of work at least once each teaching block in order to monitor progress.

Research Placements:
A variety of projects will be offered to the students and they may select an area of research dependent upon their interests (students may also put forward research projects of their own). The work can involve experimental, theoretical and/or computational work. The placements will provide experience in developing and critically assessing new work in an existing field of research. The student will be expected to be involved in health and safety assessment of the project including a comprehensive risk assessment.

Student commitment:
For the industrial placements, students are representing the University when they go out into industry and are expected to conduct themselves in a professional manner. Any student who is dismissed from their place of work will automatically fail the module. In general, the student must provide evidence during the module assessment that they have invested extensive time and endeavour to attain a professional standard.
Intended Learning Outcomes: After completion of this module the student should be able to demonstrate a knowledge and understanding of:
- The interpretation of previously un-encountered theory and/or practice in connection with a chosen field of work;
- The day-to-day operation of industrial plant or research equipment;
- Work within a research group or process team environment;
- Communication skills with work colleagues;
- Measuring and assessing process/experimental data;
- The implementation of standard working practices;
- The role of other disciplines;
- Safety regulations and practices;
- Management structures;

Develop an ability to:
- Analyse a process using basic information;
- Evaluate a complex problem or process;
- Plan a strategy for achieving a required project goal;
- Construct a time management plan for producing a required analysis;
- Select or specify suitable equipment to achieve the required project goals;
- Appreciate safety and loss aspects of processes/projects;
- Use appropriate computer packages;
- Present calculations relevant to the achievement of a required goal;
- Follow required safe-working practices;
- Communicate effectively with other personnel;
- Use time management;
- Solve problems and reach reasoned judgements.
- Prepare a comprehensive report of a well-defined piece of research or industrial work;
- Prepare and give an oral presentation of a completed piece of work to an audience.

Reading List:

Additional Notes: NOT available to visiting and exchange students.
EGCM36 Desalination

Module Aims: Desalination is an important process in the management of water resources and it has a large societal, economic and environmental impact. This module will give engineering students a solid grounding in desalination and related separation processes. This will prove invaluable for a future career in many areas of engineering.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format:
- Lectures 20 hours
- Design classes/tutorials 10 hours
- Directed private study 70 hours

Lecturer(s): Dr PM Williams, Dr N Battikh

Assessment: Examination 1 (75%)
- Coursework 1 (10%)
- Coursework 2 (15%)

Assessment Description: 75% written examination.

25% coursework (Worked tutorial sheet and presentation)

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: Exam feedback will be given via exam results and the exam feedback forms available on the Swansea University intranet.

Module Content: 1. Introduction including Resources and Need for Water Desalination; Composition of Seawater; Definition and Classification of Industrial Desalination Processes.

2. Basics of desalination systems including Pre-treatment and Post-treatment Systems; Energy Recovery Devices

3. Thermal Desalination Systems including Evaporators; Single Effect Evaporation; Multiple Effect Evaporators; Multiple Effect Distillation (MED): Forward Feed Multiple Effect Evaporation; Parallel Feed Multiple Effect Evaporation; Multi Stage Flash Distillation (MSF); Freeze Desalination Systems.

4. Reverse Osmosis: Elements of Membrane Separation; Performance Parameters; RO Membranes; Membrane Modules; Design of RO Systems; RO Feed Treatment, Biofouling and Membrane Cleaning.

5. Novel Desalination Systems including Forward Osmosis (FO), Pressure Retarded Osmosis (PRO), Solar Greenhouses; Membrane distillation etc.

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

- Demonstrate a systematic understanding of different desalination systems.
- Apply theory critically to analyse the mechanisms of desalination technologies.
- Make critical evaluation and appreciation of the different thermal and RO membrane modules used in desalination industry.
- Decide on a strategy for which process (or combination of processes) to implement a desalination process.
- Formulate mathematical models for mass and heat transfer in thermal desalination.
- Develop flowsheeting and detailed design of thermal and RO membrane systems.


Wilf, Mark, The guidebook to membrane desalination technology : reverse osmosis, nanofiltration and hybrid systems : process, design, applications and economics / Mark Wilf ; with chapters by Leon Awerbuch ... [et al.], Balaban Desalination Publications, c2007.ISBN: 9780866890656

Additional Notes: Available to visiting and exchange students with chemical engineering background.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
### EGCM38 Membrane Technology

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

**Module Aims:** A Masters Level course to deliver a working knowledge of liquid phase membrane separation processes. This will include a detailed understanding of current membrane fabrication techniques to produce polymeric hollow fibres and flat sheet membranes and subsequent production of tubular and spiral wound modules. Ceramic membrane production will also be considered. The design, construction and optimisation of membrane plants will be considered with specific emphasis placed on configuration. A detailed understanding of membrane characterisation techniques will be developed, including SEM, AFM, particle sizing, zeta potential measurement, rejection and flux experimentation. The specific operations of membrane microfiltration, ultrafiltration, nanofiltration and reverse osmosis will be investigated and mathematical descriptions will be developed. The course will conclude with a series of practical case studies detailing current applications of membrane processes and scope for future development.

**Pre-requisite Modules:** EG-100; EG-200

**Co-requisite Modules:** EGCM36; EGDM01

**Incompatible Modules:**

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<th>Format</th>
<th>Lectures 20 hours; Example classes 10 hours; Directed private study 70 hours</th>
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<tr>
<td><strong>Lecturer(s):</strong></td>
<td>Dr DL Oatley-Radcliffe, Dr P Esteban</td>
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**Assessment:**

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<tr>
<th>Examination 1 (75%)</th>
<th>Coursework 1 (10%)</th>
<th>Coursework 2 (15%)</th>
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**Assessment Description:** Standard format College of Engineering examination. Coursework 1 mathematical problems on membrane systems (individual work). Coursework 2 oral presentation on given topic (group work).

**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:** Informal feedback will be provided during lectures and examples classes. Students will receive peer review on completion of class tutorials. Formal feedback will be provided following completion of the final exam in line with standard College of Engineering protocols.

**Module Content:**

- **Introduction:** introduction to membrane processes, classification of membrane processes, the filtration spectrum, the nature of synthetic membranes, fabrication processes, molecular weight cut off, module design and plant configuration
- **Microfiltration:** introduction to frontal and cross flow filtration, development of knowledge and understanding of solid liquid separations and cake filtration, general membrane equations and adaptation to cake filtration, calculation of cake properties, time of filtration, bed depth and process optimisation, case studies
- **Ultrafiltration:** introduction to ultrafiltration processes, mass transfer and concentration polarisation effects, simple gel theory, osmotic pressure effects, effects of membrane charge, optimisation of separations, case studies
- **Nanofiltration:** introduction to nanofiltration processes, equilibrium partitioning, pore models for neutral solute rejection, effects of membrane charge, confinement issues and effects on physical properties, pore size distributions, case studies
- **Reverse Osmosis:** what is osmosis, introduction to reverse osmosis, the solution diffusion mechanism of transport, case studies
- **Optimisation:** membrane characterisation - methods and equipment, process stream characterisation - methods and equipment, rapid process feasibility studies, experimental requirements, process improvements, pre-treatments, case studies

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

- Clearly define and differentiate between the different liquid phase pressure driven membrane separation processes;
- Understand and describe the mechanisms of separation for each of the different processes;
- Describe the different membrane modules available and provide examples of ‘best use’;
- Understand membrane morphology and resulting hydraulic resistance leading to low, medium and high pressure requirements of the different processes;
- Decide on a strategy for which process (or combination of processes) to implement in order to achieve a particular separation;
- Provide a clear description and mathematical formulation of mass transfer effects in the colloidal region;
- Apply mathematical descriptions of the processes for design and optimisation purposes;
- Design ‘high level’ filtration processes across the spectrum of MF, UF, NF, and RO

**Reading List:**

Additional Notes: The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment. No prior knowledge of membranes or membrane systems is required.
**EGCM40 Pollutant transport by groundwater flows**

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

**Module Aims:** This module focuses on groundwater flow in aquifers, the transport of pollutants by groundwater flows, and the chemical and biological transformation of pollutants in the subsurface.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**
- 16 hours lectures.
- 4 hours example classes/tutorials.
- 80 hours directed private study.

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

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

**Assessment Description:**
- Written exam, 80 % of mark, closed book.
- Coursework 1: Tutorial sheet, 10 % of total mark. Individual piece of coursework.

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

**Failure Redemption:** Eligibility for the redemption process is subject to the degree scheme and the associated progression/completion criteria; where permitted, a supplementary examination will form 100% of the mark.

**Assessment Feedback:**
- Informal feedback will be provided during lectures and examples classes. Feedback on coursework will be given as written notes and informal feedback. Formal feedback following completion of exam will be provided in line with standard College of Engineering protocols.

**Module Content:**
- Introduction: Ground water, the hydrological cycle
- Characteristics of the porous medium and fluid
- Darcy flow in saturated porous media
- Role of diffusion, dispersion and anisotropy in environmental flows
- Geochemical interactions
- Carbonates and carbon dioxide
- Pollutant transport
- Numerical modelling of transport
- Multiphase flows

**Intended Learning Outcomes:**

1. Demonstrate an understanding of how flows in porous media play a fundamental role in a range of environmental and engineered processes.
2. Demonstrate detailed knowledge of how the properties of the fluid and the porous media govern the flow behaviour.
3. Evaluate the transport and fate of environmental pollutants subjected to groundwater flows.
4. Demonstrate knowledge of common geochemical reactions involving solutes carried by environmental flows.
5. Independently implement simulation models to quantify hydrological transport geochemical reactions of pollutants.
6. Critically assess model results and how they relate to real world problems.

(1 - 4 assessed in exam and coursework, 5 - 6 assessed using coursework)

**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

As this is a masters level module, it is expected that students demonstrate independent study, and seek out and extract relevant information from a range of available sources.
**Module Aims:** This module aims to advance and broaden the design practices learnt at Level 3. This project will necessitate the students to adapt the design methodologies learnt previously to an unfamiliar molecule in order to generate a novel manufacturing process. The project itself requires the students to develop an innovative design for a plant to make a molecule for which no large scale production facility exists. The molecules to be produced need to be selected on the following characteristics: they should not be manufactured on a large capacity production facility (there may however be small scale production) and an outline of a manufacturing process including basic chemistry exists somewhere. The project will require the students to make choices and judgments on: the production capacity, time of operation, raw materials to use, production process, and benefit of the molecule to the company (i.e. economic, extending the knowledge base etc.). Design is a team exercise throughout and working well as a team is critical to successfully completing this project.

**Pre-requisite Modules:** EGA319; EGA326

**Assessment:** Project (100%)

**Module Content:** The project will involve:
- A literature search of alternative and innovative technologies;
- Critical selection of a process route and explanation of rationale;
- Preparation of process scope, PFD and development of a detailed equipment P&ID;
- Sizing and mechanical design of equipment;
- Detailed analysis of capital and operating costs;
- Detailed discussion on health, safety and environmental issues of the selected process;
- A review of process operability and viability assessment.

**Intended Learning Outcomes:** After completing this module a student should be able to demonstrate a knowledge and understanding of:
- The preparation of a detailed Process and Instrumentation Diagram (P&ID);
- National standards and codes for equipment design;
- An in-depth process design for major items of equipment;
- The estimation of process capital and operating costs;
- Process safety and environmental assessment for a complex process;
- The use of computer packages for simulating complex process systems (ASPEN, UniSim, Excel etc.);
- The preparation of an advanced technical design report and oral exposition of a process design to an audience.

Develop an ability to:
- Define a problem and identify constraints
- Define solutions according to the brief
- Adapt designs to meet their new purposes or applications
- Generate an innovative design for processes, systems and products to fulfill new needs.
**Reading List:** Kirk-Othmer encyclopedia of chemical technology / executive editor, Jacqueline I. Kroschwitz; editor, Mary Howe-Grant, Wiley, 1991-.

**Additional Notes:** NOT 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.
## EGDM01 Colloid and Interface Science

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

**Module Aims:** Students will gain an in-depth understanding of the properties of colloids and their importance in industry.

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Incompatible Modules:**

**Format:**
- Lectures: 20 hours
- Example classes: 5 hours
- Directed Private Study: 75 hours

**Lecturer(s):** Prof OJ Guy, Ms RS Rodrigues Teixeira, Dr Z Tehrani

**Assessment:**
- Examination 1 (75%)
- Coursework 1 (10%)
- Presentation (15%)
- Coursework 3 (0%)

**Assessment Description:** Assessment description:

Examination - Answer 3 Questions from 4

The following assessments are all course requirements.
(i) Course work 1 comprises of a piece of individual problem paper - assessed by Prof. Guy.
(ii) Course work 2 comprises of a group presentation - assessed by Prof. Guy.
(iii) Course work 1 comprises of a piece of individual problem paper - assessed by Dr. Teixeira.

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

**Failure Redemption:** Eligibility for the redemption process is subject to the degree scheme and the associated progression/completion criteria; where permitted, a supplementary examination will form 100% of the mark.

**Assessment Feedback:** Presentations will be assessed in terms of content and delivery. Individual and general feedback will be given.

The other assessments will be marked by the lecturer.

Exam past papers and some 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:**
- Introduction to the nature of the colloidal state;
- Particle size and its determination; theory and practice;
- Determination of zeta potential;
- Charge and potential distribution: the structure of the electrical double layer;
- Interactions between particles: repulsive and attractive forces, DLVO theory;
- Applications in industry:
  - Determination of important properties for colloidal systems, e.g. osmotic pressure, solution viscosity, diffusion coefficients;
  - Surface tension and wetting;
  - Surfactants and detergents;
  - Adsorption of gases at surfaces, chemisorption, physisorption, isotherms (Langmuir, Freundlich etc.);
  - Flocculation, mechanisms and applications;
  - Ultrafiltration and nanofiltration, separation of colloids and biocolloids, biofouling;
  - Sources of nanoparticles and their health effects;
- Advanced Instrumentation: Atomic force microscopy (AFM) and applications.
**Intended Learning Outcomes:** You should be able to demonstrate a knowledge and understanding of:

What colloids are; their characteristics and properties;
How colloids are formed;
Techniques used to characterize colloid size and colloidal systems;
The detailed nature of interactions between charged particles;
The importance of colloidal science in industry;
Examples of applications of colloid science in industrial processes;
The relationship between properties at the nano, micro and bulk scales;

You should be able to demonstrate an ability to:

Use scientific literature to gather information on colloidal systems;
Present scientific findings and express ideas in a logical and coherent manner;
Apply knowledge and understanding to calculate relevant parameters, e.g. different measures of size, zeta potential, molecular weight etc.;


**Additional Notes:** This module will be supported with blackboard.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
## EGTM79 Environmental Analysis and Legislation

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

### Module Aims:
This module presents the principles of life cycle analysis and Circular Economy. It covers the assessment of resource conservation by optimal use of resources, including consideration of primary extraction processes, design/manufacturing/fabrication, improving product life and end of life usage. It also reviews the current and planned European legislation that is of relevance to materials and energy and considers its implementation in the UK.

### Pre-requisite Modules:

### Co-requisite Modules:

### Incompatible Modules:

### Format:
- Lectures 25
- Directed private study 35
- Preparation of assignments 40

### Lecturer(s):
Dr GTM Bunting

### Assessment:
- Assignment 1 (50%)
- Examination (50%)

### Assessment Description:
- Assignment 1 - a 2500 word report based around information gathering, review and collation.
- Examination - a 2 hour exam where 3 questions from a selection of 4 will need to be answered, all with equal weighting.

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

### Failure Redemption:
Submission of additional assignment.

### Assessment Feedback:
Each student will receive the mark and individual feedback comments on each piece of submitted coursework, via the Blackboard site.

### Module Content:
- The concepts of lifecycle analysis and Circular Economy.
- Principle of energy and resource conservation from 'cradle to grave' and 'cradle to cradle'..
- A review of the methodology of LCA, including inventory analysis, data sources and environmental impact assessment.
- Case studies from various sectors of engineering and waste management will be covered.
- The current environmental legislative framework, especially as it relates to energy and waste, including UN, EU and UK legislation.
- The effects of economic, social and political pressures on sustainable business activities.

### Intended Learning Outcomes:
- An understanding of the principles of life cycle analysis and the different approaches that have been used.
- An appreciation of the application of LCA to industry.
- Familiarity of the significant legislation relevant to energy and waste and an understanding of legislation as a key driver for sustainable business activities.
- An understanding of the circular economy and how it relates to new opportunities for industry.
- An appreciation of the complexity of legislative, social and political pressures on technological development.

### Reading List:

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