Swansea University
Prifysgol Abertawe

COLLEGE OF ENGINEERING

POSTGRADUATE RESEARCH DEGREE STUDENT HANDBOOK

EngD in Materials,Modelling and Manufacturing Programme (FHEQ Level 8)

Materials Research Centre

PART TWO OF TWO (MODULE AND COURSE STRUCTURE)

2017/18

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.

Full semester and term dates are available at:
http://www.swansea.ac.uk/the-university/world-class/semesterandtermdates/201718/

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WELCOME TO THE COLLEGE OF ENGINEERING

We would like to extend a very warm welcome to all research engineers for the 2017/18 academic year, especially 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 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

CONTACTS

If you have any questions about the EngD in Materials, Modelling and Manufacturing programme please contact your supervisors or a member of the Materials and Manufacturing (M2A) project team listed below:

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The M2A project team, with the exception of the Programme Directors, are located in Room A201a, Engineering East.

COLLEGE RECEPTION OFFICE

The College has a Student Reception Office, which is located in Engineering Central. The office is open each day from **08.30 until 17:00hrs**. It offers a friendly, welcoming and professional service to all students. The office is able to advise on a range of matters, book meeting rooms if you need to meet with your industrial supervisor and act as a 'gateway' to other staff within the College who you may wish to contact. Reception can be contacted on 01792 295514 or you can email them at engineeringreception@swansea.ac.uk .

M2A OFFICE

For M2A specific enquiries please visit the M2A project team located in Room A201a, Engineering East. We can help with ordering equipment for your project, printing posters for conferences, theme review and project related issues as well as being the contact for absences and booking of annual leave. Please send all orders to M2Apurchasing@swansea.ac.uk and other enquiries to M2A@swansea.ac.uk.

INTRODUCTION TO THE EngD MATERIALS, MODELLING AND MANUFACTURING PROGRAMME

The Engineering Doctorate (EngD) at Swansea University is a four-year research degree undertaken in partnership between the University and a diverse range of organisations within the engineering sector.

The Engineering and Physical Sciences Research Council (EPSRC) regard the EngD scheme as highly prestigious and you will be described to as a 'Research Engineer' (RE) rather than a 'student' to emphasise the professional nature of the degree.

Funding for those on the EngD is via the **Materials and Manufacturing Academy (M2A)**, a £20 million project funded by the Welsh European Funding Office (WEFO/ESF) and the Engineering and Physical Sciences Research Council (EPSRC). The aim of the project is to increase the affluence of Wales and the UK by delivering highly skilled individuals that can enter the industrial sector and drive the knowledge economy bringing with it more jobs with higher salaries.

The scheme supports two streams of research studentships:

1) Functional Coatings and
2) Advanced Materials and Manufacturing.

Historically, the programme was entitled 'Materials Engineering' with a focus on the steel sector and this is listed as a stream within the structure of the scheme.

The EngD will combine a challenging PhD-style research project/thesis conducted with industry together with activities comprising formal training (modules), informal training (for example, quarterly reviews) and organised events such as the Annual Conference to broaden your industrial experience.

TRAINING PROGRAMME STRUCTURE

The training element of the programme will consist both of formal training (via examined lecture courses) together with informal training.

1) FORMAL TRAINING

The training programme typically comprises of 130-160 credits with:

- 60-90 credits of technical training delivered primarily in year 1 to provide a technical foundation for the research project; and
- 70 credits of professional skills delivered across years 1-4 to facilitate progression into employment.

The technical training has been created with a streamed approach and you will be allocated to the technical stream that best fits your research project. The technical modules and interpersonal skills are front loaded in year one of the course.

There are three streams of technical modules, with **stream ii) and iii)** active this academic session:

i) Steels
ii) Functional Coatings
iii) Advanced Materials and Manufacturing

The streams then come together to undertake the professional skills modules that apply to all REs.

Additionally, research engineers attend EGTM38 'Elements of Materials Selection'. The module is **optional** for Materials Engineering graduates; however, those that wish to gain the 10 credits for this module must attend the lectures and successfully pass the closed book examination. Please be advised that attendance of EGTM38 will help with the completion of module EG-M109 'Advanced Metallurgy'.

The Functional Coatings and the Advanced Materials and Manufacturing modules are shown in **Table 1**. These streams reflect the current areas of industrial demand, the focus of the EPSRC and ESF funded schemes and the recommendations of the Steering Committee. The professional skills modules are then shared by all the technical streams to maximise efficiency of delivery.

It should be emphasised that the degree is a research degree and not a taught doctorate. However, to allow formal recognition of the training component, each section of the taught programme is examined and assigned credits. REs must successfully complete the 130-160 credits of training, passing each component with a mark of over 50%.

The modules are assessed through a mixture of formal examinations, assignments and laboratory practicals. As stated previously, the technical training is focused in year 1 to assist the REs with progression onto their research project. The profile of modules and assessment methods from year to year are shown in **Table 2**. Year 3 has only one training module to maximise research output during this period.

Table 1 - portfolio of technical and professional skills modules
All modules are 10 credits unless otherwise specified. Please refer to Appendix 1 for module descriptors.

* EGTM38 'Elements of Materials Selection' is optional for Materials Engineering graduates who are completing the Functional Coatings and Advanced Materials and Manufacturing streams.

EngD in Materials, Modelling and Manufacturing			
Technical Modules			**Professional Skills Modules**
Steels stream	**Functional Coatings stream**	**Advanced Materials and Manufacturing stream**	**Shared with all streams**
EGTM38 Elements of Materials Selection*			EGSM02 Interpersonal Skills for Engineers
EGTM85 Steel Processing	EGTM99 Functional Coatings	EG-M108 Advanced Polymers and Composites	EGSM08 Economic Appraisal of Engineering Projects
EG-M109 Advanced Metallurgy	EGTM98 Electrochemistry	EG-M109 Advanced Metallurgy	EGSM10 Entrepreneurship for Research Engineers
EGTM86 Corrosion and Coatings Technology	EGTM86 Corrosion and Coatings Technology	EG-M110 Circular Economy and Sustainable Engineering	EGTM97 Innovation to Commercialisation
EGTM38 Elements of Materials Selection	EGSM04 Grid Scale Energy Storage	EG-M111 Automation and Robotics	EGGM00 Ethics in Engineering
EG-M113 Advanced Manufacturing of Metals	EGSM07 Photochemistry of Functional Materials	EG-M113 Advanced Manufacturing of Metals	EGSM09 Industrial Process Control & Optimisation
EGTM91 Welding and Joining	EGSM06 Deposition of Functional Materials by Printing and Coating	EG-M112 Simulation and Data Analysis	EGTM16 Effective Management **(5 credits)**
	EGSM11 Public Engagement and Science Communication		EGTM18 Employee Relations Awareness **(5 credits)**
	EGSM12 Applied Instrumental & Analytical Techniques		

Table 2 - year by year profile of modules and assessment methodologies
All modules are 10 credits unless otherwise stated.

Year 1 – Total 70-90 credits

Steel Stream		
EGTM85	Steel Processing	Examination (100%)
EG-M109	Advanced Metallurgy	Examination (100%)
EGTM86	Corrosion and Coating Technology	Examination (100%)
EGTM38	Elements of Materials Selection	Examination (100%)
EG-M113	Advanced Manufacturing of Metals	Examination (100%)
EGTM91	Welding and Joining	Examination (100%)

Functional Coatings Stream		
EGTM99	Functional Coatings	Examination 1 (75%); Coursework 1 (25%) - practical lab session & write-up
EGTM98	Electrochemistry	Examination (100%)
EGTM86	Corrosion and Coating Technology	Examination (100%))
EGSM04	Grid Scale Energy Storage	Examination (100%)
EGSM07	Photochemistry of functional materials	Examination (100%)
EGSM06	Deposition of functional materials by printing & coating	Examination (50%), Coursework (50%)
EGSM12	Applied Instrumental and Analytical Techniques	Exam (50%) & Assignment 1 (50%) - 2000 word essay

Advanced Materials and Manufacturing Stream		
EG-M108	Advanced Polymers & Composites	Examination (100%)
EG-M109	Advanced Metallurgy	Examination (100%)
EG-M110	Circular Economy and Sustainable Engineering	Other (100%) - assignment (report)
EG-M111	Automation & Robotics	Examination (100%)
EG-M112	Simulation and Data Analysis	Other (100%) - continuous assessment
EG-M113	Advanced Manufacturing of Metals	Examination (100%)

RE's from Functional Coatings and Advanced Materials and Manufacturing streams may take:

EGTM38	Elements of Materials Selection	Examination (100%)

All Streams		
EGSM02	Interpersonal Skills for Engineers	Presentation (50%) & Assignment 1 (50%) – project plan

Year 2 – Total 30 credits

All Streams		
EGSM10	Entrepreneurship for Research Engineers	Other (100%) - group project. Lean canvas 30%, supporting docs 30%, presentation 30% & peer review 10%.
EGTM97	Innovation to Commercialisation	Other (100%) - 2000 word assignment
EGSM09	Industrial Process Control and Optimisation	Other (100%) - computer based assignment

Year 3 – Total 10 credits

Functional Coatings Stream		
EGSM11	Public Engagement and Science Communication	Other (100%) – attendance at Royal Institution workshops and written blog of research

Table 2 continued……

Year 4 – Total 30 credits

All Streams		
EGSM08	Economic Appraisal of Engineering Projects	Other (100%) - computer based assignment
EGGM00	Ethics in Engineering	Other (100%) - 2000 word essay
EGTM16	Effective Management (5 credits)	Other (100%) - Assignment (essay)
EGTM18	Employee Relations Awareness (5 credits)	Other (100%) - Assignment (essay)

Module Delivery

Modules will be delivered in an intensive two week format with three to four days of formal lectures in week one with the assessment at the end of week two. This intensive delivery has proved popular with past cohorts and permits attendance of industrial delegates to the courses, as they would be unable to attend lectures delivered on a weekly "long-thin" basis. Modules will typically run once per year.

If you fail to pass the module or miss the module through work commitments or illness you will be required to take/re-sit the module at the earliest available opportunity'; typically during the next academic session. Failure of a training module at the second attempt shall result in the College recommending to the Progression and Awards Board that the candidate either:

i) be required to withdraw from the programme;
ii) be required to withdraw from the programme and the University.

Candidates who fail more than one training module shall be required to attend an interview with the Programme Director and Industrial / Professional representatives. On the recommendation of the College, the Progression and Awards Board will require a candidate who fails more than one training module to withdraw from the programme with immediate effect.

Chartered Engineering status

On completion of the EngD, you will have accrued 130-160 credits at FEHQ level 7. This fact should be beneficial in counting towards the further learning (beyond an undergraduate degree) required by Professional Engineering bodies for award of *Chartered Engineer* status. The streams of modules have been designed with reference to the Engineering Council's UK-SPEC for Chartership to ensure that the training programme provides maximum benefit to you in terms of continuing professional development.

2) INFORMAL TRAINING

There will also be a component of **informal training**; this will include for example, production of quarterly progress reviews, an impact poster, quarterly presentations and an annual report. Such tasks will provide you with ample opportunities to improve your written and presentation skills. There will also be a range of other informal learning opportunities, which will include health and safety training through

the course “Research Ready”. Such opportunities are compulsory, but will be non-examined and as such not credit bearing modules.

RESEARCH PROJECT/THESIS

A key element of the EngD is a four-year doctoral level research project which is initially proposed by the industrial company in consultation with the M2A Project team.

You will typically have one Industrial Supervisor and two Academic Supervisors. Additionally, you will have a Mentor to aid and encourage continuing professional development opportunities and peer mentors who will offer advice, training support and encourage the development of student led forums and activities.

The project specifications are agreed in advance of your appointment; however, they can be refined with you during your first year at the Confirmation of Candidature phase.

You will undertake the research under the guidance of the Industrial and Academic supervisors. The research will culminate in the production of a thesis at the end of the four years, which is then examined, in accordance with University regulations; typically by one external examiner and defended in a viva examination, in accordance with Professional Doctorate Regulations. In addition, as part of the viva examination, you will be required to give a presentation to an open/invited audience including the internal and external examiners.

Furthermore, during the course of the research project, you will normally make three presentations a year and a poster or platform presentation on your work at the M2A Annual Conference. Finally, you will be encouraged, where appropriate, to present at an international conference and/or submit papers to peer-reviewed journals.

APPENDIX 1

FHEQ Level 7 Module Descriptors

The modules are listed alphabetically by module code.

EG-M108 Advanced Polymers & Composites

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

Module Aims: The module will provide a deeper understanding of the technology of plastics & composites processing. The material covered will cross cut the engineering disciplines of advanced manufacturing technology and polymer science to broaden the technical and industrial context of polymer and composite processing. Within the content of the module simulation software will be applied to industrial case study examples for critical evaluation. In addition, the module will also introduce micro injection moulding, composite layups and 3-D printing.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): Mrs RM Kerton

Assessment: Examination 1 (100%)

Assessment Description: Two hour examination, three questions out of four.

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board. The script and mark are made available to the student¿s academic supervisor who then has the opportunity to discuss the performance during regular review meetings.

Module Content: Injection moulding: processing cycle
Micro injection moulding
Material selection criteria and processing consideration
Computational simulation
Shrinkage and warpage
Polymer melt rheology
Mould cooling systems
Composite materials and processing
Nano composites

Intended Learning Outcomes: Upon successful completion of this module, students should be able to:

1.Demonstrate in an industrial context, using the appropriate terminology, a systematic understanding of knowledge and a critical awareness of polymer and composite processing.
2.Understand and apply appropriate criteria for choosing the correct material and processing methodologies for polymers and composites on an industrial scale.
3.Demonstrate a comprehensive understanding of state-of-the-art developments within injection moulding at both macro and micro scale.
4.Understand how to apply simulation software to optimize the performance of injection moulding for industrial case studies.
5.Demonstrate knowledge of characteristics of particular equipment, processes or products.

Reading List: Hull, Derek; Clyne, T. W, An introduction to composite materials / D. Hull and T. W. Clyne, Cambridge University Press, 1996.ISBN: 9780521388559
McCrum, N. G; Buckley, C. P; Bucknall, C. B, Principles of polymer engineering / N.G. McCrum, C.P. Buckley and C.B. Bucknall, Oxford University Press, 1997.ISBN: 9780198565260
Osswald, Tim A, Polymer processing fundamentals / Tim A. Osswald, Hanser ; Hanser/Gardner Publications, 1998.ISBN: 9783446195714
Matthews, F.L; Rawlings, R. D. (Rees D.), Composite materials engineering and science / F.L. Matthews and R.D. Rawlings, Woodhead Pub, 1999.ISBN: 9781855734739

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

EG-M109 Advanced Metallurgy

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

Module Aims: The module will provide a deeper understanding of the physical principles underlying the processing and surface treatment of metallic materials. The material covered will cross cut the engineering disciplines of advanced manufacturing technology and metallurgy to broaden the technical and industrial context of advanced metallurgy. Within this context the resulting phase transformations in metals and alloys can be demonstrated through the control of judicious choice of processing route and conditions.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): To be confirmed

Assessment: Examination 1 (100%)

Assessment Description: Two hour closed book examination, choice of three questions out of four.

Moderation approach to main assessment: Universal double-blind marking

Failure Redemption: Candidates shall be given one opportunity to redeem once a failed training module. All failed training modules must be redeemed within the minimum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board.

Module Content: Phase Transformations:The Iron-carbon phase diagram, Steels and Cast Irons, TTT and CCT diagrams. Equilibrium and non equilibrium Ferrous transformations. Pearlitic and Martensitic Transformations. The effect of alloy additions on steel properties:Martensitic quench, Hardenability issues, High Strength Low Alloy Steels, Interstitual Free Steels:Properties with particular emphasis on automotive applications. Tool Steels, creep resistant steels, High temperature oxidation resistant steels. Cast Irons. Surface treatment and coating technology for steel products. Microstructural characterisation techniques for Steel Products. Applications of cast Irons and Steels. A review of Stainless Steels:Stainless steel production, Prices, Classification, properties, Review of Stainless Steel applications. A short history of Stainless Steels: The essential Elements, Evolution of Stainless Steels, Recent Developments. Metallurgy and properties of wrought stainless steels: Ferritic,Martensitic and Austenitic Stainless Steels:The Cr-Mn-Ni Austenitic Stainless Steels,Duplex Stainless Steels, Precipitation Strengthened Stainless Steels, Abrasive Wear, Fretting and Galling Resistant Stainless Steels, Stainless Clad Steels. Fabrication of stainless steels, Cutting, Joining, Welding, Cold forming, Machining, Surface Finishing and Surface Treatments, Surface Hardening, Hot Forming, Fabrication by Powder Metallurgy. Corrosion resistance of stainless steels:Particular Susceptibilities, General and Localised Corrosion. Applications of stainless steels.General Applications, Automotive Applications, Surgical Implants, Turbines.Aluminium Alloys:Classification. Properties of aluminium: mechanical, physical and surface properties; Wrought alloys: heat-treatable and non heat-treatable alloys, heat-treatment of alloys, mechanical properties; Joining Methods: fusion and other methods of welding, brazing, soldering; Fabrication processes: finishing; Applications: construction, domestic, transport, packaging, decorative, electrical.

Intended Learning Outcomes: After completing this module students will:
- Have a systematic understanding of the theory underlying the principal processing techniques for metallic materials and the application of these techniques to a range of different metals and alloys.
- Demonstrate an understanding of the mechanisms of microstructural development during metallurgical processing and evaluate how these affect the final structure and properties of the material.
- Be able to apply conceptual understanding to current research and methodologies and if appropriate propose new hypothesis
- Have an appreciation of the wider multidisciplinary engineering context and its underlying principles
- Have knowledge of characteristics of particular equipment, processes or products
- Understand the need for a high level of professional and ethical conduct in engineering
- be able to integrate health and safety and environmental awareness into their knowledge of the discipline

Reading List:

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

EG-M110 Circular Economy and Sustainable Engineering

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

Module Aims: The module has been designed to promote the role of circular economy and sustainable engineering within industry, commerce and society. It will equip graduates with the knowledge and skills to help industry and commerce to reduce their environmental impacts and support the objectives of sustainable development. Topics will include: life cycle analysis, chain less supply chains, circular economy, Industry 4.0, design for disassembly/re-use/re-manufacture/recycling.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): Dr GTM Bunting

Assessment: Other (100%)

Assessment Description: Assignment - a report based around information gathering, review and collation.

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board. The script and mark are made available to the student¿s academic supervisor who then has the opportunity to discuss the performance during regular review meetings.

Module Content: - life cycle analysis,
- environmental legislation,
- circular economy,
- Industry 4.0,
- Sustainable business practices,
- design for disassembly/re-use/re-manufacture/recycling
- financial costs/benefits of sustainability

Intended Learning Outcomes: After completing this module student should be able to:
- Demonstrate a comprehensive understanding of the theory underlying the principals of circular economy and sustainable engineering.
- Demonstrate an understanding of environmental legislation and resource conservation and apply this knowledge to evaluate the impact this has on commercial and societal entities.
- Show conceptual understanding to evaluate current research and methodologies and if appropriate propose new hypothesis
- Have an appreciation of the wider multidisciplinary engineering context and its underlying principles
- provide an understanding of the need for a high level of professional and ethical conduct in engineering with relation to a sustainable engineering future through resource management and project planning.

Reading List: Braungart, Michael, McDonough, William, Cradle to cradle : remaking the way we make things, Vintage, 2009.ISBN: 0099535475

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

EG-M111 Automation & Robotics

Credits: 10 Session: 2017/18 Semester 1 and 2 (Sep-Jun Taught)

Module Aims: The module will provide the knowledge and skills to design, build and safe operation of industrial robotic and automation systems. Systematic introduction of kinematics robot manipulator will be given, based on the learning of homogeneious transformation matrix and Denavit Hartenburg (DH) convention. The graduate will gain a critical awareness in selecting and applying appropriate automation and robotic equipment for industrial applications, and they will be able to identify DH parameters of a given robot manipulator and then calculate its forward/inverse kinematics.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): Dr CA Griffiths, Dr C Yang

Assessment: Examination 1 (100%)

Assessment Description: Two hour examination, choice of three questions out of four.

Moderation approach to main assessment: Universal double-blind marking

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board. The script and mark are made available to the student¿s academic supervisor who then has the opportunity to discuss the performance during regular review meetings.

Module Content: - Industrial robot types
- The kinematic model, including Rotation Matrix, Homogeneous Transformation matrix and Euler Angles
- Calculation of Forward and Inverse kinematics
- Robot actuation systems
- Robot control systems
- Tooling design for robotic systems
- Robot programming
- Sensors systems as applied to robotics
- Vision systems
- Robot safety and the design of a safe working environment
- How to identify major areas of manufacturing application and the management requirements for successful implementation.

Intended Learning Outcomes: On completion of the module students will
- Have detailed knowledge that will permit them to program a robot off-line and on-line to perform a specified task.
- Apply conceptual knowledge to critically analyse the different mechanical configurations available for an industrial robot and what tasks each is most applicable
- Have an understanding the sources of error in robots and how this impacts on choices involved in industrial processes.
- Apply understanding to consider safety issues for a given application and how this influences the choice of automation processes in an industrial context
- Use conceptual knowledge and design to select appropriate sensors for a given automation application.
- Understand the principles of application of machine vision and set up a machine vision system.
- Identify, classify and construct kinematic models for a wide range of robots.
- Demonstrate understanding of the theory of robot statics and dynamics.
- Calculate forward and inverse kinematics and plan motion trajectories.
- Have knowledge of the wider multidisciplinary engineering context of automation and robotics and its influence and impact on engineering businesses and employees.
- Use creativity to establish innovative solutions.
- Knowledge of characteristics of particular equipment, processes or products.
- Understanding of the need for a high level of professional and ethical conduct in engineering

Reading List:

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

EG-M112 Simulation and Data Analysis

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

Module Aims: This module will introduce students to a set of computational tools that are used within the engineering industry. A series of PC based workshops will be used to guide participants in the use of the software through design and analysis tasks. The module will include the use of Excel, MATLAB and SolidWorks.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): Dr JW Jones, Dr AJ Williams

Assessment: Other (100%)

Assessment Description: Continuous assessment based on the components in the module.

Moderation approach to main assessment: Universal double-blind marking

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board. The script and mark are made available to the student¿s academic supervisor who then has the opportunity to discuss the performance during regular review meetings.

Module Content: - 3-D CAD modelling
- Structural analysis
- MATLAB programming
- Advanced Excel

Intended Learning Outcomes: After completing this module student will be able to:
- Critically analyse engineering data using Excel with regards to its impact on an engineering problem.
- Demonstrate knowledge of programming using MATLAB to apply engineering analysis to industrial issues.
- Have knowledge to design 3D CAD models using SolidWorks to effectively model and create engineering components
- Use conceptual understanding to formulate and evaluate structural analysis using SolidWorks
- Use creativity to establish innovative solutions using engineering analysis and design
- Demonstrate how knowledge of analysis techniques may be used to design and create new processes or products.
- Have an appreciation of the wider multidisciplinary engineering context and its underlying principles

Reading List:

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

EG-M113 Advanced Manufacturing of Metals

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

Module Aims: The module will provide a deeper understanding of the physical principles underlying the processing of near net and net shaped technologies for advanced metal manufacturing. The course will cover casting, semi-solid metal manufacturing (Thixoforming), additive layer manufacturing and Powder Metallurgy for manufacturing. NOTE. Continuous casting methods will not be covered.
The areas covered will cross cut the engineering disciplines of advanced manufacturing technology and material science to broaden the technical and industrial context of both conventional and advanced manufacturing for metals.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hrs lectures
80 hrs directed private study

Lecturer(s): Dr HM Davies, Dr NPN Lavery

Assessment: Examination 1 (100%)

Assessment Description: Two hour examination, choice of three questions out of four.

Moderation approach to main assessment: Universal double-blind marking

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: The student is informed of their provisional mark immediately after assessment, subject to ratification at the Swansea External Examination Board. The script and mark are made available to the student¿s academic supervisor who then has the opportunity to discuss the performance during regular review meetings.

Module Content: CASTING and SEMI-SOLID(THIXO) METAL PROCESSING
Introduction to metals and melting. Metal Casting: Various casting processes, Process fundamentals, Microstructural evolution, Defects and Quality Control
Semi-Solid (Thixo) Metal Manufacturing: Various processes, Process fundamentals microstructure/property relationship and Industrial applications

POWDER METALLURGY (MOULDING) – DR N LAVERY
• Manufacturing of Powder Metals
• Compaction (hot and cold, direct, isostatic) plus sintering
• Net-shape hot isostatic pressing & Metal injection moulding
• Summary of PM tolerances, defects, materials, properties

ADDITIVE MANUFACTURING – DR N LAVERY
• Overview of additive manufacturing
• Wire Arc Additive Manufacturing and Blown Powder
• Powder-bed Systems
• Summary of AM tolerances, defects, materials, properties
• Revision classes PM & AM

Intended Learning Outcomes: After completing this module student will:
- Have a systematic understanding of the underlying theory of a range of new and advanced materials and processes (Metal manufacturing). These processes are at the forefront of current manufacturing technologies.
- Be able to apply this conceptual understanding to predict the resulting material properties through modification of key processing parameters.
- Have the ability to choose and critically evaluate the correct manufacturing process for a variety of materials
- Be able to apply conceptual understanding to current research and methodologies and if appropriate propose new hypothesis
- Have an appreciation of the wider multidisciplinary engineering context of this discipline and its underlying principles
- Have knowledge of characteristics of particular equipment, processes or products
- Understanding of the need for a high level of professional and ethical conduct in engineering
- be able to integrate health and safety and environmental awareness into their knowledge of the discipline

Reading List:

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

EGGM00 Ethics in Engineering

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

Module Aims: This course is designed to provide students with a background to the complex ethical and professional issues that are found in engineering. The focus will be on relevant situations that the engineer/scientist may encounter in their career.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hours lectures
80 hours private and directed study

Lecturer(s): Prof MJ Mcnamee

Assessment: Other (100%)

Assessment Description: 1 x 2000 word essay

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Written, individual feedback on individual essay

Module Content:
Risk and Ethics:-
General engineering code of Ethics
Specific ASME code of ethics
Risk and risk management for engineers
Ethics and Leadership
Integrity in Management
Case studies of a relevant workplace to clinical scientists and engineers (eg)
a) Challenger disaster
b) Pinto recall
c) Hip replacement: prosthetic safety

Intended Learning Outcomes: The student should have:
- a critical and nuanced understanding of the subtleties and broader contexts of ethical issues in engineering.
- An ability to evaluate and apply an ethical principles approach to ethical decision making and professionalism
- A critical awareness of business ethics in a variety of engineering contexts

The student should have an ability to:
- Understand and critically analyse soft regulation (ie non legal) within relevant areas of engineering practise and apply them to effect leadership decisions.
- Think critically and independently, locating their career experiences within the context of modern society.
- present ethically justifiable analyses of governance considerations in engineering.

Reading List:

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

EGSM02 Interpersonal Skills for Engineers

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

Module Aims:

The module will cover both presentation and written skills required for successful communication in enigineering.

Presentations: Guidelines on making format presentations, considering attention span, visual aids, style, content and balance to ensure a memorable outcome.
Preparation for one-on-one discussions, approaches to ensure successful meetings.
Body Language: The influence of body language in communication both in formal presentations and in small group discussions. How to read body language in others, and modify your own body position to aid communication.

Written: Guidelines on report preparation, including planning,structure and use of figures and tables. Preparation of an abstract, covering length, key issues and style for maximum effectiveness.

Each candidate will prepare a detailed project plan covering background to the research, the scheduling of practical and other work, and milestone deliverables. This plan will be produced following: (i) attendance at specialist lectures covering issues of good practice in the conduct of research eg safety, procedures for laboratory work and data reporting/analysis; (ii) discussion with academic and industrial supervisors regarding technical/commercial issues associated with the specific topic; (iii) a review of the formal course units covering technical issues, personal and professional development and research skills. The overall report must demonstrate that each student relates relevant aspects of the training courses to their industry oriented research project.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 25 hours lectures and presentations
75 hours private and directed study and preparation of deliverables

Lecturer(s): Prof JH Sullivan, Dr DJ Penney, Prof G Williams

Assessment: Presentation (50%)
Assignment 1 (50%)

Assessment Description: Oral presentations
-prepared presentation on technical topic
-presentation on un-seen topic
Abstract Writing
Project Plan
Personal Development - team building

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Feedback will be provided on written reports and immediately following verbal presentations

Module Content: Written: Guidelines on report preparation, including planning,structure and use of figures and tables. Preparation of an abstract, covering length, key issues and style for maximum effectiveness.

Oral: Guidelines on making format presentations, considering attention span, visual aids, style, content and balance to ensure a memorable outcome. Preparation for one-on-one discussions, approaches to ensure successful meetings.

Body Language: The influence of body language in communication both in formal presentations and in small group discussions. How to read body language in others, and modify your own body position to aid communication.

Approach: The programme involves formal training with guidance notes supported by a video-tape package on 'Speaking', and direct participation. Discussions of individual performance are undertaken on a group basis with a strong element of interactive participation.

Information retrieval and synthesis
Setting goals and defining deliverables
Managing research progress
Delegation of tasks
Cost and resources implications
Gantt charts
Thesis planning and writing
Inserting and formatting references
As well as project planning, this module includes a short course aiming to:
Identify and define transferable skills
Provide a rationale for skills via both research evidence and stated employer/sector needs.
Provide the opportunity to identify and practise skills needed by engineers, including: communication skills, group-work and team-work skills, negotiation skills and problem-solving skills.
Offer a self-perception inventory to identify and develop future employability skills.

Overview of Personal Development aspect:

1. To raise awareness of:
(a) Individual strengths and weaknesses
(b) Personal impact on others
(c) Interpersonal effectiveness.
2. To further develop personal effectiveness in leading and working with others.
3. To build the participants into a cohesive, achievement-focused team.

Syllabus:
Self Awareness - The Identification of individual strengths and weaknesses.
Interpersonal Effectiveness - Asking for and receiving feedback on the personal impact made on others.
Response-ability - Becoming more response-able. How to change beliefs and behaviours that do not empower the individual and other people.
Positive Influencing Skills - How to assert yourself and negotiate effectively in everyday work situations.
Action-Centred Leadership - How to lead and inspire a team.
Effective Teamwork - How to work effectively with others to achieve mutually agreed goals. Understanding what makes teams effective and how teams develop.
Self-Management - How to identify what matters most to you, and organise your life/work accordingly. The importance of vision, roles, goals and proactive planning.

Approach:
The programme will be a 3-day residential course which will include a number of leadership and team challenges, both in, and outdoors, with an emphasis on learning by experience and reflection. The exercises will be mentally, rather than physically challenging.

Assessment:
Self-assessment and feedback from both colleagues and the programme facilitators will lead to the preparation of an “Action and Development Plan” at the end of the programme. With guidance from the programme facilitators, this will include the actions to be taken to improve personal effectiveness, and the further areas for development that have been identified. The “Action and Development Plan” will be discussed after the course by the participants and their

mentors, to help the participants develop even further.

Intended Learning Outcomes: Competence Statements: After completing this module you should be able to demonstrate self direction in solving problems, to act independently and professionally in planning tasks and presenting work, to develop your professional presenting skills and to be able to think quickly in unpredictable situations. In addition, you will have gained additional skill in presentation of technical work to a multidisciplinary audience.

Specialist knowledge and understanding: The course will help you identify your current limits in terms of your skills and extend these through practical experience and from illustrative examples. The course will also provide a broader introduction to the research work carried out by your peers.

Technical and commercial leadership: The course will illustrate the importance of communication skills (both oral and written) in development your project implementation plans and justifying resource requirements with key stakeholders.

Specialist knowledge and understanding: The course will help you identify your current limits in terms of your skills and extend these through practical experience and from illustrative examplses. The course will also provide a broader introduction to the research work carried out by your peers.

Technical and commercial leadership: The course will illustrate the importance of communication skills (both oral and written) in developing your project implementation plans and justifying resource requirements with key stakeholders.

After completing this module you should be able to demonstrate:
The ability to plan a research project
A knowledge of and ability to use research information sources
An ability to plan and produce Gantt charts for project planning and time management
An understanding of skills required for team working, negotiation and problem solving
The ability to develop realistic plans with measurable goals to solve challenging, multidisciplinary engineering problems.
The necessary skills to write a scientific report containing appropriately formatted references.

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

Practical work: Practical presentations to an audience on a variety of topics.

Full course notes are provided.

This module is only avaliable to students following the STRIP/COATED/ M2A EngD/MRes Scheme and IGDS

EGSM04 Grid Scale Energy Storage

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

Module Aims: The module will cover the main aspects of utility scale electrochemical energy storage, seen by many (including RCUK, TSB and UK Government) as a grand challenge for the near future. The module will cover the history of energy storage solutions and the basic concepts of batteries. Electrochemical principles, reactions and techniques will be explained in the context of batteries. Factors affecting module design and performance will be explored. Once the background has been to bring the students up to speed with the concepts common primary and secondary battery chemistries will be covered in detail, explorimng electrode reactions, manufacturing routes, applications and advantages and disadvantages of each. The requirements of utility scale energy storage will be discussed as will the techno-economics of various energy storage solutions in different environments or applications. Finally other chemistries, special applications, supercapacitors and other energy storage solutions will be introduced.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 14 Hours Lectures
6 hours Practical Class
80 Hours directed learning

Lecturer(s): Dr I Mabbett

Assessment: Examination (100%)

Assessment Description: 1 x 2 hour examination (100%)

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Feedback on Exam performance will be provided via email notification (to be issued by the Administrative Secretary of the Course).

Module Content: Basic concepts (compnents, operation of cells and batteries, theoretical cell voltage, capacity and energy, specific energy and energy density and their limits.
Electrochemical Principles and reactions, thermodynamics, kinetics, electrode processes, double layer capacity and ionic adsorption, mass transport etc.
Electrochemical techniques.
Factors affecting battery performance.
Applications for different types of batteries, how battery properties are matched to applications and markets. disposable batteries, portable electronics, back up batteries, EV, Medical devices and sensors, Utility scale.
Battery module design factors.
Techno economics.
Group activity - work out performance, community, environmental, lifetime, safety and cost factors and what affects them for each technology and apply this to see what properties are important for large scale building PV back up applications.
Primary battery types, basics of chemistry and why not really rechargeable.
Secondary batteries:
- Lead acid - chemistry, performance, charge and discharge, safety and environmental and applications.
- NiCd/NiMH (pocket and sintered plate, sealed and vented) - chemistry, performance, charge and discharge, safety and environmental and applications.
- Li ion / Li Pol - chemistry, performance, charge and discharge, safety and environmental and applications.
- Fe electrode batteries - chemistry, performance, charge and discharge, safety and environmental and applications.
- Metal Air.
- Supercapacitors.
- Other chemistries and special applications.

Other types of energy storage for buildings (including fuel cells, redox flow, hydrogen, molten salt, pumped hydro, compressed air and flywheels).
Practical session – electrochemical techniques in energy storage context.

Intended Learning Outcomes: After completing this module candidates should be able to assess the advantages and disadvantages of different battery technologies for any given application. This includes technical details and limitations of the chemistry as well as production routes, materials selection, module design, safety, lifetime, performance factors such as energy and/or power density and round trip efficiencies and economic and environmental factors and incentives.

The module will equip the student with an understanding of the history of battery developments, an understanding of different classifications such as primary and secondary batteries and a view of challenges ahead, especially storing electricity from highly distributed renewable generation.

Candidates will gain practical experience of electrochemical concepts and techniques through laboratory sessions and experience handling real electrochemical lab data to evaluate and contrast technologies and performance.

Reading List:

Additional Notes: Module code only available to students on the COATED2 and M2A EngD schemes or Steel Technology MRes scheme

EGSM06 Deposition of functional materials by printing and coating

Credits: 10 Session: 2017/18 Academic Year

Module Aims: Provide overview of coating processes that are applicable for the deposition of functional coatings and to provide an understanding of their capabilities and commercial maturity. This module will provide students with an appreciation and knowledge to address up-scaling of laboratory printing and coating processes to a commercial scale.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hour formal lectures
80 hours private directed study

Lecturer(s): Dr EH Jewell

Assessment: Examination (50%)
Coursework 1 (50%)

Assessment Description: Assessment 1 : 2 hrs multiple choice examination
Assessment 2 : Coursework

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Formative marking provided on continuous assessment with exam feedback available where required.

Module Content: The course will cover :
1. Introduction : Products and applications which make use of functional coated materials to rigid and flexible substrates. How value is added by coating
2. Classification of printing / coating processes : Patterning and non patterning process,
3. Key coating material science properties : Surface wetting, rheology, solvent evaporation rate, dispersion quality, solids.
4. Coating process : Pre metered processes; slot die, slide die and spray. Self metering processes : blade coating, knife coating, meyer bar, multi roller coating, engraved roll coating and dip coating.
5. Patterning processes : Principle classification in terms of material requirements, film thickness, resolution, substrate compatibility, manufacturing speed and capital costs. Operational principles, applications and process characteristics of screen printing, gravure, flexography, offset lithography and inkjet.
6. Curing : Curing technologies Hot air, UV , IR. Dryer design for efficient cure and common issues in ensuring complete cure.
7. Reel handling : Key aspects of high throughput processing of reels / coils of material and their impact on machine design, productivity and capability.
8. Product finishing techniques : laminating, slitting, embossing, cutting.

Intended Learning Outcomes: After completing the module, students will be able to :
1. Critically analyse the opportunities for the value added products by deposition of functional materials and identify key challenges in their manufacture
2. Demonstrate a detailed understanding of material requirements for each printing / coating process and the implications of these requirements on functional material formulation.
3. Demonstrate fundamental knowledge of each liquid coating / printing process and be able to clearly identify the relative merits of each process.
4. Demonstrate the systematic understanding which allows potential processes to be identified based on application and material requirements
5. Use acquired knowledge of materials and process to assess health and safety and environmental issues posed by current and newly developed printing processes.

Reading List: Kipphan, Helmut, Handbook of print media : technologies and production methods, Springer, 2001.ISBN: 3540673261

Additional Notes: This module is available only to EngD and Part time IGDS MRes students.

EGSM07 Photochemistry of functional materials

Credits: 10 Session: 2017/18 Academic Year

Module Aims: A postgraduate level course to deliver knowledge and skills on the basics of photochemistry, describing in detail the photochemistry of interesting materials such as LEDs, semiconductors and solar cells. The first topic, basic photochemical principles, gives an introduction to the key ideas which underpin how light interacts with matter. The absorption of light and routes of deactivation within a material are outlined. The importance of atomic and molecular orbitals and the bonding of molecular orbitals are introduced and their importance to materials properties is discussed. In particular; molecular excitons and the movement of charge, bonding interactions and electronic energy band structures in semiconductors is explained. Band theory of solids is one of the central topics of the course coupled with how bands and band gap energies can be tuned for materials applications (i.e. quantum dots). Inorganic thermochromic materials are given as an example of how the temperature can affect the energy band gap. A large part of the course then focuses on the photochemistry of photovoltaic devices.
The course uses examples of specific inorganic materials to highlight the topics covered including: inorganic light emitting diodes, inorganic thermochromics, semi-conductors/semi-conductor quantum dots and organolead halide perovskites for photovoltaic applications. The materials described have applications in electronic materials and photovoltaic technologies.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Lectures 20 hours
Examples classes 8 hours
Directed private study 36 hours
Preparation for examination 36 hours

Lecturer(s): Dr ML Davies

Assessment: Examination 1 (100%)

Assessment Description: 1 x 2hr examination

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Breakdown of marks according to a structured mark scheme. General feedback on examinations and one-on-one meetings post examination if requested.

Module Content: a) Photochemistry, light absorption, generation and deactivation of excited states, energy and electron transfer, band and orbital theory.
b) Photochemistry of materials. Photovoltaic materials (from semiconductors to organic). Light emitting diodes, tuning emission and band gaps. Quantum dots relating colour/size/band gap.

Intended Learning Outcomes: On successful completion of this module students will have:

- A detailed understanding of photochemistry, light interaction and the photophysics of materials.

- Knowledge of deactivation routes of excited states and energy and electron transfer mechanisms.

- Knowledge of the fundamental mechanisms by which key materials operate such as photovoltaics and light emitting devices.

- Conceptual understanding of the importance of photochemistry with regards to the semi-conductor industry and the manufacturing challenges associated with such devices.

- knowledge of characteristics of equipment, processes or products that are produced in relation to photochemistry.

- The understanding of the materials to be able to integrate health and safety and environmental awareness into their knowledge of the discipline

Reading List:

Additional Notes: This module is solely for students undertaking the EngD or part time IGDS MRes.

EGSM08 Economic Appraisal of Engineering Projects

Credits: 10 Session: 2017/18 Academic Year

Module Aims: Introduction to the financial appraisal of engineering projects including financial accounting, models of investment appraisal, risk and risk management, and capacity optimisation in the face of uncertainty. Coping with such uncertainty requires a basic understanding of techno - economic forecasting techniques.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Interactive seminar style lectures and practical laboratory computing.

Lecturer(s): Dr M Evans

Assessment: Other (100%)

Assessment Description: Computer based assignment. Students will build an Excel model to assess the likely profitability and degrees of risk resulting from investing in a new coating line to produce organically coated sheet steel.

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

Failure Redemption: Students will be offered the opportunity to resist the coursework in the next year of their degree programme.

Assessment Feedback: Students will receive feedback on their coursework, together with detail comments on omissions and errors made, within three weeks of submission

Module Content: Introduction: Engineering projects defined, the importance of time emphasised and the reasons for investments in steel manufacturing outlined.

Accounting: Production costs, revenue, depreciation, tax laws and cash flows.

Techno - economic forecasting: Forecasting uncertain demand and other key economic variables using growth models, grey systems and intensity of use techniques.

Models of Investment Appraisal: Compounding, discounting, time value of money, payback, net present value, internal rate of return.

Risk and Risk Management: Types of risk, risk management options, risk assessment, sensitivity analysis, probabalistic risk assessment.

Capacity optimisation in the face of uncertainty: Genetic algorithms, RiskOptimiser.

Intended Learning Outcomes: Competence statements: After completing this module you should be able to systematically use the complex techniques to appraise investment projects in the engineering sector. Emphasis is placed on the risks associated with such projects and methods of coping with such risks. You will develop your assessment individually and develop an independent solution to complex investment problems using computer based assignments.

Specialist knowledge and understanding: The module will help you to build a thorough understanding of the conceptual basis on which the practice of corporate investment analysis is built, establishing the user need, assessing and forecasting the market and developing an implementation plan.

Solution of engineering problems: The module will give you the skills to incorporate the latest computer orientated tools for making informed financial decisions within an economic environment of great uncertainty and risk allowing you to make recommendations for investment strategy.

Technical and commercial leadership: The module will allow you to satisfy the very practical need that Engineers will be called upon to make informed financial decisions when acting as team members/managers of engineering projects. You will also gain an appreciation of the important relationships between customers and suppliers that help in making the correct business decision.

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

The course requires familiarity with the spreadsheet - EXCEL and the ADD in @ Risk. Students are advised to learn this package and AddIn before attending. Each Engineer will be provided with lecture handouts.

EGSM09 Industrial Process Control and Optimisation

Credits: 10 Session: 2017/18 Academic Year

Module Aims: This module introduces the engineering student to the techniques available for designing and implementing efficient linear and nonlinear industrial experiments. Participants will also be made aware of the limitations present in standard Taguchi experimental designs and how to use the results from such experiments to control and optimise complex manufacturing processes that are either linear or non linear in nature. emphasis is placed on reducing process variation whilst maintainng desired material properties.

These techniques are illustrated using the ausforming and other processes for the production of high strength steels and a case study on friction welding.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Interactive seminar style lectures and practical laboratory computing.

Lecturer(s): Dr M Evans

Assessment: Other (100%)

Assessment Description: Computer based assignment on the quality of welds produced via the friction welding pocess. Students will design a non linear experiment in relation to this process and build a second order response surfacemodel for the mean and variability in weld quality. This model will then be used to optimisation the quality of the weld.

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

Failure Redemption: Students will be offered the opportunity to resist the coursework in the next year of their degree programme.

Assessment Feedback: Students will receive feedback on their coursework, together with detail comments on omissions and errors made, within three weeks of submission.

Module Content: Quality through experimentation: Overview of designed experiments, robust design, location and dispersion effects, planning programmes of research, case studies.

Linear (two level) factorial designs: The 2(2), 2(3) and 2(k) designs.

Linear (two level) fractional factorial designs - The 2(k-1) and 2(k-p) designs, liaising, confounding and resolution. Probability plots. Replication.

Taguchi Designs - The L(8) and L(16) designs, linear graphs and poor resolution.

Non linear designs: 3(k) designs, central composite designs, Box-Behnken designs and mixed level factorial designs

Optimising linear processes: Location effects, PerMIA statistics, interactions, Yates algorithm, robustness, modelling and placing mean quality on target and minimising process variation. Illustrated using the ausforming and friction welding process.

Optimising non-linear processes: Sequential testing of non linear processes, dual response surface methodologies.

Intended Learning Outcomes: Competence statements: After completing this module you should be able to a demonstrate comprehensive and up to date understanding of the practical applications of statistically designed experiments. The module will help you independently develop your skills in designing and implementing complex experimental programmes to satisfy the practical need of Engineers to find innovative ways to improve their company's processes and products in order to remain world class competitive.

Specialist knowledge and understanding: The module will provide you with new theoretical approaches to help you statistically design experimentation in an innovative format that will promote the development of new products and processes through experimentation and continuous improvement.

Solution of engineering problems: You will incorporate the latest software products used to assist in the development of empirical models, via designed experiments, of manufacturing systems. The design of experiments is critically important in the development of viable implementation plans and you will be provided with data in the assignments which will require analysis, assimilation and comprehension to enable project plans to be formulated effectively.

Technical and commercial leadership: You will gain and enhance skills of budgeting, project planning and management together with the statistical tools aimed at maximising experimental efficiency and productivity of research. The tools will also help you evaluate project progress and enable suggestions on continuous improvement.

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

The course requires familiarity with Excel spreadsheets.

EGSM10 Entrepreneurship for Research Engineers

Credits: 10 Session: 2017/18 Academic Year

Module Aims: To show the concepts and characteristics behind Enterprise and Entrepreneurs and to demonstrate the skills allowing an individual or group to operate succesfully in an Entrepreneurial manner in a personal start-up or corporate business environment.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Day 1 - 7 Hrs
Day 2 - 7 Hrs
Day 3 - 6 Hrs
Open Tutorials - 3 Hrs

Lecturer(s): Dr RJ Holness

Assessment: Other (100%)

Assessment Description: Group (max 5 people) project to submit a Lean Canvas supporting entrepreneurial concept (generated in workshop) and team selection (though workshop Networking). This one page document should be supported by a maximum of 7 pages of supporting documents. This will also be supported by a 15 minute presentation to a panel explaining concept and team.

Lean Canvas - 30%
Supporting Docs - 30%
Presentation - 30%
Peer Review - 10%

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Group discussions during module at the end of each day and at open tutorials.

Module Content: Part 1 - What is Entrepreneurship and do you think you have what it takes to be an Entrepreneur?
Module aims, objectives, structure and assignments
Entrepreneurship and Enterprise definitions, benefits and value, Social entrepreneurship, Corporate entrepreneurship and Engineers as Entrepreneurs - discussion
Conduct and review “Enterprise Catalyst” - exercise
Are you an Entrepreneur? - discussion
Examples of Entrepreneurs - discussion
Can you become an entrepreneur – nature/nurture!!! - discussion

Part 2 – Starting Up & Some Inspiration!
Case study – The Big Ideas Role Models
Feedback and thoughts on case studies
Setting up a business in the UK

Part 3 – Creating Ideas and Getting it Across
Idea generation techniques
Networking
Pitching

Part 4 – People you need to make your Ideas work (Personal & Professional Development)
Structure of a business
Management styles
Leadership styles
Teams
Skills sets

Part 5 – Pitching your Ideas - Team Selection
Pitching of Ideas for group assignment and Networking Session to generate teams for group assignment

Part 6 – Planning your Ideas (Business Planning)
The Lean Canvas
The Value Proposition Canvas
Practice

Part 7 - Funding your Ideas
Outline of finance routes

Part 8 – Protecting your ideas and selling your Ideas
Intellectual Property
PR, Marketing & Sales

Intended Learning Outcomes: A detailed understanding of the concepts of Enterprise and Entrepreneurship and a critical analysis of the qualities typically associated with an Entrepreneur.

Formulate and modify ideas for business/product creation using various individual and group techniques.

Develop a greater understanding and maximise application of your own personal and professional skills (including leadership, communication, pitching and networking.)

Create and develop a team within an Entrepreneurial environment.

Have a conceptual understanding of the legalities, mechanisms of raising finance and the business knowledge (including sustainability and business plan development) of starting a business.

Be inspired to utilise all of the above to be Entrepreneurial in any environment.

Reading List:

Additional Notes: Module code reserved by b.j.williams on 12/08/2015 10:25:39

EGSM11 Public Engagement and Science Communication

Credits: 10 Session: 2017/18 Academic Year

Module Aims: Group workshops, group discussion, and case studies will be used to give students an enhanced understanding of public engagement and science communication, and how they can develop content. It will highlight the importance of communicating science to publics. Using examples of science communication from different outlets and aimed at different audiences.
The module will consider science communication from a researcher's point of view, and also journalism/press/media and how to work with science news outlets, and also from the perspective of the audience.

Students will also learn about outreach and public engagement, linked to the Materials Live programme at Swansea University, and from science engagement experts at the Royal Institution in London. This will be a residential activity based in London for two days, covering different outreach and engagement methods, language, content, and delivery styles. Group sessions will focus on developing and delivering talks, demonstrations, and web content/talking to camera.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format:

Lecturer(s): Dr RE Johnston

Assessment: Other (100%)

Assessment Description: Attendance at workshops within the Royal Institution, which include developing and delivering talks, demonstrations, and web content/talking to camera.

A written blog detailing their research for a lay audience.

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

Failure Redemption: Resubmission of the coursework (written blog)

Assessment Feedback: Students will receive formative feedback during the workshops at the Royal Institution.

They will also receive written feedback on the research blog. They will also have the opportunity to discuss and receive feedback with the assessor in a one-to-one meeting.

Module Content: What is science communication – and why is it important?

Different audiences and methods of reaching them.

Academic blogging

A researcher's web visibility and accessibility

Current engagement structures and activities available to students – STEMNET, Materials Live

Training with current outreach demonstrations

Public Engagement training at the Royal Institution.
- Devising a school outreach activity, video, or talk – risk assessment, planning, considering diversity, evaluation, improvement.

Intended Learning Outcomes: On completion of the module the student will demonstrate:

• A greater understanding of the importance of communicating science and engaging publics
• Increased awareness of the different methods that can be used to communicate their science
• Students will be more media aware and accessible
• Science communication and outreach outputs aligned with their research that can be published.
• Greater confidence in developing and delivering content to publics, including schoolchildren – to inform and inspire the next generation of scientists and engineers.
• Activities and outputs developed with the Royal Institution that can be delivered to non-academic audiences including schools.
• Reporting the different engagement outputs to the funder (EPSRC).

Reading List:

Additional Notes: Provide engineering students with an appreciation of science communication and the media, and the skills to develop, devise, and contribute their own outputs and activities for public engagement and outreach.

EGSM12 Applied Instrumental & Analytical Techniques

Credits: 10 Session: 2017/18 Academic Year

Module Aims: The various research groups based in the department of Materials Engineering hosts a truly World-class suite of materials and coatings characterisation and analysis equipment. The module is designed to give an overview of all the techniques available to students during their postgraduate research.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Lectures over 3 days (20 hours) plus 80 hours directed private study.

Lecturer(s): Dr MJ Carnie, Dr CME Charbonneau

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

Assessment Description: Exam - 50%
Essay (2000 words) - 50%

The pass mark for the module is 50%.

Moderation approach to main assessment: Universal double-blind marking

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Feedback will be provided via email notification (via the Course Administrative Secretary)

Module Content: The Module is divided broadly into 8 themes.

Theme 1 – Spectroscopy
Theme 2 – Electrochemistry
Theme 3 – Materials characterisation
Theme 4 – Thermal techniques
Theme 5 – Accelerated weathering
Theme 6 – PV characterisation and other electronic devices
Theme 7 – Manufacturing and printing
Theme 8 - Applied photochemistry

Theme 1 – Spectroscopy, will discuss UV-Vis, FTIR, Raman Spectroscopy, as well as Fluorometry

Theme 2 – Electrochemistry, will give a case study showing the benefit of utilising several electrochemical techniques in order to prove a single hypothesis

Theme 3 – Materials Characterisation, will look at techniques such as, XRD, SEM, BET, XPS, SIMS, AFM, profilometry and contact angle measurements

Theme 4 – Thermal techniques, will look at techniques such as, TGA, DSC, DTA, as well as combined "hyphenated" thermal techniques

Theme 5 – Accelerated weathering, will look at photodegradation of polymer coatings, UV and Atlas weathering, salt spray, as well as techniques such as ICPMS & GCMS

Theme 6 – PV characterisation and other electronic devices, will look at techniques such as, solar simulation IV measurements, IPCE and various time and frequency resolved techniques, and lifetime testing of photovoltaics and other devices.

Theme 7 – Manufacturing and printing, will look at lab scale techniques such as spin coating, bar casting and screen printing. It will look at medium-sized scale-up techniques and will also give an overview of large-scale techniques available at SPECIFIC'S Pilot and Manufacturing Resource Centre (PMRC).

Theme 8 - Applied photochemistry, will discuss the use of time resolved laser spectroscopy and its application to materials chemistry

Intended Learning Outcomes: 1. To be better prepared for the commencement of research projects
2. To have a greater understanding of the wider research community in Materials Engineering
3. To think critically about the techniques that will be applied specifically to individual research projects

Reading List: Bard, Allen J, Electrochemical methods, Wiley, 2001.ISBN: 0471043729
Skoog, Douglas A; Holler, F. James; Crouch, Stanley R, Principles of instrumental analysis, Thomson Brooks/Cole, 2007.ISBN: 9780495125709

Additional Notes: Module to be available to EngD and MSc students enrolled on specific schemes of study within the engineering school and as a module for industrial delegates for CPD purposes.

Module code reserved by b.j.williams on 06/09/2016 09:50:55

EGTM16 Effective Management

Credits: 5 Session: 2017/18 Semester 2 (Jan - Jun Taught)

Module Aims: Learner-centred, experimental, indoor and outdoor practical exercises covering key aspects of good management practice in advanced engineering industries.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Interactive seminar style lectures.
Group working on core topics.

Lecturer(s): Prof JH Sullivan

Assessment: Other (100%)

Assessment Description: Evaluation and reflective assignment on experiences of effective management.

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Formative marking

Module Content: Learner-centred, experimental, indoor and outdoor practical exercises covering key aspects of good management practice in advanced engineering industries. The course aims,

To develop understanding of core leadership responsibilities and practices.

To develop understanding of team member responsibilities and practices.

To develop understanding of a wide range of influencing styles.

To develop assertive behaviour and communication as a core influencing skill.

To overcome barriers to personal effectiveness when speaking to influence other people positively.

To develop self-management skills relating to forward planning, time management and self-organisation.

Intended Learning Outcomes: Competence statements: After completing this module you should be able to demonstrate a comprehensive understanding of core leadership responsibilities and practices, team member responsibilities and practices and a wide range of influencing styles. The module will assist you in dealing with complex decisions that have to be made by you in a business management role.

Solution of Engineering Problems: The module will allow you to develop additional skills to ensure management quality throughout an organisation and will illustrate how failures in effective management can impact on product quality, morale and productivity.

Technical and commercial leadership: The module will develop your negotiating skills to overcome barriers to personal effectiveness when speaking to influence other people positively. The module will also develop self-management skills relating to forward planning, time management and self-organisation and help you evaluate and implement methods for motivating your team and therefore maximise effectiveness.

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

Taught by i2i training.

Full course notes provided.

Some parts of this course are undertaken outside of the lecture theatre and as such suitable external clothing should be worn.

Not available to visiting or exchange students.

EGTM18 Employee Relations Awareness

Credits: 5 Session: 2017/18 Semester 2 (Jan - Jun Taught)

Module Aims: Learner-centred, discussion, video, role play, covering negotiating skills and practice, disciplinary skills and practice as well as recruitment interviewing. Employment law and industrial tribunals.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: Interactive seminar style lectures and group work.

Lecturer(s): Prof JH Sullivan

Assessment: Other (100%)

Assessment Description: Negotiation focussed coursework assessment

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Formative marking

Module Content: Learner-centred, discussion, video, role play, covering negotiating skills and practice, disciplinary skills and practice as well as recruitment interviewing. Employment law and industrial tribunals.

To identify the difference between employee and industrial relations.

To understand employee relations in a business context.

To identify the factors that lead to effective employee relations.

To develop negotiating skills and practice.

To develop disciplinary skills and practice.

To evaluate employment law and industrial tribunals.

To understand what a line manager needs to know.

Intended Learning Outcomes: Competence statements: After completing this module you should have an in depth understanding regarding the differences between employee and industrial relations. The module will help you solve complex issues related to employee relations in a business context identifying the factors that lead to effective employee relations.

Specialist knowledge and understanding: The module will provide you with knowledge and analysis to help you to manage and work with a team effectively that will allow you to operate in an industrial environment and succeed in maximising the potential for technology transfer from your research project.

Technical and commercial leadership: The module will provide the complex skills required to provide line management responsibility for employees enabling your team to meet challenging technical and business needs. The module will also enhance your key skills regarding the formulation and modification of plans for resource justification and assessment and feedback to a team to ensure their effectiveness.

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.

Taught by i2i training.

Group working.

Full course notes provided.

Not available to visiting or exchange students.

EGTM38 Elements of Materials Selection

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

Module Aims: Elements of materials selection. Characterisation of mechanical properties covering elastic behaviour, tensile testing, impact testing and hardness measurement. Atomic and crystal structures of metallic and ceramic materials. Polymer structures and the influence of processing variables. Vacancies and diffusion. Elements of Dislocation Theory: Mechanism of Slip, Slip Systems, Schmidt's Law.
Deformation Processes in crystals: Deformation of Polycrystals, Solid solution strengthening, Fracture of Metals
Microstructural evolution covering solidification. Equilibrium diagrams. Equilibrium and non-equilibrium microstructures in plain carbon steels and the effects of heat treatment on mechanical properties. Alloy steels. Dislocation and mechanical properties. Microstructure control of properties in relation to selection criteria for engineering applications.
Phase Transformations in Ferrous alloys
Study of equilibrium and non equilibrium Ferrous transformations, Lever rule

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hours of Lectures
80 hours of private and directed study

Lecturer(s): Dr DJ Warren, Dr E Sackett

Assessment: Examination 1 (100%)

Assessment Description: a 2h closed book exam. The pass mark will be 50%.

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Feedback will be provided via the EngD/IGDS Administrator (via email notification).

Module Content: Elements of materials selection (1h).
Characterisation of mechanical properties covering elastic behaviour, tensile testing, impact testing and hardness measurement (3h)
Crystal structures of metallic and ceramic materials (3h). Polymer structures and the influence of processing variables (1h). Vacancies and diffusion (1h). Elements of Dislocation Theory: Mechanism of Slip, Slip Systems, Schmidt's Law (3h).
Deformation Processes in crystals: Deformation of Polycrystals, Solid solution strengthening, Fracture of Metals (1h).
Microstructural evolution covering solidification (1h). Equilibrium diagrams (2h). Equilibrium and non-equilibrium microstructures in plain carbon steels and the effects of heat treatment on mechanical properties (1h). Alloy steels (1h). Microstructure control of properties in relation to selection criteria for engineering applications (1h).
Phase Transformations in Ferrous alloys (2h)
Study of equilibrium and non equilibrium Ferrous transformations, Lever rule (3h).

Intended Learning Outcomes: Competence statements: After completing this module you should be able to demonstrate:
a) an appreciation of materials selection in relation to the structure/mechanical and physical properties/applications of metallic, ceramic, polymeric and composite materials.
b) have the ability to synthesize information from different materials groups to ensure appropriate selection criteria are established.
c) Solution of engineering problems: The module will underpin your ability to identify project opportunities in harness with your industry sponsor to aim to generate next generation materials and technologies for cost effective manufacturing.
d)Advanced understanding of the metallurgical principles of ferrous alloys, their development and applications
e) Establish relationships between processing routes and microstructure to properties, facilitating prediction of engineering properties
f) Advanced materials selections with steels
g) Promoting the ability of carrying out self-directed stuy, including communication skills and computing skills

Reading List:

Additional Notes: Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded.
Full course notes provided via Blackboard, based on the powerpoint presentations, used for the lectures.

Not available to visiting or exchange students.

Materials Engineering graduates could elect to attend this module as an optional module. However, if they choose to elect it, they must attend the closed book exam on the 29th of September 2016.
The College of Engineering has a ZERO torelance penalty policy for late submission of all coursework and continuous assessment.

EGTM86 Corrosion and Coating Technology

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

Module Aims: To provide a detailed overview of the fundamentals of corrosion and how coating processes have been developed and are utilised in industry to overcome inherent corrosion issues

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hours lectures
80 hours private and directed study

Lecturer(s): Prof JH Sullivan, Prof HN Mcmurray

Assessment: Examination 1 (100%)

Assessment Description: 1 x 2hour examination

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature. Candidates who pass the training module at the second attempt/re-sit shall obtain an uncapped mark.

Assessment Feedback: Feedback on Exam performance will be provided via email notification (to be issued by the Administrative Secretary of the Course).

Module Content: This course will cover both the importance in economic and engineering terms of corrosion of metals and the electrochemistry of the processes that lead to corrosive failure. Through illustrated lectures and interactive workshop style seminar teaching the group will learn about how corrosion occurs and the general methods for reducing corrosion activity to acceptable levels with practical illustrations drawn from the Swansea Corrosion and Coatings research activity. In addition, delegates will learn about state of the art electrochemical tools and techniques that can be used to image and quantify corrosion reactions and can be used to accelerate product development specifically for coated steel materials but with reference to other metal surfaces (since these are often also applied as coatings to steel). Specifically the course will cover :-

1. Introduction to the mechanisms of metallic corrosion and outline of the anti-corrosion components used in the manufacture of strip steel products: sacrificial coatings, barrier coatings and inhibitors including controlled release systems.

2. Corrosion on metals, iron, aluminium, zinc and magnesium to include the effects of alloying elements.

3. Description of continuous wide strip coating processes, hot dipping, electroplating, diffusion annealing, plasma vapour deposition and organic coating.

4. Principles of hot dip coating:pre cleaning, surface activation, control of coating thickness and intermetallic formation, thermal post-treatments including galvannealing.

5. Specific processes and products: aluminising, tinplating, galvanising (including Al-Zn alloy coatings) and magnesium zinc systems and future opportunities for vapour deposition.

6. Description of how electrochemical technniques can be used as an investigative tool for accelerating product development cycles.

7. Specific processes and products: description of production methods and properties for pre-painted and laminated strip steels.

8. For each product set discuss the corrosion behaviour, formability and durability of the various coated products together with an outline of their applications in the automotive, construction and packaging industries will be given.

9. The final course component will cover recent developments in coating functionality, for example coated products used as solar and water collectors to illustrate the importance of product differentiation in the coated metal industry of the future.

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

1. Demonstrate systematic advanced understanding of the fundamental electrochemical processes that give rise to corrosion on a variety of metal surfaces.

2. Contrast materials performance and make predictions on likely corrosion failures in example situations.

3. Understand how to reduce corrosion through inhibition, sacrificial and barrier coating.

4. Understand the major coil coating techniques used to protect steel and evaluate the advantages of one technique over another for specific applications.

5. Assess how electrochemical techniques can be used to distinguish between good and bad corrosion protection solutions.

6. Critically assess future customer requirements and potential production methods for high volume, low cost manufacture.

7. The module will provide comprehensive theoretical understanding of the advancing coatings technology in the strip steel industry which will be of critical value in the design and implementation of the student's research project and in the appreciation of value added products

8. Discuss and assess the environmental issues associated with coatings manufacture and the health and safety implications for employees.

Reading List: Llewellyn, D. T, Steels : metallurgy and applications / D.T. Llewellyn and R.C. Hudd, Butterworth-Heinemann, 1998.ISBN: 9780750637572
Trethewey, Kenneth R, Corrosion : for students of science and engineering / Kenneth R. Trethewey, John Chamberlain, Longman Scientific & Technical, 1988.ISBN: 0470207949
Schweitzer, Philip A, Corrosion of linings and coatings : cathodic and inhibitor protection and corrosion monitoring / Philip A. Schweitzer, CRC Press, 2007.ISBN: 9780849382475

Additional Notes: Module to be available to EngD and MRes students enrolled on specific schemes of study within the engineering school and as a module for industrial delegates for CPD purposes.

EGTM97 Innovation to Commercialisation

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

Module Aims: This course is an interactive module that may just change the way you look at the world. It may also change the way that you view your future career....from employee to employer perhaps: engineer to entrepreneur!

The fields of engineering and business have changed dramatically over the past 15 years and it is a change that continues to accelerate. What drives that change and what are the consequences for engineers and research? This course will expose you to insights about the convergence of engineering and business - the fact that engineers are moving away from production and process towards a greater contribution to ideas and market awareness will act as a basis for the course. In fact it is these two areas where real value can and is added to engineering and where reseacrh can have the highest impact.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 25 hours lecture based teaching
12 hours assessment and directed study
63 hours private study

Lecturer(s): Prof JH Sullivan

Assessment: Other (100%)

Assessment Description: Module assessed through an assignment (2000 words) encompassing application of learned techniques during the module to the students research project

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Formative marking applied to submitted assessment

Module Content: Listed below is an indicative outline of the course content.

1) Introduction: this sets out the landscape of markets today – we also attempt (with your help) to look at ‘over the horizon’ opportunities – the future socioeconomic factors that will impact upon us (engineering and business) in the next 3 – 5 years and from which commercial opportunities will emerge for your research output.
- Change
-Markets
-Technology
-The need for innovation
- Models of Innovation
- Relational Thinking

2) Innovation and Creative Thinking: what is creative thinking? How can we creative a creative environment and a creative organisation? Here we will explore our creative side...we are all creative and innovative but just in different ways – so it is valuable to acknowledge our creative type and that of others...always a session that creates surprises and a lot of laughter!
- Components of creativity
- The important of intuition
- Thinking outside the box
- Creating creativity
- Behaviours of creative people
- Resource enablers, facilitators and blockers
- Managing the innovative process
- Motivation

3) Opportunity Recognition: the final session puts things together from the first two sessions and links the value creating aspects of ideation and commercialisation and highlights your place in that value creation. We typically create an entrepreneurial business this session!
- From ideation to commercialisation
developing market opportunities
- Sources of new idea
- Change agents

Intended Learning Outcomes: 1) Develop an appreciation of how creatvitiy can be a value driver in an organisation/business and how engineering research is central to that value

2) Initiate a skill set for market sensing allowing the participant to sense societal market opportunities that are currently "just over the horizon" and match these to your research and discipline

3) Develop awareness of your own and others creative process and typology and apply this to your own resaerch and industry interactions

4) Show that entrepreneurship is central to developing economic models and ideas for progressing research and engineering

5) develop an engineering mindset that is a fundamental activtiy of any commercial organisation and apprecaite that the gaps between management and engeeering disciplines are closing

Reading List:

Additional Notes: This module is solely for students undertaking the EngD or IGDS scheme

EGTM98 Electrochemistry

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

Module Aims: Electrochemistry basic principles including: Electrode potentials, Nernst equation, dynamic electrochemistry including current-voltage relationships.
Potentiostat based electrochemistry methods including potentiodynamic, potentiostatic, galvanostatic and cyclic voltammetric techniques.
Applications of potentiostat-based electrochemistry methods, especially in corrosion and coatings research.
Advanced electrochemical scanning techniques: basic principles of operation, design and applications.
Scanning reference and vibrating electrode techniques (SRET and SVET) and scanning electrochemical microscopy (SECM) applied to corrosion research.
Introduction to electrochemical techniques for characterising organic coated metals.
Basic principles of electrochemical impedance spectroscopy and applications in evaluating corrosion protection of metals using coatings.
The scanning Kelvin probe technique: principles of operation, design of instrumentation and applications in the study of corrosion protection of metals by organic coatings.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 18 hours formal lectures
2 hours lab demonstrations
80 hours private and direct study

Lecturer(s): Prof G Williams, Prof HN Mcmurray

Assessment: Examination 1 (100%)

Assessment Description: 2 hour written examination

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Feedback on exam performance will be provide by a general comments sheet on request

Module Content: • Electrochemistry basic principles including: Electrode potentials, Nernst equation, dynamic electrochemistry including current-voltage relationships.
• Potentiostat based electrochemistry methods including potentiodynamic, potentiostatic, galvanostatic and cyclic voltammetric techniques.
• Applications of potentiostat-based electrochemistry methods, especially in corrosion and coatings research.
• Advanced electrochemical scanning techniques: basic principles of operation, design and applications.
• Scanning reference and vibrating electrode techniques (SRET and SVET) and scanning electrochemical microscopy (SECM) applied to corrosion research.
• Introduction to electrochemical techniques for characterising organic coated metals
• Basic principles of electrochemical impedance spectroscopy and applications in evaluating corrosion protection of metals using coatings
• The scanning Kelvin probe technique: principles of operation, design of instrumentation and applications in the study of corrosion protection of metals by organic coatings.

Intended Learning Outcomes: Develop high level understanding of the theory of electrochemistry and apply the theory to worked examples including calculation

Obtain knowledge on the impact of electrochemistry on the day to day performance of materials in particular environments and apply this knowledge to materials selection for use in industry

Develop an understanding for electrochemical testing methods and how they may be used within industry to assist in design and prediction of new materials systems

Assess how electrochemical influenced corrosion failures could impact on the deliverables of a business and thus spot these problems before they initiate

Assess the impact of electrochemical materials failures on the working and surrounding environment

Reading List:

Additional Notes: This module is limited to EngD students and MSc by research postgraduates

EGTM99 Functional Coatings

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

Module Aims: Historically coatings have been relatively benign with developments focussing on increased lifetime or greater control of colour and adhesion. In recent years industry and society have demanded increased functionality for coatings and no more so than in the world of construction. Every year millions up millions of square meters of painted cladded material is produced in the UK. By functionalising just a small percentage of this output to generate, store and release energy it is possible to have a huge impact in the energy and climate challenges set by government. This module will furnish the students with information and knowledge on the various photovoltaic technologies under development, paying particular attention to technologies that utilise earth abundant, environmentally friendly materials. The course will require students to make a solar cell in the laboratory and perform measurements on its efficiency.

Pre-requisite Modules:

Co-requisite Modules:

Incompatible Modules:

Format: 20 hours formal lectures and practicals
80 hours private and directed learning

Lecturer(s): Dr TM Watson

Assessment: Examination 1 (75%)
Coursework 1 (25%)

Assessment Description: 2hours exam - 75% (closed book)

Practical lab session and write up - 25%

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

Failure Redemption: Candidates shall be given one opportunity to redeem a failed training module. All failed training modules must be redeemed within the maximum period of candidature.

Assessment Feedback: Formative marking on coursework and general feedback sheet for examination on request

Module Content:

Introduction

(a) Course outline
(b) Context (who is involved in functional coatings and what are they?)
(c) Metal coatings (link to course)
(d) Building integrated functional coatings

Types of functional coating

(a) Paint
(b) Self cleaning
(c) Anti microbial
(d) Lighting
(e) Heating
(f) Water cleaning
(g) Transpired solar collectors

Titanium dioxide

(a) What is TiO2
(b) Why is TiO2 so popular in functional coatings?
(c) TiO2 polymorphs
(d) Manufacturing process for titanium dioxide
(e) Band gaps and the link to photovoltaics

Photovoltaics and band gaps

1. (a) Chronology of solar energy development
(b) Photovoltaic and photoelectric effect (Demonstration)
(c) What is a band gap (recap)
(d) Insulators, semi-conductors and conductors
(e) Photo-excitation, valence to conduction band

Introduction to photovoltaic coatings

(a) Silicon solar cells (demonstration), CIGS, CdTe
(b) Comparison of thin film versus rigid PV
(c) PV in building integration

(d) Link TiO2 with Photovoltaics (recap)
(e) Photovoltaics as functional coating (recap)

DAY 2.

Dye-sensitized solar cells introduction and recap

Operating mechanism of a DSC

(a) TiO_2 deposition and sinter/porosity
(b) Dyeing/sensitization
(c) Redox electrolyte
(d) Platinisation
(e) Encapsulation

Electron pathways

(a) Electron transport in TiO_2
(b) Dye injection
(c) Electron regeneration
(d) Recombination

Solid state DSC

(a) Why use a solid state device
(b) Differences between liquid and solid state devices
(c) Hole transport layers
(c) Manufacturing a solid state DSC

Measurement and preparation for laboratory class

(a) Defining performance characteristics (e.g. fill factor, efficiency)
(b) Obtaining an I-V curve
(c) Deriving parameters (group exercise)
(d) Preparation for laboratory practical (walk through manufacturing process)

DAY 3.
Practical class

This 'workshop' will entail the progressive manufacture of a dye-sensitized solar cell on glass. All materials will be provided at the start of the practical and the researcher will be required to carry out all the steps of the manufacture individually.
The day will be run in a show and tell fashion with the lecturer demonstrating each process and the researcher following afterwards. As follows
(a) Deposition of TiO_2 paste
(b) Sinter/heat treatment of TiO_2 layer
(c) Dyeing of the TiO_2
(d) Platinisation of the working electrode
(e) Sealing of the working and counter electrodes
(d) Injection of electrolyte

Following manufacture the researcher will provide the device to a lab assistant who will measure the device using our solar simulator. They will then provide and IV-Curve and a measurement of Fill Factor (this is included as I believe the calculation of FF to be beyond the scope of this course) .
The requirement at the end will be that the researcher label the IV-curve (Isc and Voc), write a short 4 paragraph account of the manufacture and using the IV curve and the equation for photovoltage performance determine a rough efficiency for the device.

Intended Learning Outcomes: Students will gain:

A knowledge of functional coatings and their integration into industries to aid economic benefits

An understanding of the various options for photovoltaic (PV) technologies, Si, CIGS, thin film CdTe, and OPV.

An understanding of the relative efficiency, cost and potential application of PV technologies and their impact on the environment and society

An advanced understanding of the theory and manufacturing processes of dye-sensitized solar cells.

A detailed understanding of the theory and mechanisms behind a dye-sensitized solar cell function, stability, degradation mechanisms and comparisons with other PV technologies.

Practical demonstrations and cell building workshops within the laboratory will reinforce the key knowledge learning outcomes and develop lab skills.

The practical laboratory session will enable the participants to learn how to design and manufacture a working device from individual components to completion and characterise photovoltaic performance (current output, voltage and efficiency).

As a result of this training the participant will have a broad appreciation of the potential application of PV and a detailed understanding of the emerging technologies which are being industrialised in collaborative research programmes led by Swansea with Tata Steel.

Reading List:

Additional Notes: This module is solely for students undertaking the EngD/MRes or IGDS scheme.