

Heriot Watt Course Catalogue



**School of Engineering and Physical Sciences (EPS) including
Chemical Engineering, Computer Engineering, Electrical Engineering
and Electronics, Mechanical Engineering, Chemistry, and Physics.**

Email KEI (info@KEIabroad.org) if you need syllabi for courses.
Make sure to include the course numbers and titles in your email.

School: EPS Level 1 Semester: Fall
Course Code: B17LA Course Title: Chemical Applications 1

Chemical Applications 1 provides a sound training in the basic practical skills fundamental to chemistry while developing an awareness of available resources. The course also covers basic computer literacy skills and provides experience in the use of standard computer programs. Students also receive an introduction to personal development skills e.g. record keeping, communication skills, reflective practice.

School: EPS Level 1 Semester: Fall
Course Code: B17LS Course Title: Chemistry for Life Sciences

Chemistry for Life Sciences provides an introduction to the fundamental concepts of atomic theory and the construction of the periodic table as well as the basic concepts of chemical bonding theory and the structure of molecules of biological relevance. Student will receive a broad overview of the kinds of structure and reactivity of the families of organic compounds relevant to biological chemistry and be provided with an introduction to the fundamental concepts of thermochemistry, equilibrium in chemical systems and chemical catalysis.

School: EPS Level 1 Semester: Fall
Course Code: B47AC Course Title: Foundation Engineering A

Foundation Engineering A is a learning skills and fundamentals course that runs in parallel with B47AA Process Industries A. Students should benefit from a revision of fundamental physics and its application to engineering. This course will highlight the role that Chemical Engineers play within the chemicals and related industries. Students should also gain awareness of a significant branch of the industry through a combination of directed reading, a related site visit and quiz. The students are also introduced to Professional Development Planning, the role of their Professional Body and provided appropriate training in study skills for their transition to Higher Education.

School: EPS Level 1 Semester: Fall
Course Code: B37EA Course Title: Introduction to Electrical Engineering and Circuits

Introduction to Electrical Engineering and Circuits aims to explain fundamental concepts of Electrical Engineering using modern everyday examples while presenting concepts of energy, power, charge, voltage, current and resistance. Students will be presented with magnetic field concepts, basic feedback control concepts and different methods for analysing multi-loop circuits. The course will introduce load-line method for circuits with nonlinear elements and capacitance and inductance as circuit elements and the properties of such elements.

School: EPS Level 1 Semester: Fall
Course Code: B27TA Course Title: Investigative Techniques 1

Investigative Techniques 1 aims to provide a sound training in the basic practical skills fundamental to physics, including an appreciation of safe conduct in a laboratory, and to develop the students' basic computer literacy and their ability to record and analyse data using software packages such as Excel. The course will also develop the students' abilities to record experimental work in their

laboratory notebooks and provide an introduction to personal development planning. Students will work extensively in groups both in a laboratory context and in general learning.

School: EPS Level 1 Semester: Fall
Course Code: B27TC Course Title: Investigative Techniques 1 (ChemPhys)

Investigative Techniques 1 (ChemPhys) aims to provide a sound training in the basic practical skills fundamental to chemical physics, including an appreciation of safe conduct in a laboratory. The course also develops the students' basic computer literacy and their ability to record and analyse data using software packages such as Excel, as well as recording experimental work in their laboratory notebooks. Student will be provided with an introduction to personal development planning and to the understanding of errors in the measurement of physical quantities. The course develops the students' skills in group working in a laboratory context and improves their understanding and application of mathematical and chemical topics by the use of tutorials in small groups.

School: EPS Level 1 Semester: Fall
Course Code: B57EA Course Title: Mechanical Engineering Science 1

Mechanical Engineering Science 1 develops an understanding of Mechanical Engineering Science (Statics, Thermodynamics and Fluid Mechanics). Students are introduced to Newton's laws and other concepts relating to statics, the underlying principles of thermodynamics, and taught to recognise and model situations of simple shear flow, hydrostatics, and mass conservation

School: EPS Level 1 Semester: Fall
Course Code: B27MO Course Title: Mechanics and Optics

Mechanics and Optics aims to provide a sound basis for analysis of simple mechanics problems by developing the relevant mathematical skills (vectors) and applying these to problems in mechanics. The course offers an insight into material properties, by considering the simple gas laws and kinetic model of a gas as well as developing the knowledge and understanding of simple optical systems.

School: EPS Level 1 Semester: Fall
Course Code: B27MW Course Title: Mechanics and Waves

Mechanics and Waves provides an understanding of the fundamentals of linear and rotational dynamics, including an introduction to Special Relativity and develops the principles of dynamics by showing a wide range of applications in engineering and science. The course also assists students towards an understanding of the use of mathematical models and techniques used for describing kinematics and mechanics. Students will develop an understanding of the basic principles of wave phenomena, and further develop this understanding by considering wave phenomena in a wide range of applications in mechanics, sound and light.

School: EPS Level 1 Semester: Fall
Course Code: B57VA Course Title: Praxis (Mechanical)

Praxis (Mechanical) aims to provide a training in basic practical skills of engineering observation, analysis and reporting. Students will also develop basic computer literacy and the use of standard programs as well as receiving an introduction to personal development skills.

School: EPS Level 1 Semester: Fall
Course Code: B37VA Course Title: Praxis Electronic Design

Praxis Electronic Design provides a training in basic practical skills of Electrical Engineering and develops basic computer literacy and the use of standard programs. The course also introduces personal development skills.

School: EPS Level 1 Semester: Fall
Course Code: B17CA Course Title: Principles of Chemistry

Principles of Chemistry aims to provide an introduction to the fundamental concepts of atomic theory and the basic concepts of chemical bonding theory and the structure of molecules. The course also describes elementary ideas of stoichiometry in chemical reactions as well as providing an introduction to basic organic chemistry and introducing the molecular structures of simple organic compounds. Students will also cover a variety of organic compounds containing different functional groups and receive a broad overview of the kinds of structure, stoichiometry and reactivity of compounds of Main Group elements.

School: EPS Level 1 Semester: Fall
Course Code: B47AA Course Title: Process Industries A

Process Industries A aims to introduce students to the characteristics and fundamental techniques employed in the Process Industries and the role Chemical Engineers play within that industry. Students should benefit from a revision of simple chemistry, and build on this to develop an understanding of a fundamental tool in chemical engineering – the mass balance. They should also start to understand the importance of physical properties of materials and simple phase behaviour. Students should also gain awareness of a significant branch of the industry through a combination of directed reading, a related site visit and quiz. The students are also introduced to Professional Development Planning, the role of their Professional Body and provided appropriate training in study skills for their transition to Higher Education.

School: EPS Level 1 Semester: Spring
Course Code: B17LB Course Title: Chemical Applications 2

Chemical Applications 2 provides a sound training in the basic practical skills fundamental to chemistry and continues the development of basic computer literacy and the use of standard programs MS Word, Excel and ChemDraw. The course provides a continuation to personal development planning and students will foster an appreciation of team work and the applications of chemistry in the completion of a chemical industry project.

School: EPS Level 1 Semester: Spring
Course Code: B17CB Course Title: Chemical Reactivity

Chemical Reactivity aims to provide an introduction to the properties of gases and the gas laws as well as introducing the basic concepts of thermochemistry and chemical equilibria and describing elementary ideas of the states of matter. Students will receive a broad overview of the kinds of structure, stoichiometry and reactivity of compounds of the first Transition Series elements and gain a broad knowledge of the types of functional groupings found in organic chemistry. The course also introduces the concept of reaction mechanisms of carbon containing compounds and illustrates how organic syntheses are planned and executed.

School: EPS Level 1 Semester: Spring
Course Code: B57CA Course Title: Computing for Engineers 1

Computing for Engineers 1 provides an introductory grounding in programming and the language (BASIC/C++) and an ability to program in an integrated development environment using the software tools available in modern compilers. The course is assessed purely on coursework. Coursework assignments are completed at regular intervals throughout the semester. This aspect of the course teaches the students good time management. Although problem-solving skills are recognised as an integral component of computing for engineers, the primary focus of this module is to teach the specific components of the BASIC and C++ language. Each lesson and activities focuses on this objective by having students examine and evaluate existing code, and modify or create new code that implements the components they have just learned about.

School: EPS Level 1 Semester: Spring
Course Code: B57DA Course Title: Design and Manufacture 1

Design and Manufacture 1 imparts the necessary problem-solving skills and knowledge required by mechanical engineers in the area of design and manufacture. It forms part of the core requirements by professional accreditation bodies in terms of practical skills, analysis, application of engineering knowledge and team working. Students are introduced to manufacturing processes and manufacturing techniques which are contextualised by a design, build and test group exercise.

School: EPS Level 1 Semester: Spring
Course Code: B37DA Course Title: Digital Design and Project

Digital Design and Project aims to introduce students to digital logic design. The students should on successful completion of the project have an understanding of the basics of logic design and be able to perform a variety of different digital logic problems. The students should also be familiar with an industry standard design package for digital systems and have completed both laboratory exercises and an individual project.

School: EPS Level 1 Semester: Spring
Course Code: B27EO Course Title: Electronics, Optoelectronics & Nuclear Physics

Electronics, Optoelectronics & Nuclear Physics aims to provide a sound basis for understanding simple electronic circuits and an insight into the interaction of light with matter. The course also provides a basis for understanding nuclear reactions and safety aspects. Students will also develop the skills and mathematical tools to solve problems in these topics.

School: EPS Level 1 Semester: Spring
Course Code: B27FF Course Title: Fields and Forces

Fields and Forces aims to provide an understanding of the linkage between potentials, fields and forces, and to assist students towards an understanding of the use of mathematical models and techniques used for describing motion in gravitational, electric and magnetic fields. Students will gain a knowledge and understanding of gravitational and electric fields, and develop an appreciation of the issue of wave-particle duality. The course will also provide an understanding of the basic principles of inductors and their electrical behaviour and introduce students to the ideas of quantum mechanics.

School: EPS Level 1 Semester: Spring
Course Code: B47AD Course Title: Foundation Engineering B

Foundation Engineering B is a learning skills and fundamentals course that runs in parallel with B47AB Process Industries B. This course will highlight the role that Chemical Engineers play within the chemicals and related industries. Students should also gain awareness of a significant branch of the industry through a combination of directed reading, a related site visit and quiz. The students are also introduced to Professional Development Planning, the role of their Professional Body and provided appropriate training in study skills for their transition to Higher Education. Detailed examples and problems will be provided to help students consolidate their learning.

School: EPS Level 1 Semester: Spring
Course Code: B27TB Course Title: Investigative Techniques 2

Investigative Techniques 2 builds upon the knowledge and skills from Investigative Techniques 1 which aims to provide a sound training in the basic practical skills fundamental to physics, including an appreciation of safe conduct in a laboratory, and to develop the students' basic computer literacy and their ability to record and analyse data using software packages such as Excel. The course will also develop the students' abilities to record experimental work in their laboratory notebooks and provide an introduction to personal development planning. Students will work extensively in groups both in a laboratory context and in general learning.

School: EPS Level 1 Semester: Spring
Course Code: B27TD Course Title: Investigative Techniques 2 (ChemPhys)

Investigative Techniques 2 (ChemPhys) builds upon the knowledge and skills from Investigative Techniques 1 (ChemPhys) which aims to provide a sound training in the basic practical skills fundamental to chemical physics, including an appreciation of safe conduct in a laboratory. The course also develops the students' basic computer literacy and their ability to record and analyse data using software packages such as Excel, as well as recording experimental work in their laboratory notebooks. Student will be provided with an introduction to personal development planning and to the understanding of errors in the measurement of physical quantities. The course develops the students' skills in group working in a laboratory context and improves their understanding and application of mathematical and chemical topics by the use of tutorials in small

groups.

School: EPS Level 1 Semester: Spring
Course Code: B57EB Course Title: Mechanical Engineering Science 2

Mechanical Engineering Science 2 develops an understanding of mechanical engineering science (materials science, strength of materials and dynamics). Students will develop an understanding of the relation between material properties and strength of materials, and be further introduced to Newton's laws and other concepts relating to dynamics.

School: EPS Level 1 Semester: Spring
Course Code: B37VB Course Title: Praxis Programming for Engineers

Praxis Programming for Engineers aims to provide a practical working knowledge of a high-level programming language while instilling good practise in software writing from flowchart to completion and de-bugging. Student will also be introduced to integrated development environments.

School: EPS Level 1 Semester: Spring
Course Code: B47AB Course Title: Process Industries B

Process Industries B aims to introduce students to the characteristics and fundamental techniques employed in the Process Industries and the role Chemical Engineers play within that industry. Students should build on their understanding of heat and energy to develop an understanding of a fundamental tool in chemical engineering – the energy balance. This is approached by introducing the simple energy calculations and the commonly used charts and tables. Students should also gain awareness of a significant branch of the industry through a combination of directed reading, a related site visit and quiz. The students also continue their introduction to Professional Development Planning through a written research project, a presentation and time management exercises.

School: EPS Level 2 Semester: Fall
Course Code: B18IA Course Title: Atomic & Molecular Structure & Chemical Bonding

Atomic & Molecular Structure & Chemical Bonding aims to introduce the concepts of symmetry and group theory by reference to the shapes of main group compounds and provide an introduction to quantum mechanics and quantum chemistry. The course also gives a basic understanding of the structures and properties of some simple main group compounds through the application of molecular orbital theory.

School: EPS Level 2 Semester: Fall
Course Code: B38BA Course Title: Bridging Module

Bridging Module provides students an introduction to: a high-level programming language; the relevance of design to writing software; program development tools; the basics of Boolean logic; Combinational logic and Karnaugh maps; Flip-flops; shift registers and counters. This course is aimed to students who have not studied the level 1 material previously.

School: EPS Level 2 Semester: Fall
Course Code: B18PA Course Title: Chemical Thermodynamics & Introductory Chemical Kinetics

Chemical Thermodynamics & Introductory Chemical Kinetics aims to introduce the students to concepts in chemical thermodynamics and related electrochemistry and provide an introduction to chemical kinetics. The course shows how the rates of reaction depend upon concentration, temperature and time and other variables, while exploring the relationship between reaction rate law and the mechanism of reaction, and examining complex reactions such as enzyme reaction, chain and branched chain reaction.

School: EPS Level 2 Semester: Fall
Course Code: B18AA Course Title: Chemical Thermodynamics & Introductory Chemical Kinetics for Chemical Engineers

Chemical Thermodynamics & Introductory Chemical Kinetics for Chemical Engineers aims to introduce the students to concepts in chemical thermodynamics and related electrochemistry while providing an introduction to chemical kinetics. The course also shows how the rates of reaction depend upon concentration, temperature and time and other variables as well as exploring the relationship between reaction rate law and the mechanism of reaction and examining complex reactions such as enzyme reaction, chain and branched chain reaction.

School: EPS Level 2 Semester: Fall
Course Code: B38EB Course Title: Circuits and Analysis

Circuits and Analysis reviews the basic circuit theorems such as Kirchhoff's Laws, Nodal Analysis, Thevenin, Norton and RL/RC transients for dc circuits, and introduces AC waveforms, the sine and cosine function and the phasor with relation to amplitude, frequency, phase and time. The course shows how phasor addition/ subtraction requires complex number manipulation as well as how to determine the equations for inductive and capacitive reactance and hence impedance. Students will learn to analyse series and parallel R,L and C circuits for single frequency sinusoidal excitation, and to show the relationship between Impedance and Admittance, and introduce conductance and susceptance terms.

School: EPS Level 2 Semester: Fall
Course Code: B39DC Course Title: Computer Architecture and Embedded Systems

Computer Architecture and Embedded Systems aims to give an understand the virtual machine hierarchy, and its relation to the underlying hardware, while giving the students the ability to program computer architectures at several levels of abstraction. Students will be able to develop programmable logic circuits using modern design tools and understand the importance of timing and synchronisation and how computer performance is quantified and measured.

School: EPS Level 2 Semester: Fall
Course Code: B58DB Course Title: Design and Manufacture 2

Design and Manufacture 2 develops an appreciation of how real products are designed, analysed and planned for manufacture, and further develop CAD skills into the area of 3D solid modelling,

through focussed product design exercises, as well as introducing tolerancing and the application of limits and fits. Students will develop an appreciation of Mechanical Engineering Applications and a basic understanding of process planning in the context of a designed product and associated manufacturing processes.

School: EPS Level 2 Semester: Fall
Course Code: B38DB Course Title: Digital Design and Programming

Digital Design and Programming aims to give students an understanding of Basic flip-flop structures and the action state-machines, while gaining proficiency in the design and implementation of digital circuits, and appreciating the role of programmable logic as a replacement for discrete devices. Students will develop skills in high level programming and have these skills tested through practical projects and assignments including programming and implementing a simple m controller program based on a case-study device and writing a significant high-level language program with multiple functions that manipulate data structures and arrays.

School: EPS Level 2 Semester: Fall
Course Code: B29XM Course Title: Experimental Lab & Transferable Skills

Experimental Lab & Transferable Skills aims to provide a sound training in an advanced practical skills fundamental to physics and to foster an appreciation of advanced practical work in physics. Students will also develop an advanced computer literacy in the use of Excel, Powerpoint and optical design packages. The course also covers training in and a knowledge of programming structure, its variables and constructs. The course will instil a skill in transforming a problem into a computer programme and develop skills in finding and correcting programming errors.

School: EPS Level 2 Semester: Fall
Course Code: B58EC Course Title: Mechanical Engineering Science 3

Mechanical Engineering Science 3 develops an understanding of Mechanical Engineering Science (Machine Dynamics and Strength of Materials), and introduces the underlying theories and principles of Machine Dynamics and material strength.

School: EPS Level 2 Semester: Fall
Course Code: B58EE Course Title: Mechanical Engineering Science 5

Mechanical Engineering Science 5 provides a methodology for applying mass, momentum and energy principles to simple flow systems, and covers the tools required for analysing thermodynamics processes and evaluating thermodynamic properties of systems. Students will gain an understanding of the physical laws controlling thermo-fluid systems and to develop skills in their application, along with observational skills in practical work that underpins the taught material, and experience of instrumentation systems.

School: EPS Level 2 Semester: Fall
Course Code: B18OA Course Title: Organic Structural Identification, Stereochemistry & Reaction Mechanisms

Organic Structural Identification, Stereochemistry & Reaction Mechanisms provides an introductory course on the principles of IR, UV, mass and NMR spectroscopy, as they relate to the determination of chemical structures of organic compounds, while conducting exercises on structure determination of simple organic compounds through use of the above methods. Students will also learn to describe and apply conformational and configurational analysis to a range of acyclic and cyclic molecules.

School: EPS Level 2 Semester: Fall
Course Code: B28PQ Course Title: Photonics and Quantum Mechanics

Photonics and Quantum Mechanics aims to give a grounding in quantum mechanics and particle physics while demonstrating the importance of quantum mechanics in photonics and hence in the everyday world via applications of photonics. The course also provides an understanding of wave optics, including interference, coherence, diffraction, as well as providing an understanding of the physics behind the 3 major photonics elements: lasers; semiconductor devices; optical fibres. Students will also gain a grounding in the technology of photonics and its applications.

School: EPS Level 2 Semester: Fall
Course Code: B18CC Course Title: Pigments, Dyes and Fibres

Pigments, Dyes and Fibres introduces students to dyes, pigments and fibrous materials. The course discusses the molecular design involved in the coloration of polymers and fibres and provides experience in different methods for the forensic identification of fibres. Students will be introduced to the chemical and physical properties of both inorganic and organic pigments, and methods for the control of application properties and for the forensic analysis of pigments. The synthesis and technical requirements required of dyes and pigments for materials coloration will also be covered.

School: EPS Level 2 Semester: Fall
Course Code: B48BB Course Title: Process Engineering A

Process Engineering A deals with fluid flow, fluid statics, hydrostatic pressure, manometers. Fluid mechanics deals with the transport of liquids through pipelines, frictional pressure losses, shear stress, pumping systems, pressure drops.

School: EPS Level 2 Semester: Fall
Course Code: B48BA Course Title: Process Industries C

Process Industries C includes material balances, and introduction to core topics of fluid mechanics, heat transfer and thermodynamics.

School: EPS Level 2 Semester: Spring
Course Code: B18PB Course Title: Atomic and Molecular Spectroscopy

Atomic and Molecular Spectroscopy aims to provide an introduction to the quantum mechanical models of molecular rotation and vibration and show how microwave and IR spectra arise from these. The course also explores the use of spectroscopy to give chemical structure information and introduces the atomic term symbols and electronic selection rules. Students will be provided with an introduction to the electronic spectra of transition metal ions.

School: EPS Level 2 Semester: Spring
Course Code: B38VC Course Title: Autonomous Vehicles

Autonomous Vehicles aims to introduce the basic technologies used in autonomous robot vehicles and provide an application that shows the use of embedded microcontroller technology. The course will also provide an applications area where students can use programming skills and an environment for students to develop their group working skills.

School: EPS Level 2 Semester: Spring
Course Code: B18IB Course Title: Chemistry of the Elements

Chemistry of the Elements aims to describe the chemical and structural aspects of transition metal complexes and the application of Crystal Field Theory in co-ordination chemistry while presenting the descriptive chemistry of main group elements and their compounds. The course will also introduce the structures and bonding of solid-state materials and give a brief description of the chemical and physical properties of the lanthanides and actinides, in terms of the characteristics of the metal's f electrons.

School: EPS Level 2 Semester: Spring
Course Code: B38EI Course Title: Electric Circuits and Machines

Electric Circuits and Machines introduces AC waveforms, the sine and cosine function and the phasor with relation to amplitude, frequency, phase and time. The course also shows how phasor addition/subtraction requires complex number manipulation, and how to determine the equations for inductive and capacitive reactance and hence impedance. Students will develop a broad knowledge and skills to deal with diverse technological systems that exist in electromechanics and a detailed understanding of the range of tools and techniques available to support this process. The course ensures students develop a general understanding of the relationships and interactions between the various components in an electromechanical system, as well as developing and using a limited range of core theories and a range of principles and concepts, techniques and practices in the domain of electromechanics.

School: EPS Level 2 Semester: Spring
Course Code: B38EC Course Title: Electromechanical Systems

Electromechanical Systems develops a broad knowledge and skills to deal with diverse technological systems that exist in electromechanics and a detailed understanding of the range of tools and techniques available to support this process. The course also develops a general understanding of the relationships and interactions between the various components in an electromechanical system. The students will develop and learn to use a limited range of core theories and a range of principles and concepts, techniques and practices in the domain of electromechanics. The course ensures student acquire an outline knowledge and understanding of the fundamental uses of electromechanics in the context of current research for use in diverse areas of power generation.

School: EPS Level 2 Semester: Spring
Course Code: B28LT Course Title: Experimental Lab & Communication Skills

Experimental Lab & Communication Skills aims to provide a sound training in practical skills fundamental to physics and foster an appreciation of practical work in physics. Students will receive an understanding of experimental errors and a continuation to personal development planning. The course conveys the importance of communication skills in science and for students' future careers, while providing important and useful experience in communicating science, individually and in groups, on paper and orally.

School: EPS Level 2 Semester: Spring
Course Code: B58ED Course Title: Mechanical Engineering Science 4

Mechanical Engineering Science 4 builds upon the knowledge gained in Mechanical Engineering Science 2 and further introduces the underlying theories and principles of Machine Dynamics and strength of materials, and present these concepts in an applied problem solving framework.

School: EPS Level 2 Semester: Spring
Course Code: B58EF Course Title: Mechanical Engineering Science 6

Mechanical Engineering Science 6 aims to provide a methodology for applying mass, momentum and energy principles to complex flow systems and to develop the ability to analyse thermodynamic cycles representative of real world thermodynamic devices. Students will gain an understanding of the physical laws controlling thermo-fluid systems and to develop skills in their application, well as developing observational skills in practical work that underpins the taught material. Experience of instrumentation systems will also be gained.

School: EPS Level 2 Semester: Spring
Course Code: B48BE Course Title: Process Design A

Process Design A is a mini design project which pulls together the other topics in the year. You will be working in a group on a design type exercise. There is also a section on material selection, application of mechanics for stress/strain calculations.

School: EPS Level 2 Semester: Spring
Course Code: B48BC Course Title: Process Engineering B

Process Engineering B covers thermodynamics which is a core topic in engineering which students will need to cover other courses at later levels of study. Concentrates on cyclic processes, state functions, energy, entropy, cycle efficiency.

School: EPS Level 2 Semester: Spring
Course Code: B48BD Course Title: Process Engineering C

Process Engineering C covers heat transfer, which deals with the transport of energy in the form of heat and the equipment used for this process operation.

School: EPS Level 2 Semester: Spring
Course Code: B38SA Course Title: Signals and Systems

Signals and Systems introduces linear time invariant systems, with examples in instrumentation and introduces students to the fundamental building blocks that constitute a modern communication system. Students will also be introduced the concepts of signal bandwidth, spectral relocation, signal-to-noise ratio and information content, and simple coding schemes for error reduction.

School: EPS Level 2 Semester: Spring
Course Code: B18OB Course Title: Synthesis in Organic Chemistry

Synthesis in Organic Chemistry aims to provide an understanding of the major types of reactivity of carbonyl compounds and describe the use of enolates derived from carbonyl compounds in the formation of carbon-carbon bonds. The courses discusses the chemistry of alkynes with particular reference to their use in the assembly of carbon skeletons and shows the principles of retrosynthetic analysis and the use of the methods described in this module in the design of organic syntheses.

School: EPS Level 2 Semester: Spring
Course Code: B28TR Course Title: Thermal Physics and Relativity

Thermal Physics and Relativity introduces and develops the topics of thermal physics, properties of matter and special relativity. The course also provides the mathematical techniques for analysing and solving problems in these topics.

School: EPS Level 3 Semester: Fall
Course Code: B19PC Course Title: Applications of Chemical Kinetics

Applications of Chemical Kinetics aims to describe a range of applications of kinetics to the solution of chemical problems and provide specific discussion of the kinetics of atmospheric chemistry. The course will also discuss the mechanisms of redox and substitution reactions at metal centres.

School: EPS Level 3 Semester: Fall
Course Code: B49CB Course Title: Business Awareness, Safety and Sustainability

Business Awareness, Safety and Sustainability covers the viability of a manufacturing process depends on a number of factors, not least the financial viability, but also the organisation's attitude and procedures in dealing with safety and environmental sustainability. Students will also study tools to access financial recovery and the legislation governing occupational safety, environmental monitoring and environmental management systems are generic, applicable across a number of disciplines. All topics covered are required under UK-SPEC guidelines. Assessment will be via examination using mixed mode essay and numerical calculation, and submitted work.

School: EPS Level 3 Semester: Fall
Course Code: B49CC Course Title: Chemical Reaction Engineering

Chemical Reaction Engineering is aimed at applying knowledge of chemical reaction rates to the sizing and operation of chemical reactors. Students apply stoichiometry, reaction kinetics and

chemical equilibrium to different types of chemical reactions. They also develop an understanding of how a chemical reactor would work or is working, learn to apply the methods for sizing 'ideal' reactors for different reaction types, and achieve an understanding of the basics of 'non-ideal' flow and their application in sizing of 'non-ideal' reactors. Learning materials are supported by practical laboratory experiments; e.g. measuring residence time distributions, determining rate constants.

School: EPS Level 3 Semester: Fall
Course Code: B19LM Course Title: Chemistry – Practical Work 1

Chemistry – Practical Work 1 aims to provide experience of practical work in chemistry at the appropriate level and give additional experience of the use of spectroscopic methods for the identification of compounds. Students will gain experience of the use of computational chemistry in the analysis of molecular structure and bonding and develop the use of ICT in the preparation of their formal laboratory reports. The course will also develop the skills of accurate recording of data, manipulation of data and the correct drawing of conclusions from data and the mathematical tools and the use of appropriate IT methods of handling numerical data.

School: EPS Level 3 Semester: Fall
Course Code: B19MA Course Title: Chemistry of Materials

Chemistry of Materials aims to provide an advanced discussion in key topics in Inorganic Materials Chemistry, with particular emphasis on the concept of selectivity in framework solids and the technological applications that result. The course also presents the concepts of polymer synthesis, structure, properties, mechanical behaviour and characterisation.

School: EPS Level 3 Semester: Fall
Course Code: B19AB Course Title: Chemistry of Materials for Chemical Engineers

Chemistry of Materials for Chemical Engineers aims to provide an advanced discussion in key topics in Inorganic Materials Chemistry and present the concepts of polymer synthesis, structure, properties, mechanical behaviour and characterisation with a the audience of Chemical Engineers in mind.

School: EPS Level 3 Semester: Fall
Course Code: B59DE Course Title: Design and Manufacture 3

Design and Manufacture 3 gives students an understanding of design and manufacture in the context of the design and production processes, and provides awareness of design and associated manufacturing processes, materials and methods. Students will also be provided with an introduction to Robotics and an outline of further fundamental manufacturing processes (machining theory, casting and forming).

School: EPS Level 3 Semester: Fall
Course Code: B29DS Course Title: Dynamics & Statistical Physics

Dynamics & Statistical Physics aims to introduce the basic concepts of advanced classical mechanics, while establishing the transition from classical observables to operators in quantum mechanics.

Students will be provided with a basic level of working knowledge of the physics of fluctuations and their connection with traditional thermodynamics, and given an introduction with applications of Fermi-Dirac and Bose-Einstein quantum statistics.

School: EPS Level 3 Semester: Fall
Course Code: B29ER Course Title: Electromagnetism and Optics

Electromagnetism and Optics provides an extension of electromagnetic concepts and an intermediate level working knowledge on the physics of electric fields, magnetic fields and their combination as electromagnetic waves. The course also extends the mathematical basis for this subject, to include integral and differential forms of field equations, and develops the mathematics of EM waves to provide a foundation for topics covered in this and subsequent modules, including optics, waveguides, more advanced electromagnetism, polarisation physics and non-linear optics. Students will gain an understanding of optics and simple optical systems and of coherence, interference and diffraction.

School: EPS Level 3 Semester: Fall
Course Code: B19FD Course Title: Introduction to Pharmaceutical Chemistry

Introduction to Pharmaceutical Chemistry provides the requisite background knowledge for studying pharmaceutical chemistry in more depth in later stages of the course covering topics such as: Molecular Basis for Drug Action and Pharmacokinetics

School: EPS Level 3 Semester: Fall
Course Code: B59EG Course Title: Mechanical Engineering Science 7

Mechanical Engineering Science 7 provides students with an understanding to vibration theory while applying the understanding of strength of materials to evaluate design using computer simulations.

School: EPS Level 3 Semester: Fall
Course Code: B59EI Course Title: Mechanical Engineering Science 9

Mechanical Engineering Science 9 introduces students to the concepts of turbomachinery and provide an introduction to its theory, and to the technique of Dimensional Analysis and its application. Students will also cover advanced thermodynamic theory and heat transfer calculation methodologies and their application to the analysis of practical thermodynamic devices.

School: EPS Level 3 Semester: Fall
Course Code: B19OC Course Title: Organic Reactions 1

Organic Reactions 1 aims to provide a range of methods for the interconversion of key functional groups, emphasising issues of regio- and stereocontrol. The course also discusses an extended range of reactions for the formation of carbon-carbon bonds and develops the concept of retrosynthetic analysis (RSA) in a structured manner. Students will cover how RSA, together with knowledge from this module and its prerequisites, can be used for the design of syntheses of organic molecules of moderate complexity.

School: EPS Level 3 Semester: Fall
Course Code: B19IC Course Title: Organometallic Chemistry & Multinuclear NMR Spectroscopy

Organometallic Chemistry & Multinuclear NMR Spectroscopy introduces the elementary concepts of organometallic chemistry, including synthesis, structure, bonding and reactivity of relevant species. The course also describes how these fundamental ideas may be applied to the development of homogeneous catalysts as well as describing the background to selected homogeneously catalysed processes. The skill base of students will be extended in practical aspects of multinuclear NMR spectroscopy in analysis of Inorganic compounds.

School: EPS Level 3 Semester: Fall
Course Code: B39MB Course Title: Physical Electronics and Semiconductors

Physical Electronics and Semiconductors aims to develop a critical understanding of Physical Electronics and modern electronic and opto-electronic devices.

School: EPS Level 3 Semester: Fall
Course Code: B29CA Course Title: Physical Mathematics 1

Physical Mathematics 1 gives an introduction to vector calculus that enables students to compute line, surface and volume integrals and to apply the Divergence, Stokes' and Green's theorems. Students will also learn to solve basic ordinary differential equations and how to use them for modelling, and to obtain discrete spectra using Fourier expansions in time and space.

School: EPS Level 3 Semester: Fall
Course Code: B49CA Course Title: Separation Processes A

Separation Processes A introduces the concepts of separation of mixtures, where process is dictated by either an equilibrium condition or a rate of transfer. The course deals with liquid systems and covers the application of theory to the design and operation of key unit operations, including distillation, liquid-liquid extraction, gas absorption and evaporation. Practical experiments reinforce subject matter covered with learning materials.

School: EPS Level 3 Semester: Fall
Course Code: B39SB Course Title: Signals and Communications

Signals and Communications establishes an understanding of the transient and steady-state (time and frequency domain) characteristics of LTI systems using Laplace and Fourier transform methods. Students will be introduced to sampling theory and sampled data (discrete time) systems, as well as to techniques and concepts used in communications systems, notably modulation and information theory.

School: EPS Level 3 Semester: Spring
Course Code: B19MB Course Title: Advanced Materials

Advanced Materials provides an advanced discussion of the physical and chemical properties of liquid crystalline materials and present topics in the science of synthetic and natural fibres. The

course also provides information on the structure, properties and processing of ceramic materials, including the influence of microstructure. Students will cover the role of powder and fibre diffraction techniques in the analysis of modern materials and study a range of technologically important materials for energy conversion and recovery.

School: EPS Level 3 Semester: Spring
Course Code: B39EE Course Title: Analogue Electronics

Analogue Electronics aims to develop an understanding of active electronic devices (at transistor and simple IC level). The course also provides a grounding in the tools and techniques necessary for the analysis and design of analogue circuit blocks with emphasis of operational amplifier techniques. Students will develop their use of CAD in analysing circuit function and design.

School: EPS Level 3 Semester: Spring
Course Code: B19AC Course Title: Analytical Chemistry

Analytical Chemistry aims to provide a general introduction to quantitative analytical methods and to chemical separation techniques and to discuss the application and practice of various chromatographic methods in chemical analysis. Students will also receive an introduction to the properties and reactions of gas phase ions and their use in the interpretation of spectra in analytical mass spectrometry, and to electrochemical methods of chemical analysis.

School: EPS Level 3 Semester: Spring
Course Code: B29PI Course Title: Applied Physics

Applied Physics aims to provide a sound training in an advanced practical skills fundamental to physics and develop advanced computer literacy and the use of Excel, Powerpoint and optical design packages. The course will foster an appreciation of advanced practical work in physics, provide a knowledge of digital electronics and introduce instrumentation relevant to measurements in Physics.

School: EPS Level 3 Semester: Spring
Course Code: B59AA Course Title: Automotive Technologies 1

Automotive Technologies 1 provides students with an overview of the drive-train and energy, and develops a comprehensive understanding of automotive technology specifically relating to thermofluids and furthermore to discuss design trends leading to good performance and fuel economy. The aspects of design of vehicles covered in this course which raise the student's awareness of the design process are generic to many sectors. Furthermore, the analysis of thermofluid systems is more generally useful to other areas of mechanical engineering.

School: EPS Level 3 Semester: Spring
Course Code: B19ID Course Title: Chemical Structure

Chemical Structure aims to show how the basic ideas of group theory introduced in Stage 2 can be applied to the bonding in transition-metal co-ordination and organometallic compounds and to the interpretation of the infra-red spectra of molecules and fragments. Students will learn to apply the principles of quantum chemistry to the study of the electronic spectroscopy of diatomic and

polyatomic molecules. The course will also introduce the methodology of the solution of molecular structure by single crystal X-ray diffraction and describe the basic principles of Raman spectroscopy.

School: EPS Level 3 Semester: Spring
Course Code: B19LN Course Title: Chemistry – Practical Work 2

Chemistry – Practical Work 2 continues and builds upon the knowledge and skills gained from Chemistry – Practical Work 1 which aims to provide experience of practical work in chemistry at the appropriate level and give additional experience of the use of spectroscopic methods for the identification of compounds. Students will gain experience of the use of computational chemistry in the analysis of molecular structure and bonding and develop the use of ICT in the preparation of their formal laboratory reports. The course will also develop the skills of accurate recording of data, manipulation of data and the correct drawing of conclusions from data and the mathematical tools and the use of appropriate IT methods of handling numerical data.

School: EPS Level 3 Semester: Spring
Course Code: B59CC Course Title: Computing for Engineers 2

Computing for Engineers 2 provides a good understanding of the C++ programming language or similar language and/or the application of MATLAB as a simulation tool. Students will also gain the ability to program in an integrated development environment using all of the software tools available in modern compilers.

School: EPS Level 3 Semester: Spring
Course Code: B59DF Course Title: Design and Manufacture 4

Design and Manufacture 4 provides a deeper awareness of the integration of the design and associated manufacturing processes and materials. The course also develops methods related to computer numerical control (CNC), and provides an introduction to CNC turning and laser machining/milling.

School: EPS Level 3 Semester: Spring
Course Code: B39ES Course Title: Electrical Energy Systems

Electrical Energy Systems aims to have students develop an appreciation of electrical energy systems as well as the ability to use knowledge in circuits and analysis to perform calculations and circuit analysis for energy systems.

School: EPS Level 3 Semester: Spring
Course Code: B39MA Course Title: Electromagnetism

Electromagnetism provides students with an understanding of fundamentals of electromagnetism pertinent to propagation of electromagnetic waves and of ray optics for imaging systems. Students will also learn to apply critical analysis, evaluation and synthesis to a range of problems in electromagnetism and optics.

School: EPS Level 3 Semester: Spring
Course Code: B59ES Course Title: Energy Studies

Energy Studies is designed to familiarise the students with technologies used in electricity generation and energy conversion with a focus on Renewable Energy and Heat Exchange. The course will also introduce the students to the basic concepts of Demand Side Management and the impact of energy in a wider social and environmental context.

School: EPS Level 3 Semester: Spring
Course Code: B19FA Course Title: Forensic Analysis

Forensic Analysis Provides an introduction to the theory and practice of some modern techniques of chemical instrumental quantitative analysis of particular relevance to the practising forensic analytical chemistry.

School: EPS Level 3 Semester: Spring
Course Code: B59EJ Course Title: Mechanical Engineering Science 10

Mechanical Engineering Science 10 deepens students' insight and skills of the concepts of turbomachinery, and introduces students to the mechanisms in a range of turbines. The course also introduces the fundamentals of heat transfer by conduction and convection and overall heat transfer coefficients in linear and radial situations. Students will be able to apply entropy concept to irreversible mixing of perfect gases.

School: EPS Level 3 Semester: Spring
Course Code: B59EH Course Title: Mechanical Engineering Science 8

Mechanical Engineering Science 8 provides students with an understanding of system dynamics and control theory, and allows students to apply the understanding and underlying principles of strength of materials to evaluate design.

School: EPS Level 3 Semester: Spring
Course Code: B19PD Course Title: Molecules to Systems

Molecules to Systems shows students how the statistical model enables us to understand the laws of thermodynamics and the relationship between the properties of individual molecules and the properties of matter in bulk. The course also allows students to acquire the skill of using the statistical model to: a) calculate thermodynamic functions for specific chemical systems; b) study chemical equilibria and; c) estimate the rates of chemical reactions.

School: EPS Level 3 Semester: Spring
Course Code: B49CE Course Title: Multiphase Thermodynamics

Multiphase Thermodynamics aims to develop and use chemical process thermodynamics tools to describe multi-phase, multi-component equilibria for reacting and non-reacting systems. The mathematical formalisms for compressible flow of fluids are also developed. Students will be able to construct simple phase diagrams from experimental data for a range of system types. They will also

be able to determine the composition of phases for a multiphase system and the total amount of each phase.

School: EPS Level 3 Semester: Spring
Course Code: B19OD Course Title: Organic Reactions 2

Organic Reactions 2 aims to give an understanding of the nature of pericyclic reactions including electrocyclic, cycloaddition, and sigmatropic rearrangements, and extend upon the ideas on aromaticity from benzene to non-benzenoid aromatic systems. The course will also provide further study of heterocyclic chemistry, and provide applications of aspects of physical organic chemistry.

School: EPS Level 3 Semester: Spring
Course Code: B29CB Course Title: Physical Mathematics 2

Physical Mathematics 2 aims to give an understanding of continuous spectra through the Fourier transform. The course also cover the application of Laplace transforms in ordinary and partial differential equations and to test the stability of physical systems, and will familiarise students with the use of linear partial differential equations in physics.

School: EPS Level 3 Semester: Spring
Course Code: B19FE Course Title: Principles of Drug Discovery & Development

Principles of Drug Discovery & Development aims to provide a knowledge and understanding of the ways in which drug leads are first identified, outline how leads are developed into pharmaceuticals, and describe how pharmaceuticals are developed further.

School: EPS Level 3 Semester: Spring
Course Code: B29QS Course Title: Quantum theory and Spectroscopy

Quantum theory and Spectroscopy aims to provide a fundamental course in the basic physics, concepts and techniques of quantum mechanics and spectroscopy.

School: EPS Level 3 Semester: Spring
Course Code: B49CD Course Title: Seperation Processes B

Seperation Processes B aims to further to apply theories of equilibrium and rate determining processes to separation of components, with specific reference to gas-liquid and solid systems. This course specifically reviews the application of theory to a number of unit operations involving solids processing stages, typically: drying of solids and gas dehydration, filtration, cyclonic separation, filtration and crystallisation. Practical experiments will reinforce subject matter covered with learning materials.

School: EPS Level 3 Semester: Spring
Course Code: B29SS Course Title: Solid State Physics

Solid State Physics provides an introduction to solid state physics and develops connections between solid state physics and other introductory parts of the course. Students will receive a foundation for

subsequent modules (e.g. year four modules: quantum theory and solid state B20QS, semiconductor optoelectronics, B20SO), and develop the skills and techniques to solve problems relating to Solid State physics.

School: EPS

Level 3

Semester: Spring

Course Code: B49CF

Course Title: Process Modelling and Control

Process Modelling and Control covers the concepts of controlling chemical and physical processes against identified criteria is a key topic for process engineers and an effective control scheme depends on understanding the dynamic behaviour and physical characteristics of a process. Modelling processes is a key element of tackling process control. This course aims to introduce core topics in process control, demonstrate the application of mathematics to the development of process models for typical unit operations and introduce advanced techniques to solve the models. Students will participate in workshop and practical sessions using computer based tools and laboratory based experiments supporting the learning materials.