Natural Sciences Module Handbook 2021-22

Archaeology Y1

Module Title	Autumn	Spring
Understanding the Past I	20	
Understanding the Past II		20

UNDERSTANDING THE PAST I (CLAR1021)

Semester Taught: Autumn **Credits:** 20

Style of Teaching: Lectures, Labs and Workshops

Module Convenor: Dr Will Bowden

Assessment (s): 100% Coursework (2,000 word Report)

Overview: Archaeologists are interested in all aspects of the human past, from ancient landscapes and changing environments, buried settlements and standing monuments and structures, to material objects and evidence for diet, trade, ritual and social life. This module provides a basic introduction to the discipline of archaeology, the process by which the material remains of the past are discovered, analysed and used to provide evidence for human societies from prehistory to the present day. Through this it will form a foundation for future student learning thoughout the single and joint-honours degree programmes. It introduces the historical development of the subject, followed by an overview of current practice in the areas of archaeological prospection and survey, excavation and post-excavation analysis, relative and absolute dating, the study of archaeological artefacts, and frameworks of social interpretation. Focusing on methods of analysing remains of past societies, it will also introduce some of the basic principles of archaeological science, including the analysis of plant and faunal remains and the scientific analysis of materials such as metals, ceramics and glass, using both classroom and laboratory based sessions allowing students to gain hands-on experience with different types of materials.

UNDERSTANDING THE PAST II (CLAR1020)

Semester Taught: Spring **Credits:** 20

Style of Teaching: Lectures, Fieldwork and Practical Workshops

Module Convenor: Dr Will Bowden

Assessment (s): 100% Coursework (Portfolio)

Overview: This module builds on the autumn semester module, Understanding the Past I, as an introduction to the core aims and methodologies of Archaeology as a discipline in providing a basic introduction to the process by which the material remains of the past are discovered, analysed and used to provide evidence for human societies from prehistory to the present day. Through lectures, classroom activities and practical fieldwork, students will be introduced to the study of landscape and the built environment, looking at how the archaeological record is both created and investigated. Students will be taken into the field to gain practical experience of core archaeological methods in field survey and buildings archaeology. By the end of the module, we aim to ensure that students will have developed a good understanding of the concepts used in archaeology, the questions asked and methods applied in investigating the evidence.

Biology Y1

Molecular Biology and Genetics Specialism

Module Title	Autumn	Spring
Genes, Molecules and Cells	40	

GENES, MOLECULES AND CELLS (LIFE1029)

Semester Taught: Full Year **Credits:** 40

Style of Teaching: Lectures and Lab Practicals

Module Convenor: Dr Alistair Chambers

Assessment (s): 40% Coursework (class tests based on practical work); 60% Exams

Overview: This module is designed to provide students with an understanding of the cell biology, biochemistry and molecular genetics of living organisms. Topics covered will include the structure and function of cells and organelles, structure of proteins and enzymes, structure of DNA, transcription, translation, mutations, basic recombinant DNA technology, organisation and control of genes in a diversity of organisms, metabolism of macromolecules, structure of cell membranes, transport processes, cell signalling and cell division. This module underpins more advanced biochemical and genetic modules in subsequent years. Practical sessions will illustrate the key principles covered in lectures as well as introduce some of the most important prokaryotic and eukaryotic model organisms used in genetic analysis.

Evolutionary Biology and Ecology Specialism

Module Title	Autumn	Spring
Life on Earth	20	
Evolution, Ecology and Behaviour	20	

LIFE ON EARTH (LIFE1030)

Semester Taught: Full Year **Credits:** 20

Style of Teaching: Lectures and Lab Practicals

Module Convenor: Dr Thomas Hartman

Assessment (s): 50% Coursework (class tests based on practical work); 50% Exams

Overview: This module introduces students to the vast range of living (and many extinct) species to be found on Earth. The conditions for life will be discussed and whether these conditions may be found in other parts of the solar system. The various domains of life will be explored with due attention to the archea and eubacteria and then detailed views of the eukaryotes. Issues of how they arose and how the process of endysymbiosis added much more complexity will be examined. Questions about the processes that drove the evolution of complexity and multicellularity, the development of mitosis, meiosis and the production of asymmetrical gametes will be considered. Within the context of the most recent phylogenetic trees the distribution of phyla will be examined in detail with the most complex groups, fungi, animals and plants being targeted for special consideration. The animal kingdom will be examined in detail looking at the relationships of many of the phyla and how this complexity arose. The course will emphasise our current understanding of biodiversity and how a simple morphological-based taxonomy has been shaken up by current molecular techniques. The module concentrates on the unity and diversity of life set in an evolutionary context and how the genotype gives rise to both phenotype and behaviour.

EVOLUTION, ECOLOGY AND BEHAVIOUR (LIFE1031)

Semester Taught: Full Year **Credits:** 20

Style of Teaching: Lectures, Practicals and Workshops

Module Convenor: Dr Kate Durrant

Assessment (s): 48% Coursework (based on practical work); 52% Exams

Overview: This module provides an introduction to the fundamentals of evolution, ecology and behaviour. Evolutionary processes are explored from a variety of approaches, from the fossil record, through adaptation, speciation and the study of phylogenetics and how it shapes the tree of life, right up to the cutting edge of genomic evolution. Modern ecology has never been a more important subject than now, a result of our major environmental problems. In this module ecological topics are explored by examining ecosystem processes, competition, predation, pathogens, parasites and disease, life histories, resources, niches, demographic processes, and sustainability. Understanding animal behaviour in response to their ecosystem begins with asking rigorous questions about foraging, signalling, sexual selection, parental care, altruism and also allows us to understand human behaviour in an evolutionary context.

Cancer Science Y1

Module Title	Autumn	Spring
Hallmarks of Cancer	20	
Causes and Consequences of Cancer		20

HALLMARKS OF CANCER (ONCG1001)

Semester Taught: Autumn **Credits:** 20

Style of Teaching: Lectures, Practicals and Workshops

Module Convenor: Professor Kevin Gaston

Assessment (s): 30% In-Class Tests (based on practical work), 70% Exam

Overview: This module considers:

- The hallmarks of cancer and their importance
- Control of the cell cycle and cell cycle misregulation in cancer
- Oncogenes and tumour suppressor genes
- Genome instability and mutation
- The misregulation of cellular energetics in cancer
- The importance of the immune system in cancer

CAUSES AND CONSEQUENCES OF CANCER (ONCG1002)

Semester Taught: Spring **Credits:** 20

Style of Teaching: Lectures, Practicals and Workshops

Module Convenor: Professor Kevin Gaston

Assessment (s): 10% Project, 20% Essay, 70% Exam

Overview: This module considers:

- The incidence and prevalence of cancer
- Epidemiology and the causes of cancer
- Cancer diagnosis (biochemistry, molecular biology, and histopathology)
- Cancer treatment (surgery, radiotherapy, and chemotherapy)
- Care for cancer patients (palliative care and recovery)

Chemistry Y1

Module Title	Autumn	Spring
Fundamental Chemistry Theory and Practical	40	

FUNDAMENTAL CHEMISTRY: THEORY AND PRACTICAL (CHEM1020)

Semester Taught: Full Year **Credits:** 40

Style of Teaching: Lectures, Lab Practicals, Workshops and Tutorials

Module Convenor: Dr Anna Bertram & Dr Kyle Galloway

Assessment (s): 35% Coursework (30% Practical Reports; 5% PeerWise Assessment); 65% Exams (x2)

Overview:

Inorganic: Atomic structure; Quantum numbers; Electronic configuration; Building the periodic table using theory; Periodicity; Chemical bonding; Lewis structures; Molecular shape and symmetry; Intermolecular interactions; Ligands and how they coordinate to metal centres; Bonding in transition metal complexes; Crystal field and molecular orbital theory; Geometries of complexes and isomerism; UV/vis spectroscopic and magnetic properties of octahedral, tetrahedral and square planar complexes; Reaction kinetics and thermodynamics; Trends in the properties of d-block element complexes.

Organic: Bonding, Structure and reactivity of organic molecules; Shapes and electronic properties of organic molecules; Classification of reactions and reaction components; Reaction mechanisms, 'Curly arrows', Nucleophilic substitution, Elimination reactions; Core carbonyl chemistry: Reactions and mechanisms; Chemistry of carboxylic acid derivatives: reactions and mechanisms; Functional group interconversions including redox chemistry; Synthesis using functional group interconversions and carbonyl chemistry.

Physical: Quantum theory; Bonding; Molecular orbitals; Vibrational and NMR spectroscopy; Intermolecular forces; Thermodynamics; Reaction kinetics; Electrochemistry.

Formative feedback is given on the theory in this module at the associated workshops and tutorials. Summative feedback is provided after the exam by the module staff.

Practical: This module introduces the essential qualitative and quantitative laboratory skills which are required in Inorganic, Organic and Physical chemistry. As well as performing experiments and collecting and using appropriate data, students will be required to produce written reports of their experimental work. Each laboratory component is a non-compensatable module element. In order to pass the module students must attain a mark of at least 40% in each laboratory component (i.e. inorganic laboratory practical, organic laboratory practical, physical laboratory practical).

Earth Science Y1

Module Title	Autumn	Spring
Environmental Geoscience		20
Optional Modules 20 credits (one module) from the following:		
Global Environmental Processes	20	
Physical Landscapes of Britain	10	
Introduction to GIS		10
On Earth and Life		10

ENVIRONMENTAL GEOSCIENCE (BIOS1013) *Prerequisite for: Minerology & Petrology, Sedimentology & Palaeontology*

Semester Taught: Spring **Credits:** 20

Style of Teaching: Lectures and Practicals

Module Convenor: Dr Barry Lomax

Assessment (s): TBC

Overview: Introduces basic geological skills, understanding and interpreting geological information, Knowledge of geology in the context of Ecosystem & Environment. Bulk properties of the Earth, Minerals, Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks, Geological Time, Tectonics, Geological Structures, Map interpretation, Geological hazards, Resource Geology.

GLOBAL ENVIRONMENTAL PROCESSES (BIOS1004)

Semester Taught: Autumn **Credit:** 20

Style of Teaching: Lectures

Module Convenor: Dr Liz Bailey

Assessment (s): 30% Coursework (Video Presentation), 70% Exam

Overview: The unifying theme of this module is biogeochemical cycling - the production, distribution and cycling of materials on the Earth and their availability to, and use by, biological organisms. The introduction covers the history of the universe, from the big bang to the evolution of the Earth's surface environment, via formation of galaxies, stars, elements and the solar system. Then we describe the major global systems and their circulations as they are today - solids (plate tectonics, formation and erosion of crustal rocks), liquids (oceans, temperature and salinity gradients) and gases (atmosphere, weather and climate). In the final section we examine the major materials - including carbon, nitrogen, sulphur, oxygen and metals - and their budgets and cycles; and the interactions between biological and physical/chemical processes on a global scale.

PHYSICAL LANDSCAPES OF BRITAIN (GEOL1001) *Prerequisite for: Minerology & Petrology*

Semester Taught: Autumn **Credits:** 10

Style of Teaching: Lectures and Practicals

Module Convenor: Dr Matt Jones

Assessment (s): 100% Exam

Overview: This module provides an understanding of the history and origins of the Earth and its life and landforms through consideration of the following topics using the British Isles as a case study:

- Tectonic History of Britain
- Environmental changes over geological time and associated rock types
- Geomorphology of typical British landscapes.

INTRODUCTION TO GEOGRAPHIC INFORMATION SCIENCES (GEOG1010) *Prerequisite for: Spatial Decision Making*

Semester Taught: Spring Credits: 10

Style of Teaching: Lectures and Practicals

Module Convenor: Dr Gary Priestnall

Assessment (s): TBC

Overview: The module provides students with the theoretical background and practical training to undertake basic spatial analysis within a contemporary Geographic Information System (GIS). It is built upon a structured set of paired theory lectures and practical sessions, supported by detailed theory topics delivered via Moodle, which contain linkages to associated textbook resources. It aims to ensure competency in the use of a contemporary GIS software package whilst developing transferable ICT skills. It also encourages students to develop the analytical skills necessary for the creation of workflows that utilise the built-in analytical functionality of a GIS to solve a spatial problem.

Specific topics covered are:

- What is GIS?
- Cartographic principles behind GIS
- Spatial data models and database management systems
- Fundamental spatial analysis
- Presenting the results of GIS analysis

ON EARTH AND LIFE (GEOG1014) *Useful for Sedimentology and Palaeontology*

Semester Taught: Spring Credits: 10

Style of Teaching: Lectures

Module Convenor: Dr Richard Field

Assessment (s): 100% Exam (1hr MCQ)

Overview: On Earth and Life is a ten-credit module that explores the deep historical co-evolution of Earth and Life and emphasizes uniqueness of place and historical contingency. The module leads on from and complements Physical Landscapes of Britain in exploring geological, plate tectonic and palaeoenvironmental ideas and research, but at the global scale. It emphasizes the role of life in creating past and present planetary environments, and conversely the role of environment and environmental change in the evolution and geography of life.

- How to do science when it focuses on the deep past
- The nature of geological evidence
- Early life on the young Earth
- Carbon cycling
- The Great Oxygenation Event
- Snowball Earth
- What molybdenum tells us
- Skeletons in the rocks
- Black Earth
- Warm-blooded vs cold-blooded
- The Great Dying
- Outliving *Tyrannosaures rex*
- The geography of evolution
- Evolutionary hotspots
- Maori mystery
- Human origins

Ecosystem and Environment Y1

Module Title	Autumn	Spring
Planet Earth: Exploring the Physical Environment	20	
Optional Modules 20 credits from the following:		
The Ecology of Natural and Managed Ecosystems	20	
Physical Landscapes of Britain	10	
Climate, Atmosphere and Oceans		10
On Earth and Life		10

PLANET EARTH: EXPLORING THE PHYSICAL ENVIRONMENT (GEOL1002) *Prerequisite for: Global Climate Change*

Semester Taught: Full Year **Credits:** 20

Style of Teaching: Lectures

Module Convenor: Dr Giles Foody

Assessment (s): 100% Exams (x2)

Overview: This module integrates knowledge of hydrological, geomorphological and ecological processes to inform an understanding of global systems and environmental change. The module considers:

- Principles of key systems such as the hydrological, fluvial and geomorphological
- Principles of biogeography and ecology
- Principles of environmental change and monitoring by remote sensing.

THE ECOLOGY OF NATURAL AND MANAGED SYSTEMS (BIOS1016)

Semester Taught: Autumn **Credits:** 20

Style of Teaching: Lectures and Practicals

Module Convenor: Dr Helen West & Dr Ruth Blunt

Assessment (s): 50% Coursework & 50% Exam

Overview: The module covers: evolutionary aspects of ecology. Organisms and their environment: physical, chemical and biotic factors limiting species distribution; capture and utilization of resources by organisms; the niche concept; life cycles and dispersal. Population Ecology: intraspecific and interspecific competition; predation; parasitism and mutualism. Community Ecology: diversity and stability of communities; patterns of species richness; the concept of a climax community; energy flow and nutrient cycling. The module explores definitions of biodiversity and explores the value of biodiversity through different ethical frameworks. The loss of species and habitats is discussed with particular reference to semi natural and managed habitats such as woodland, hedgerows, meadows, and farmland.

PHYSICAL LANDSCAPES OF BRITAIN (GEOL1001)

Semester Taught: Autumn **Credits:** 10

Style of Teaching: Lectures and Practicals

Module Convenor: Dr Matt Jones

Assessment (s): 100% Exam

Overview: This module provides an understanding of the history and origins of the Earth and its life and landforms through consideration of the following topics using the British Isles as a case study:

- Tectonic History of Britain
- Environmental changes over geological time and associated rock types
- Geomorphology of typical British landscapes.

CLIMATE, ATMOSPHERE AND OCEANS (BIOS1052)

Semester Taught: Spring Credits: 10

Style of Teaching: Lectures, Practicals, Field Work & Seminars

Module Convenor: Dr Kamal Alskaf

Assessment (s): 100% Exam

Overview: Introduces key components of the Earths circulation systems and how those contribute to determining the Earth's climate on regional scales. It provides an overview of weather formation, atmospheric and ocean chemistry, large scale ocean circulation patterns, and Earth's resulting climatic zones. Introduce concepts of climate and how that impacts on functioning of the Earths ecosystems. Develop process based understanding practical as well as the spatial distribution of weather patterns and ocean currents. Using models and field measurements of air flow to test how energy is transported. Scale, rates, distribution and causes of weather systems and the implications of this for global climate change. We will examine the linkages between weather systems and ocean currents.

ON EARTH AND LIFE (GEOG1014) *Useful for Environmental Change and Patterns of Life*

Semester Taught: Spring Credits: 10

Style of Teaching: Lectures

Module Convenor: Dr Richard Field

Assessment (s): 100% Exam

Overview: On Earth and Life is a ten-credit module that explores the deep historical co-evolution of Earth and Life and emphasizes uniqueness of place and historical contingency. The module complements (but does not require) Physical Landscapes of Britain in exploring geological, plate tectonic and palaeoenvironmental ideas and research, but at the global scale. It emphasizes the role of life in creating past and present planetary environments, and conversely the role of environment and environmental change in the evolution and geography of life.

- How to do science when it focuses on the deep past
- The nature of geological evidence
- Early life on the young Earth
- Carbon cycling
- The Great Oxygenation Event
- Snowball Earth
- What molybdenum tells us
- Skeletons in the rocks
- Black Earth
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- The Great Dying
- Outliving *Tyrannosaures rex*
- The geography of evolution
- Evolutionary hotspots
- Maori mystery
- Human origins

Mathematics Y1

Module Title	Autumn	Spring
Calculus and Linear Algebra	40	

CALCULUS AND LINEAR ALGEBRA (MTHS1001)

Semester Taught: Full Year **Credits:** 40

Style of Teaching: Lectures, Workshops, Computing Workshops and Tutorials

Module Convenor: Dr R Symonds

Assessment (s): 25% Coursework (mix of problem based and computing courseworks); 75% Exams (x2)

Overview: The course consolidates core GCE mathematical topics in the differential and integral calculus of a function of single variable and used to solve some classes of differential equations. Basic theory is extended to more advanced topics in the calculus of several variables. In addition, the basic concepts of complex numbers, vector and matrix algebra are established and extended to provide an introduction to vector spaces. Students are introduced to different types of proof, such as direct proof, proof by contradiction and proof by induction, as well as theorems and tests for determining the limits of sequences and series. An emphasis in the course is to develop general skills and confidence in applying the methods of calculus and developing techniques and ideas that are widely applicable and used in subsequent modules. Students will be use a computer package to plot graphs and implement basic algorithms.

Major topics include:

- Differential and integral calculus of a single variable;
- Differential equations;
- Differential calculus of several variables;
- Multiple integrals;
- Complex numbers;
- Matrix algebra;
- Vector algebra and vector spaces;
- Logic and proof;
- Limits of sequences;
- Limits of series;
- Use of a computer package.

Physics Y1

Module Title	Autumn	Spring
From Newton to Einstein	40	

FROM NEWTON TO EINSTEIN (PHYS1001)

Semester Taught: Full Year **Credits:** 40

Style of Teaching: Lectures and Tutorials

Module Convenor: Dr R Hill

Assessment (s): 20% Continuous Assessment (Portfolio of task sheets), 80% Exams (x2)

Overview: This module is based on the textbook "Physics for Scientists and Engineers" by Knight (all first years are provided with a copy of this book). The module aims to introduce core topics in physics which will underpin all subsequent physics modules. The module begins by discussing classical mechanics in the language of vectors and the key notion of harmonic motion which is extended to cover wave phenomena. The first semester ends with an introduction to Einstein's special theory of relativity. The second semester introduces the basic ideas of electromagnetism and electrical circuits and quantum physics.

- Vectors and Coordinate systems
- Kinematics and Motion in 1D and 2D
- Newton's Laws
- Conservation Laws
- Rotation of a Rigid Body
- Micro-macro connection
- Oscillations
- Travelling Waves
- Superposition of Waves
- Galilean Relativity
- Relativity of Time
- Spacetime
- Relativistic Energy and Momentum

Psychology Y1

Biological/Neuroscience Specialism

Module Title	Autumn	Spring
Cognitive Psychology	20	
Biological Psychology	20	

COGNITIVE PSYCHOLOGY (PSGY1002)

Semester Taught: Autumn **Credits:** 20

Style of Teaching: Lectures and Workshops (details on moodle)

Module Convenor: Dr Neil Roach

Assessment (s): 25% Essay, 75% Exam

Overview: Cognitive psychology is the study of mental processes: the ways in which we gain information from the world, how that information is represented and transformed as knowledge, how it is sorted and how it is used to direct our attention and behaviour. This is our ability to perceive, comprehend, attend, store and retrieve information gained from the world. This module will introduce the methods used to investigate cognitive processes, together with summaries of principal findings in the domains of attention, perception, language, memory and thinking.

BIOLOGICAL PSYCHOLOGY (PSGY1003)

Semester Taught: Spring **Credits:** 20

Style of Teaching: Lectures and Workshops (details on moodle)

Module Convenor: Dr Emma Whitt

Assessment (s): 25% Essay; 75% Exam

Overview: Biological psychology encompasses physiological, anatomical and genetic processes as a way of understanding psychology. This module provides core knowledge about basic biological facts (anatomy, physiology, neuropsychology, genetics and evolution) before covering their involvement in both typical psychological processes and in psychological disorders (e.g., amnesia, visual agnosia, narcolepsy, obesity, Balint's syndrome, and schizophrenia).

Social and Developmental Specialism

Module Title	Autumn	Spring
Cognitive Psychology	20	
Developmental Psychology	10	
Social Psychology		10

COGNITIVE PSYCHOLOGY (PSGY1002)

Semester Taught: Autumn **Credits:** 20

Style of Teaching: Lectures and Workshops (details on moodle)

Module Convenor: Dr Neil Roach

Assessment (s): 25% Essay, 75% Exam

Overview: Cognitive psychology is the study of mental processes: the ways in which we gain information from the world, how that information is represented and transformed as knowledge, how it is sorted and how it is used to direct our attention and behaviour. This is our ability to perceive, comprehend, attend, store and retrieve information gained from the world. This module will introduce the methods used to investigate cognitive processes, together with summaries of principal findings in the domains of attention, perception, language, memory and thinking.

DEVELOPMENTAL PSYCHOLOGY (PSGY1006)

Semester Taught: Autumn **Credits:** 10

Style of Teaching: Lectures and Workshops (details on moodle)

Module Convenor: Angeliki Makra & Dr Lauren Marsh

Assessment (s): 25% Essay; 75% Exam

Overview: This module introduces students to the fascinating world of the developing child. Lectures consider different theoretical, applied and experimental approaches to cognitive, linguistic and social developmental from early to late childhood. Topics include the development of thinking, perception, drawing, understanding the mind, intelligence, attachment, language, and moral development.

SOCIAL PSYCHOLOGY (PSGY1007)

Semester Taught: Spring **Credits:** 10

Style of Teaching: Lectures and Workshops (details on moodle)

Module Convenor: Dr Stephanie McDonald

Assessment (s): 100% Exam

Overview: This module introduces students to the core topics in social psychology. Social psychology is concerned with trying to understand the social behaviour of individuals in terms of both internal characteristics of the person (e.g. cognitive mental processes) and external influences (the social environment). Lectures will cover topics on how we define the self, attitudes, attribution, obedience, aggression, pro-social behaviour and formation of friendships.

Natural Sciences Second Year Module

Nottingham Futures (NATS2001)

Recommended for: Natural Sciences & Liberal Arts Students

Semester Taught: Full Year | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Workshops & Project Work | Module Convenor: Dr C Brignell & Dr R Wilson

Assessment (s): 100% Coursework (Poster 10%, Article 20%, Review Paper 20%, Strategy Paper 30%, Presentation 20%)

Overview: This module focuses on applied knowledge asking students to engage with the research undertaken at the University of Nottingham and use it to address contemporary issues within the city. As science and technology are accelerating at a rapid rate, we are beset by dangers across the world that threaten our environment, challenge our society and endanger life on Earth. These are concerns which impact upon communities and change peoples' lives. Therefore, we need to focus our skills as scientists, humanities scholars and social science researchers but then integrate these approaches into an interdisciplinary agenda.

The University of Nottingham is at the forefront of dealing with these issues, as it is a world-leading institution for its research in six beacons of excellence:

- Rights Lab
- Precision Imaging
- Future Foods
- Propulsion Futures
- Green Chemicals
- Smart Products

Each of these areas integrates scientific applications with research from the humanities and social sciences. Within this module, workshops led by scholars from these beacons with teach students how they can apply their skills across different fields and integrate their knowledge with others to solve problems. Students will study scientific techniques and will also engage with how the social, political and cultural impact of new ideas or initiatives can be planned or understood. Once students have examined how interdisciplinary science and humanities research can be combined in these fields, they will then apply these concepts to address problems in the local area. Workshops will introduce the economic, social and environmental issues that are preventing or impairing development to meet the needs of current and future generations in Nottingham. Students will be asked to solve the question: how can we improve Nottingham's future?

In the spring semester students contribute to solving local sustainability issues by proposing policies or strategies that address issues based on the latest technological, scientific, political and social research of the university. Working in interdisciplinary teams, students can apply their disciplinary knowledge of the sciences, arts and humanities and work to improve life in Nottingham. This might be achieved through scientific advances discussed in this module, such as alterations in transport technology so that it is more efficient and less polluting; improving the design of housing to accommodate a growing population within a limited space; allowing people to feel the psychological benefits of the natural environment when there is limited access to green spaces; driving the growth in new industries that provide employment; or clearing up pollution in soil, water and air to provide health benefits. We might also consider how behavioural changes in peoples' use of public transport can be used to improve the take-up of buses or trams; understanding the historical processes that have shaped house design so we can ensure people feel 'at home' or create a sense of place in new housing areas; or how the social, philosophical and cultural experience of the city can be mapped and understood.

This module can be taken to replace 20 credits of options in the subjects you are studying in year 2.

Archaeology Y2

Compulsory	Autumn	Spring
Archaeology: Theory and Practice	20	
Optional Modules - 40 credits from the following:		
Humans-Animals-Landscapes Relationships	20	
Medieval Europe and the Mediterranean AD 500-1500	20	
The Silk Road: cultural interactions and perceptions	20	
Commodities, Consumption and Connections: the Global World of Things		20
Human Osteology		20
Rome and the Mediterranean		20
Through a Glass Darkly		20

Archaeological Research: Theory and Practice (CLAR2011)

Core for: Natural Sciences students taking Archaeology

Semester Taught: Autumn Credits: 20

Prerequisites: None Corequisites: None

Style of Teaching: Lectures and workshops Module Convenor: Dr H Miller

Assessment (s): 20% Class Test (1 hour); 80% Archaeological Interpretation Assignment (2,000 words)

Overview: Archaeological knowledge is created through rigorous and systematic analysis of material remains, and the use of theory to formulate research questions and build interpretations of those remains as evidence for societies in the past and present. Theory and practice are therefore interconnected and embedded at the heart of our discipline. In this module, teaching is led by research and focuses on the interrelationship between concepts, interpretive approaches and analytical frameworks in the design and implementation of archaeological research projects.

In the autumn semester, students will be introduced to the development of archaeological theory and interpretation, with special attention to the paradigms put forward over the last 30 years, and the ensuing debates. Topics include uniformitarianism, ethnography, typology, 'New Archaeology', processualism, post-processualism, economic archaeology and neo-Marxist paradigms. This knowledge will be further developed through more in-depth studies of key issues and themes, and through the exploration of archaeological research in a wide range of different areas and projects. Students will also develop aspects of their professional practice through the creation of a desk-based assessment for an archaeological site or project. The module assessment also incorporates a report on the student fieldwork written with reference to the theoretical components of the module.

Humans-Animals-Landscapes relationships (CLAR3014)

Semester Taught: Autumn Credits: 20

Prerequisites: None Corequisites: None

Style of Teaching: Lectures and Fieldtrip Module Convenor: Dr H Miller

Assessment (s): 100% Coursework (2,500 word Critical Report)

Overview: A module which critically explores human-(non-human)animal-landscape relationships through time, using archaeological data to reflect on themes in prehistory, history, anthropological and current interactions. Drawing directly from current research, the course would introduce resonant themes to be explored through lectures.

The aim of this module is to demonstrate how data can be drawn together from multiple sources to highlight closely interwoven human-(non-human)animal-landscape relationships. As these are often indivisible, in reality if not worldview, the themes studied in this course would allow for a nuanced understanding of past societies but also a

critical reflection of our own interactions. The periods and contents covered in this module would be broad and could be tailored by the students to fit their individual interests, teaching and research needs.

Medieval Europe and the Mediterranean AD500-1500 (CLAR3091)

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr C Loveluck

Assessment (s): 100% Coursework (3,000-word Essay)

Overview: This module considers the archaeological evidence for the development of British and European societies and their connections around the Mediterranean, Africa and across Eurasia in the medieval period (from c. AD 500-1500). This was a period of significant social, political, economic and climate change which laid the foundations of the modern world. . Key topics will include in-depth analysis of themes such as the transformation of European and Mediterranean landscapes and settlement patterns from the Fall of the Roman Empire to the Renaissance; the towns of western Europe, Byzantium and the Islamic world; the impact of climate change, epidemic disease and population growth; the rise of kingdoms, states and empires; and the development of nearly global trade networks in Europe, Africa and Asia, between AD 500 and 1500 that would culminate in permanent European settlement in the Americas. The lectures and seminars will explore interdisciplinary approaches to the examination of these topics and what they can tell us about social and economic change, ideologies and social identities over 1000 years of human history.

The Silk Road: cultural interactions and perspectives (CLAR3085)

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Prof J Henderson

Assessment (s): 100% Coursework (3,000 word Essay)

Overview: This discipline-bridging module will involve colleagues from across the three University campuses. The Silk Road will be presented as a range of archaeological, historical, geographical, political and scientific themes. Broad cultural themes will be balanced with the presentation of specific case studies, such as the Roman, Byzantine and (medieval) Islamic Silk Roads and their links with e.g. the Tang and Ming dynasties along the networks which made up the terrestrial and maritime silk and spice roads. Later examples will also be considered to provide a balance. The ways in which Silk Roads can be defined such as a consideration of trade and exchange of a wide range materials across central and eastern Asia will be considered. Furthermore scientific analysis and its role in the interpretation of trade and exchange will be considered between for example China, central Asia , Scandinavia and the Middle east. Nineteenth century and more recent perceptions of the Silk Road will be considered too. This cross-disciplinary approach will focus on a range of geographical areas during a range of time periods. Movement of peoples and things will therefore be considered from a wide range of viewpoints producing mutually enriching studies set in global contexts.

Commodities, Consumption and Connections: the Global World of Things 1500-1800 (HIST2060)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr C King

Assessment (s): 100% Coursework (2,500-word Essay 50%; Digital Project 50%)

Overview: The early modern period witnessed the birth of commodity culture and the transformation of the relationship between people and their material world. Expanding global trade networks and early colonial encounters brought a range of exotic products into early modern homes including spices, sugar, tea, tobacco, cotton, porcelain and mahogany, while the rise of capitalism and industrialisation revolutionised the manufacture and availability of necessities and luxuries across the social spectrum. The richness of this ‘new world of goods’ had profound consequences, transforming patterns of consumption, introducing new understandings of scientific knowledge and cultural production, and reshaping social identities and relationships based on class, gender and race.

This module takes advantage of a sweep of new interdisciplinary perspectives across a range of subject areas, including social, economic and cultural history, archaeology, anthropology and art history, which have focused on the role and significance of early modern 'things'. Students will gain a fresh and stimulating grounding of central themes in early modern history as well as a deeper understanding of the importance of looking at early modern Europe as part of a globalising world. Students will explore a range of textual sources including wills and inventories, account books, letters and diaries which tell us about expanding global connections, what people consumed and how they thought about their objects. They will also be taught key methods and approaches for using physical objects, archaeological finds, museum collections and visual culture as primary sources for understanding early modern culture through the lens of object meanings, agency and networks, with opportunities for hands-on and digital engagement with sources of evidence. This interdisciplinary approach will enable students to understand the ways in which the study of material culture can provide fresh insights into everyday lives in the past and can also illuminate larger cultural histories and concerns.

Human Osteology (CLAR3086)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals and Fieldtrip | Module Convenor: Dr H O'Regan

Assessment (s): 40% In-Class Lab Tests x 2; 60% 2,000-word Lab Report

Overview: This module will examine what we can learn from the human skeleton, about the lives of people who lived in the past. We will also include some basic zooarchaeology to understand the similarities and differences between these two specialisms. The module will involve handling real archaeological human and non-human skeletons, learning how to identify their age, sex, stature, pathologies and taphonomy. We will also examine the demography of 19th century Nottingham on a fieldtrip to one of the city's largest (and most atmospheric) cemeteries.

This module will introduce students to human and non-human skeletons, and the information that can be gained from them, including aging, sexing, stature, pathology and isotope analysis. Sampling strategies, data collection and analysis will also be covered using data collected by the students themselves on a fieldtrip. The aim of the module is to make students confident in handling human and zooarchaeological remains, to have the background necessary to undertake final year dissertations on either human remains or zooarchaeology, and to teach some basic data visualisation and analysis.

Rome and the Mediterranean (CLAR3007)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr W Bowden

Assessment (s): 100% Coursework (3,500 word Essay 75%; Presentation and Reflective Statement 25%)

Overview: The module will examine the archaeological evidence for the Roman period in Italy and the Mediterranean from c. 300 BC to c. AD 550, in the context of the major social, cultural and economic changes of the region in this period and in the context of wider historical and archaeological approaches to the Mediterranean. It is aimed in particular at developing students' skills in using and understanding source material. Subjects covered include the evidence for use of rural and urban landscapes, public and domestic building and the Mediterranean economy.

Through a Glass Darkly (CLAR3003)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals and Seminars | Module Convenor: Prof J Henderson

Assessment (s): 100% Coursework (4,000-word Essay 70%; Seminar 30%)

Overview: Glass is a unique material with some unusual properties that were used in past societies in a wide range of ways. Archaeological, ethnographic, historical and scientific approaches will all be used to answer cultural questions about the production and use of glass in past societies. All seminars and lectures will consist of a rich interdisciplinary

mix of approaches to ancient glass. The module uses archaeological case studies extensively and covers glass from the earliest made in the 3rd millennium BC up to the medieval period. Geographically we will cover glass that occurs in the West, the Middle East and as far away as China.

In practical sessions students will get the chance to handle ancient glass of a range of dates, including evidence for its production and to identify what it was used for. Students will work hot glass themselves in the Ancient Technology lab in Humanities – such as decorated glass bead making. They will also see at first hand through the use of University analytical equipment how the scientific analysis of glass can answer questions about ancient glass technology and provenance.

All lectures and discussion groups will be presented in a way that involves students and to encourage them to voice their opinions about different aspects of the study of ancient glass. The seminars in particular will give students the opportunities to develop a presentation and allow them think in detail about interpretations.

Biology Y2

Biology - Molecular Biology and Genetics Specialism

Compulsory	Autumn	Spring
The Genome and Human Disease	20	
Bacterial Genes and Development		10
Microbial Biotechnology		10
Optional Modules - 20 credits from the following:		
Evolutionary Biology of Animals	10	
Infection and Immunity	20	
Developmental Biology		10
Neurobiology of Disease		20

The Genome and Human Disease (LIFE2072)

Core for: Natural Sciences Biology on the Molecular Biology and Genetics Specialism

Semester Taught: Full Year — Credits: 20

Prerequisite: Genes, Molecules and Cells — Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals — Module Convenor: Dr A Chambers

Assessment (s): 10% Practical Assessments; 30% Rogo Exam (1hr), 60% Exam (2hr)

Overview: In this module you will learn about the structure and function of the eukaryotic genome, including that of humans, and the approaches that have led to their understanding. You will learn about techniques that are employed to manipulate genes and genomes and how they can be applied to the field of medical genetics. By using specific disease examples, you will learn about the different type of DNA mutation that can lead to disease and how they have been identified. Practical elements will teach you about basic techniques used in medical genetics such as sub-cloning of DNA fragments into expression vectors. Practical classes and problem based learning will be used to explore the methods used for genetic engineering and genome manipulation.

Bacterial Genes and Development (LIFE2009)

Core for: Natural Sciences Biology on the Molecular Biology and Genetics Specialism

Semester Taught: Spring — Credits: 10

Prerequisites: Genes, Molecules and Cells — Corequisites: None

Style of Teaching: Lectures — Module Convenor: Prof R Sockett

Assessment (s): 100% Exam (2hr)

Overview: This module aims to describe in some detail the molecular events, which occur during the control of gene expression in bacteria. The material covered will begin with simple control circuits, followed by case studies, which show how complex developmental programmes can occur in response to environmental stimuli. Examples of gene regulation in pathogenic bacteria are also included.

Microbial Biotechnology (LIFE2020)

Core for: Natural Sciences Biology on the Molecular Biology and Genetics Specialism

Semester Taught: Spring — Credits: 10

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures — Module Convenor: Prof S Avery & Dr Y Zhang

Assessment (s): 100% Essay-based Exam

Overview: The aim of the course is to describe the use of yeasts, filamentous fungi and bacteria in biotechnology as it relates to the food, agriculture, medicine and other industries. The course will demonstrate how an understanding of the biology and genetics of microorganisms allows their use as cell factories for the production, and models for the discovery, of enzymes and metabolites. The course will also explore how microbial activities themselves can be exploited in processes ranging from food production to biocontrol of disease-causing organisms. The course will cover the key types of product, metabolic pathways, their regulation at the gene level, and methods for strain improvement including the use of recombinant DNA technology for ameliorating product yield and the synthesis of new products. The impact of genomics and systems biology on microbial biotechnology will be presented.

Evolutionary Biology of Animals (LIFE2046)

Semester Taught: Autumn | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr A Davidson

Assessment (s): 100% Exams (MCQ & Essay Exam)

Overview: Evolutionary thinking is overarching all disciplines in zoology and genomics studies. The main aim of this module is to introduce the student to key evolutionary concepts. It is expected to place the student's scientific interests into the broad context of evolutionary biology and to act as a support to the modules offered in subsequent academic years. The module is aimed at zoologists as well as molecular biologists and geneticists.

1. History of evolutionary thinking
2. Genome evolution
3. Natural selection versus genetic drift
4. Adaptation, speciation and population structure
5. Population differentiation and phylogeography
6. Sexual selection
7. Domestication
8. Human evolution
9. Palaeontology, macroevolution and extinction
10. Guest speaker and revision session.

Infection and Immunity (LIFE2080)

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures & Lab Practicals | Module Convenor: Dr P Tighe

Assessment (s): 20% Lab Reports (x2), 20% ROGO Exam (1hr), 60% ROGO Exam (2hr - MCQ & Essay Exam)

Overview: In this module you will study basic immunology, learning about the organs, cells and molecules of the immune system and the mechanisms engaged in the generation an of immune response to pathogens. You will learn by studying examples of types of human pathogens (viral, bacterial, fungal, protozoa and helminths), the varied nature of the immune response, depending on the pathogen, its niche(s) in the host and pathogen strategies for invading and surviving in the host. You will learn how immunological methods can be effectively utilized for disease diagnosis and vaccine development, and about the consequences of failure of normal immune function, including autoimmunity and hypersensitivity.

Developmental Biology (LIFE2016)

Semester Taught: Spring | Credits: 10

Prerequisite: Recommended Genes, Molecules and Cells | Corequisite: None

Style of Teaching: Lectures | Module Convenor: Prof A Johnson

Assessment (s): 100% Exam (2hr)

Overview: This module is designed to introduce students to the basic concepts of vertebrate embryonic development and the molecular mechanisms underlying these processes. Maternal determinants, inductive signalling, the cell movements of gastrulation, tissue differentiation and stem cells including embryonic stem cells, will be covered. Specific topics to be discussed will include germ cells, blood and muscle cell differentiation, left-right asymmetry and miRNA. There will be a strong emphasis on the major methodological breakthroughs that have enabled vertebrate development to be understood at the genetic and biochemical levels. These will include model organisms such as Xenopus, zebra fish, chicken and mouse.

Neurobiology of Disease (LIFE2071)

Semester Taught: Spring

Credits: 20

Prerequisite: First Year Neuroanatomy

Corequisites: None

Style of Teaching: Lectures and Seminars

Module Convenor: Prof K Fone

Assessment (s): 100% Rogo Exam (2hr)

Overview: This module provides an understanding of the underlying neurophysiology and pathology associated with several common CNS disorders and the neuropharmacology of currently available medication. It also describes the neurotransmitters and pathways involved in normal brain function and provides a broad understanding of how changes in these contribute to abnormal function. The module also explains the pharmacological mechanism of drugs used to treat these CNS disorders.

Biology – Evolutionary Biology and Ecology Specialism

Module Title	Autumn	Spring
Ecology	20	
The Green Planet		20
Optional Modules - 20 credits from the following:		
Building Brains	20	
Evolutionary Biology of Animals	10	
Infection and Immunity	20	
Reproductive Physiology	10	
Animal Behaviour & Physiology		20

Ecology (LIFE2081)

Core for: Natural Sciences Biology on the Evolutionary Biology & Ecology Specialism

Semester Taught: Autumn

Credits: 20

Prerequisite: Evolution, Ecology & Behaviour

Corequisites: None

Style of Teaching: Lectures, Discussions and Computing Practicals

Module Convenor: Dr S Evison

Assessment (s): 40% Coursework (20% Data Analysis Quiz, 20% Essay) & 60% Exam (1hr ROGO exam)

Overview: Ecology is the study of how natural systems are structured. This includes understanding how populations grow and change, how interactions among species form communities, and how biogeographical patterns across the Earth are generated. Applications will focus on sustainable management, conservation and predicting responses of the natural world to human impacts. The module will reveal core processes underpinning general patterns in nature, illustrated through case studies from a wide range of organisms and habitats.

The Green Planet (BIOS2075) – University Park

Core for: Natural Sciences Biology on the Evolutionary Biology & Ecology Specialism

Semester Taught: Spring | Credits: 20

Prerequisite: Life on Earth | Corequisites: None

Style of Teaching: Lectures and Lab Practicals | Module Convenor: Dr S Lydon & Prof M Bennett

Assessment (s): 33% Coursework (Lab Report); Formative Group Poster & 67% ROGO Exam (1.5hr)

Overview: This module considers plant evolution from a functional perspective:

- Green Oceans & green lakes
- Green Land: key challenges
- Soils and symbioses
- Foraging: Rhizoids & roots, emergence of structures
- Transport: evolving structures to move water and nutrients
- Harvesting light: cuticle & stomata to modern leaves
- Growing Up: vascular tissues
- Escaping the need for water for reproduction: Seeds
- Co-evolution of plants and animals: flowers, fruits & herbivory

Building Brains (LIFE2061)

Semester Taught: Autumn | Credits: 20

Prerequisite: Life on Earth and Y1 Neuroanatomy | Corequisites: None

Style of Teaching: Lectures and Practical Workshops | Module Convenor: Dr A Renault & Dr T Farr

Assessment (s): 30% Coursework (Moodle test x 2) & 70% Exam (2hr ROGO exam)

Overview: This module will enable students to understand how the nervous system develops, is organised and processes information. Students will understand how comparative studies and evolutionary concepts help us understand the development, structure, and function of the mammalian brain. Students should be able to explain how the nervous system develops, is organised, and processes information. This will be achieved through presentation of comparative invertebrate and vertebrate studies, consideration of evolutionary concepts, and a detailed analysis of the development, structure, and function of the mammalian brain. The lecture sessions are complemented by workshops on Drosophila and chick embryo development, on the neuroanatomy of the human spinal cord, and dissection of pig brains subject to the availability of tissue.

Evolutionary Biology of Animals (LIFE2046)

Semester Taught: Autumn | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr A Davidson

Assessment (s): 100% Exams (MCQ & Essay Exam)

Overview: Evolutionary thinking is overarching all disciplines in zoology and genomics studies. The main aim of this module is to introduce the student to key evolutionary concepts. It is expected to place the student's scientific interests into the broad context of evolutionary biology and to act as a support to the modules offered in subsequent academic years. The module is aimed at zoologists as well as molecular biologists and geneticists.

1. History of evolutionary thinking
2. Genome evolution
3. Natural selection versus genetic drift
4. Adaptation, speciation and population structure
5. Population differentiation and phylogeography
6. Sexual selection
7. Domestication

8. Human evolution
9. Palaeontology, macroevolution and extinction
10. Guest speaker and revision session.

Infection and Immunity (LIFE2080)

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures & Lab Practicals | Module Convenor: Dr P Tighe

Assessment (s): 20% Lab Reports (x2), 20% ROGO Exam (1hr), 60% ROGO Exam (2hr - MCQ & Essay Exam)

Overview: In this module you will study basic immunology, learning about the organs, cells and molecules of the immune system and the mechanisms engaged in the generation an of immune response to pathogens. You will learn by studying examples of types of human pathogens (viral, bacterial, fungal, protozoa and helminths), the varied nature of the immune response, depending on the pathogen, its niche(s) in the host and pathogen strategies for invading and surviving in the host. You will learn how immunological methods can be effectively utilized for disease diagnosis and vaccine development, and about the consequences of failure of normal immune function, including autoimmunity and hypersensitivity.

Reproductive Physiology (BIOS2011)

Semester Taught: Autumn | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Lab Practicals | Module Convenor: Dr R Anand-Ivell

Assessment (s): 100% Coursework (2x ROGO Class Tests 1x 70%, 1x 30%)

Overview: Reproductive Physiology of both male and female mammals including comparative information for farm animals and human. Reproductive physiological processes and their regulation from gametogenesis to fertilization and preparations for a successful pregnancy. Development of mammary glands and hormonal regulation of lactation will also be discussed. Principal features of avian reproduction and the avian maintenance of calcium homeostasis for efficient egg formation. Hormonal regulation of egg laying with emphasis on the nutritional and metabolic challenges associated with commercial rates of egg lay.

Hands-on practical's have been changed to online dissection demonstrations that are performed by experts and are very nicely recorded. This helps students to understand the taught subject matter and provide additional understanding when observing live dissection. This can be viewed multiple times and helps students when preparing for assessment.

Animal Behaviour & Physiology (LIFE2060)

Semester Taught: Spring | Credits: 20

Prerequisites: Life on Earth & Evolution, Ecology & Behaviour | Corequisites: None

Style of Teaching: Lectures, Lab Practicals and Workshops | Module Convenor: Dr K Durrant

Assessment (s): 30% Coursework (Moodle exercises related to practical work x2), 70% Exam (2hr ROGO & Essay Exam)

Overview: This module provides a comprehensive introduction to the study of animal behaviour, from the physiological and genetic bases of behaviour to its development through learning and its adaptive significance in the natural environment. Practical classes will demonstrate the physiological basis of fundamental behaviours. Using examples from across the animal kingdom, it emphasises how predictive modelling, experimental and observational approaches integrate to explain how and why animals behave as they do.

Cancer Sciences Y2

Module Title	Autumn	Spring
Students take 60 credits from:		
Angiogenesis and Tumour-Host Interactions	20	
Cancer Cell Genetics	20	
Colorectal Cancer and Ovarian Cancer	20	
Lung Cancer and Breast Cancer		20

Angiogenesis and Tumour-Host Interactions (ONCG2001)

Semester Taught: Autumn — Credits: 20

Prerequisites: Genes, Molecules and Cells &Hallmarks of Cancer — Corequisites: None

Style of Teaching: Lectures, Lab Practicals and Workshops — Module Convenor: Andrew Benest

Assessment (s): 100% Coursework (40% 1,000-word Essay, 40% Presentation, 20% Data Analysis Worksheet)

Overview: The module is capped at 100 students due to the requirement for practical classes. Existing teaching spaces will be used. Required resources including laboratory equipment where appropriate have been budgeted and sourced. This module considers:

- Angiogenesis and the role of angiogenic growth factors
- Angiogenesis in renal, colorectal and other cancers
- Anti-angiogenic cancer therapy
- The tumour microenvironment with respect to vessel formation and immune cell infiltration
- An introduction to immunology, immunity, and checkpoint inhibitors
- Immunotherapy for melanoma and other cancers

Cancer Cell Genetics (ONCG2002)

Semester Taught: Autumn — Credits: 20

Prerequisites: Genes, Molecules and Cells &Hallmarks of Cancer — Corequisites: None

Style of Teaching: Lectures, Computer Workshops and Tutorials — Module Convenor: Dr A Shams-Nateri

Assessment (s): 100% Coursework (40% 1,000-word Essay, 40% Presentation, 20% Data Analysis Worksheet)

Overview: This module considers:

- Genetic polymorphisms and genome-wide association studies
- Chemical, viral, and radiation induced DNA damage and tumourigenesis
- Cancer cell genomics and the 100,000 genome project
- Cancer cell transcriptomics and epigenomics
- Precision medicine in cancer treatment

To understand the causes of genetic changes in cancer cells and the evolution of the cancer cell genome during cancer progression. To understand the tools that are used to study the cancer cell genome, epigenome, and transcriptome and how these tools can guide precision medicine.

Colorectal Cancer and Ovarian Cancer (ONCG2003)

Semester Taught: Autumn — Credits: 20

Prerequisites: Genes, Molecules and Cells &Hallmarks of Cancer — Corequisites: None

Style of Teaching: Lectures, Computer Workshops and Tutorials — Module Convenor: Prof M Ilyas

Assessment (s): 100% Coursework (40% 1,000-word Essay, 40% Presentation, 20% Data Analysis Worksheet)

Overview: This module considers:

- DNA repair mechanisms and the role these play in genetic stability
- Cancer stem cells and tumourigenesis
- Colorectal cancer progression to invasion and metastasis
- Ovarian cancer and drug resistance mechanisms

To describe DNA repair mechanisms and outline their importance in tumourigenesis with reference to colorectal cancer and other cancers. To understand the concept of the stem cell niche and the cancer stem cell. To understand cancer progression as exemplified by colorectal cancer. To understand the acquisition of drug resistance as exemplified by ovarian cancer.

Lung Cancer and Breast Cancer (ONCG2004)

Semester Taught: Spring | Credits: 20

Prerequisites: Genes, Molecules and Cells & Hallmarks of Cancer | Corequisites: None

Style of Teaching: Lectures, Practical Workshops and Tutorials | Module Convenor: S Johnson

Assessment (s): 30% Coursework (20% 1,000-word Essay, 10% Data Analysis Worksheet) & 70% MCQ Exam

Overview: This module considers:

- Tobacco-induced mutations, fibrosis, and lung cancer
- Growth factor biology and breast cancer
- Oestrogen and anti-oestrogen treatment
- Androgens and prostate cancer

To describe the importance of tobacco-induced mutations in lung cancer and the role of oncogenes and tumour suppressor genes in this disease. To describe the importance of growth factor signalling in breast cancer and breast cancer treatment and the evolution of drug resistance. To outline the role of oestrogen in breast cancer and the use of anti-oestrogens. To compare breast cancer and prostate cancer discussing androgens and prostate cancer treatment.

Chemistry Y2

Chemistry - Organic-Inorganic Specialism (compulsory with Biology)

Module Title	Autumn	Spring
Core Laboratory Work	20	
Intermediate Inorganic Chemistry	10	
Intermediate Organic Spectroscopy & Stereochemistry	10	
Intermediate Synthetic Organic Chemistry		10
Optional Modules - 10 credits from the following:		
Principles of Analytical Chemistry	10	
Sustainable Chemistry	10	

Core Laboratory Work (CHEM2009)

Core for: Natural Sciences Chemistry Y2

Semester Taught: Full Year (Labs will be in one semester or the other) Credits: 20

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: Y2 Chemistry Theory

Style of Teaching: Laboratory Practicals

Module Convenor: Dr A Bertram

Assessment (s): 100% Coursework (Laboratory Performance and Reports)

Overview: This module builds on the practical, analytical and communication skills acquired in the first year and introduces more advanced experiments across Inorganic and Physical chemistry. Increasing use is made of spectroscopic and other analytical techniques in the characterisation of compounds. More detailed laboratory reports will be required. Each laboratory component is a non-compensatable module element. In order to pass the module students must attain a mark of at least 40% in each laboratory component (in inorganic & physical laboratory practicals).

Intermediate Inorganic Chemistry (CHEM2012)

Core for: Natural Sciences Chemistry Y2

Semester Taught: Full Year Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: None

Style of Teaching: Lectures, Tutorials and Workshops Module Convenor: Dr K Galloway

Assessment (s): 100% Exam

Overview: Organometallic nomenclature and principal reaction types. Synthesis of compounds with metal-carbon bonds, and their bonding and reactivity. Main Group Chemistry including the reactions of main group elements and their components. The use of symmetry and Group Theory to fully analyse vibrational spectroscopic data. Trends in the chemical properties within a group and across a period. Selected recent highlights in inorganic chemistry. The use of multinuclear NMR spectroscopy as a tool for the characterisation of molecules.

Intermediate Organic Spectroscopy and Stereochemistry (CHEM2002)

Core for: Natural Sciences Chemistry Y2 Organic and Inorganic Specialism

Semester Taught: Autumn Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: None

Style of Teaching: Lectures, Workshops and Tutorials Module Convenor: Prof S Woodward

Assessment (s): 100% Exam (2hr)

Overview: The module provides both a theoretical description of modern spectroscopic techniques (NMR, IR, and mass spectrometry) for structural analysis of organic and biological molecules and practical applications of these techniques in problem solving and structural analysis. Aspects of the stereochemistry of bio-organic molecules are covered, including prochirality, molecular chirality and properties of non-racemic compounds, conformational analysis and aspects of stereocontrol in bio-organic reactions are developed.

Intermediate Synthetic Organic Chemistry (CHEM2013)

Core for: Natural Sciences Chemistry Y2 Organic & Inorganic Specialism

Semester Taught: Spring

Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical

Corequisites: None

Style of Teaching: Lectures, Workshops and Tutorials

Module Convenor: Prof R Stockman

Assessment (s): 100% Exam

Overview: The module is divided into two parts: (a) Functional group chemistry: synthetic transformations of alcohols, amines, carbonyls, and alkenes, and how these transformations are used to synthesise complex molecules such as natural products or pharmaceutical agents. (b) Synthesis: Introduction to retrosynthetic analysis and synthesis of organic molecules using a selection of pharmaceutical agents as examples.

Principles of Analytical Chemistry (CHEM2006)

Semester Taught: Autumn

Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical

Corequisites: None

Style of Teaching: Lectures, Seminars and Workshops

Module Convenor: Dr G Newton

Assessment (s): 100% Exam (2hr)

Overview: The module introduces the basic ideas of analytical chemistry, outlining general types of analytical problem, the main types of instrumentation used for separation and detection of analytes, and statistical treatment of analytical results. All principles will be illustrated by relevant recent examples from the literature.

Sustainable Chemistry (CHEM2018)

Semester Taught: Autumn

Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical

Corequisites: None

Style of Teaching: Lectures, Seminars and Workshops

Module Convenor: Prof Martin Poliakoff

Assessment (s): 100% Exam (2hr)

Overview: This module covers material related to developing a more sustainable approach to chemistry. Topics covered include: The criteria for Sustainable Chemistry and its relationship to Green Chemistry; Synthetic biology and its importance for the future of chemical production; The structure of the chemical manufacturing industry; Environmental and legislative constraints on introducing new chemistry into commercial-scale manufacturing; Structure/Activity relationships. Toxicology, toxicity testing and registration of new compounds; The importance of industrial business models for sustainability including chemical leasing. The lectures will include the application of these ideas to topical case studies.

Chemistry - Inorganic-Physical Specialism (compulsory with Maths and Physics)

Module Title	Autumn	Spring
Core Laboratory Work	20	
Energy, Spectroscopy and Solid State Chemistry	20	
Intermediate Inorganic Chemistry	10	
Optional Modules - 10 credits from the following:		
Principles of Analytical Chemistry	10	
Sustainable Chemistry	10	

Core Laboratory Work (CHEM2009)

Core for: Natural Sciences Chemistry Y2

Semester Taught: Full Year (Labs will be in one semester or the other) Credits: 20

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: Y2 Chemistry Theory

Style of Teaching: Laboratory Practicals

Module Convenor: Dr A Bertram

Assessment (s): 100% Coursework (Laboratory Performance and Reports)

Overview: This module builds on the practical, analytical and communication skills acquired in the first year and introduces more advanced experiments across Inorganic and Physical chemistry. Increasing use is made of spectroscopic and other analytical techniques in the characterisation of compounds. More detailed laboratory reports will be required. Each laboratory component is a non-compensatable module element. In order to pass the module students must attain a mark of at least 40% in each laboratory component (in inorganic & physical laboratory practicals).

Energy, Spectroscopy & Solid State Chemistry (CHEM2017)

Core for: Natural Sciences Chemistry Y2 Inorganic and Physical Specialism

Semester Taught: Full Year Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: None

Style of Teaching: Lectures, Tutorials and Workshops Module Convenor: Dr R Wheatley

Assessment (s): 100% Exam (3hr)

Overview: To introduce the philosophy of quantum mechanics and to show how it can be applied in situations of importance in chemistry, including confined particles, rotation and vibration of molecules, the hydrogen atom, and one-electron ions. To investigate approximations commonly used in quantum chemistry for studying many-electron atoms and molecules. To introduce the principles of spectroscopy in order to predict and understand atomic and diatomic molecular spectra; to understand how electronic and molecular structure determines the appearance of spectra and how structural information may be derived by interpretation of the spectra. To extend existing knowledge and concepts in thermodynamics to a more advanced level, including more complex systems. To introduce the topic of statistical thermodynamics. To provide an understanding of solid-state chemistry, including energetics, structures, characterisation and simple band theory of solids.

Intermediate Inorganic Chemistry (CHEM2012)

Core for: Natural Sciences Chemistry Y2

Semester Taught: Full Year Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical Corequisites: None

Style of Teaching: Lectures, Tutorials and Workshops Module Convenor: Dr K Galloway

Assessment (s): 100% Exam

Overview: Organometallic nomenclature and principal reaction types. Synthesis of compounds with metal-carbon bonds, and their bonding and reactivity. Main Group Chemistry including the reactions of main group elements and their components. The use of symmetry and Group Theory to fully analyse vibrational spectroscopic data. Trends in the chemical properties within a group and across a period. Selected recent highlights in inorganic chemistry. The use of multinuclear NMR spectroscopy as a tool for the characterisation of molecules.

Principles of Analytical Chemistry (CHEM2006)

Semester Taught: Autumn

Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical

Corequisites: None

Style of Teaching: Lectures, Seminars and Workshops

Module Convenor: Dr G Newton

Assessment (s): 100% Exam (2hr)

Overview: The module introduces the basic ideas of analytical chemistry, outlining general types of analytical problem, the main types of instrumentation used for separation and detection of analytes, and statistical treatment of analytical results. All principles will be illustrated by relevant recent examples from the literature.

Sustainable Chemistry (CHEM2018)

Semester Taught: Autumn

Credits: 10

Prerequisites: Fundamental Chemistry Theory and Practical

Corequisites: None

Style of Teaching: Lectures, Seminars and Workshops

Module Convenor: Prof Martin Poliakoff

Assessment (s): 100% Exam (2hr)

Overview: This module covers material related to developing a more sustainable approach to chemistry. Topics covered include: The criteria for Sustainable Chemistry and its relationship to Green Chemistry; Synthetic biology and its importance for the future of chemical production; The structure of the chemical manufacturing industry; Environmental and legislative constraints on introducing new chemistry into commercial-scale manufacturing; Structure/Activity relationships. Toxicology, toxicity testing and registration of new compounds; The importance of industrial business models for sustainability including chemical leasing. The lectures will include the application of these ideas to topical case studies.

Earth Science Y2

Module Title	Autumn	Spring
Students take 60 credits from:		
Spatial Decision Making	20	
Techniques in Physical Geography	20	
Soils	10	
River Processes and Dynamics	20	
Earth Observation		20
Environmental Geochemistry		10

Spatial Decision Making (GEOG2014)

Semester Taught: Full Year — Credits: 20

Prerequisite: Introduction to GIS — Corequisite: None

Style of Teaching: Lectures & Computing Workshops — Module Convenor: Dr L Clark

Assessment (s): 100% Coursework (50% Technical Report; 50% Project Work)

Overview: This module provides a consideration of:

- Spatial Decision Making & the role that GIS has in this
- Spatial Data Types and Sources
- Vector and Raster Processing Algorithms
- Professional Training in ArcGIS
- Project planning, implementation and reporting

Techniques in Physical Geography (GEOG2003)

Semester Taught: Full Year — Credits: 20

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures, Field/Lab Work & Computing Workshops — Module Convenor: Dr S McGowan

Assessment (s): 100% (20% Group Project, 50% Individual Project & 30% Individual Poster)

Overview: This module presents the opportunity for hands-on experience of field, laboratory, and computational analytical techniques in physical geography appropriate to the domain of interest of the participants. To achieve these aims all students participate, via small group teaching, in field projects on a residential field course, some of which are completed in the laboratory back in Nottingham, leading to an individual project. In addition, students choose further laboratory and analytical techniques to investigate, again via small group teaching, in the second semester. The ethical, safety and fieldwork limitations of geographical work are also considered.

- Students may be required to make a financial contribution towards field trips.

Soils (BIOS2005) – University Park

Semester Taught: Autumn — Credits: 10

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures — Module Convenor: Prof S Mooney

Assessment (s): 100% ROGO Exam (1.5hr)

Overview: Soils are the most complex biomaterial on earth. An understanding of the basic concepts concerning the form and function of soils is important for future management strategies such as mitigating the effects of climate change and providing safe and sustainable food. This module focuses on the important soil properties from physical,

chemical and biological perspectives including soil organic matter (microbiology and chemistry); soil chemical reactions (acidity, redox); soil fauna and flora; soil-water relations (irrigation and drainage).

River Processes and Dynamics (GEOG2008)

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Field Trip, Practicals & Coursework Clinics | Module Convenor: Dr M Johnson

Assessment (s): 60% Fieldwork Report; 40% Short-Essay

Overview: Introduces the water and sediment processes that operate in rivers. Describes the characteristic forms of alluvial channels and the links between river processes and channel dynamics. Uses laboratory practicals and a fieldtrip to deliver kinaesthetic, student-centred learning and add value to teaching and learning during lectures. Topics covered include:

- Catchments and longitudinal patterns
- River planforms: braided, meandering and straight
- Timescales of river change and morphological adjustments
- Complex response in the fluvial system
- Flow resistance, sediment transport and bank erosion
- Introduction to biogeomorphology and aquatic ecology

*** Students are required to make a financial contribution towards the cost of field trips.**

Earth Observation (GEOG2021)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr S Owen

Assessment (s): 40% Coursework (1,500-word Report) & 60% Exam

Overview: This module provides a general introduction to the subject of Earth Observation. This involves analysing remotely sensed images, typically acquired from instruments on board satellites or aircraft, to investigate spatial phenomena on the Earth's surface. Example topics include the use of global image data sets to investigate climate change, analysis of satellite sensor imagery to identify wildlife habitats and conservation concerns, and urban land use mapping from detailed aerial photography. Theoretical lectures cover the concepts underpinning remote sensing, including the physical principles determining image creation, fundamental image characteristics, methods of image analysis and uses or applications of Earth Observation. There is also a strong practical component to the module, with regular practical exercises on various forms of digital image analysis.

Environmental Geochemistry (BIOS2044) – University Park

Semester Taught: Spring | Credits: 10

Prerequisite: Soils | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr E Bailey

Assessment (s): 100% ROGO Exam

Overview: This module will develop understanding of the important chemical and physical processes that operate in the terrestrial environment, principally within soils and fresh water systems. It includes the study of the hydrological cycle, surface and sub-surface water chemistry including rainfall, rivers and lakes, processes that govern the movement of solutes and colloidal materials, adsorption, redox, solubility, diffusion and kinetics.

Ecosystems & Environment Y2

Module Title	Autumn	Spring
Students take 60 credits from:		
Environmental Change	20	
Fieldwork Skills – Sampling & Surveying Techniques	10	
Techniques in Physical Geography	20	
Ecosystem Processes	10	
Forest Ecology and Management	20	
Climate Change Science		10
Computer Modelling in Science: Introduction		20
Patterns of Life		20
Virtual Environmental Management Field Course		10

Environmental Change (GEOL2001)

Semester Taught: Full Year

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: Dr V Panizzo

Assessment (s): 30% Coursework (15% Online Test; 15% Group Podcast) & 70% Exams (35% exam in each semester)

Overview: This module considers the mechanisms for, and evidence of, global climate change during the timescale of the Quaternary period. The nature, causes and impacts of change are evaluated in the context of the available evidence within a range of natural and human environments. Evidence for human impact on natural resources is reviewed. Evidence for human impact on the global atmosphere, and the nature and impacts of future climate change are also considered. Students will gain an understanding of remote sensing for the study of land cover change.

Fieldwork Skills – Sampling and Surveying Techniques (BIOS2089) – University Park and Sutton Bonington

Semester Taught: Full Year

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Fieldwork

Module Convenor: Dr R Blunt

Assessment (s): 100% Coursework (combination of in-class tests and short written assignments alongside a skills diary)

Overview: This module, run as a non-residential field course, will introduce students to a range of skills for environmental monitoring and ecological assessment. Students will develop key practical skills and gain valuable experience in planning and conducting fieldwork. There will be a strong focus on developing practical skills and enhancing employability in the environmental job sector. Students choose from a range of 1 or 2 day activities running through the year. These may include:

- Air and water quality monitoring
- Contaminated land surveys
- Using GPS and spatial sampling techniques
- Terrestrial invertebrate survey techniques
- Phase 1 habitat surveys- plant identification
- Freshwater monitoring using BMWP and macroinvertebrates.

Techniques in Physical Geography (GEOG2003)

Semester Taught: Full Year | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Field/Lab Work & Computing Workshops | Module Convenor: Dr S McGowan

Assessment (s): 100% (20% Group Project, 50% Individual Project & 30% Individual Poster)

Overview: This module presents the opportunity for hands-on experience of field, laboratory, and computational analytical techniques in physical geography appropriate to the domain of interest of the participants. To achieve these aims all students participate, via small group teaching, in field projects on a residential field course, some of which are completed in the laboratory back in Nottingham, leading to an individual project. In addition, students choose further laboratory and analytical techniques to investigate, again via small group teaching, in the second semester. The ethical, safety and fieldwork limitations of geographical work are also considered.

- Students may be required to make a financial contribution towards field trips.

Ecosystem Processes (BIOS2019) – University Park and Sutton Bonington (Labs)

Semester Taught: Autumn | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals, Computer Workshops & Fieldwork | Module Convenor: Dr S Sjogersten

Assessment (s): 100% ROGO Exam

Overview: The course will focus on the processes that govern terrestrial ecosystem function. We will identify key ecosystem drivers and processes and explore how these have shaped the biosphere. Students will gain an understanding of the mechanisms that control changes in the physiochemical environment and their impact upon communities. Particular topics will include primary productivity, decomposition, herbivory, biodiversity and human impact on ecosystems.

Forest Ecology and Management (BIOS2080) – University Park

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr R Blunt

Assessment (s): 100% Coursework (30% Practical Class Test; 70% 1,500-word Report)

Overview: This module introduces students to forest environments and ecology within natural and semi-natural and planted ecosystems. Students examine environmental and ecological factors affecting forest/woodland composition, structure, biodiversity and distribution, developing practical skills in tree species identification and survey techniques during fieldwork and site visits. Students gain an understanding for how woodlands are managed for environmental, wildlife conservation and commercial timber extraction, looking at the scale, rates, distribution and causes of deforestation and forest degradation and the implications of this for global and local ecosystem services. Looking at environmental and ecological impacts of deforestation, commercial forestry and afforestation, looking at different management objectives including timber production, environmental services, amenity and conservation. We will examine the impact of invasive species and pests and disease on tree species and woodlands, particularly in the UK.

Climate Change Science (BIOS2013) – University Park and Sutton Bonington (Computing)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals and Computing Workshops | Module Convenor: Dr S Sjogersten

Assessment (s): 100% Exam

Overview: The module presents a broad overview the science that underpin climate change. It shows the importance of historical understanding in interpreting the present and predicting the future. It provides an understanding of the energy flows that are causing climate change, and insights into the way that computer models can be used to relate

complex parameter sets. It reviews the impacts of climate change for plants, animals and people, both on land and in the oceans. It also shows how a range of options exists for reducing and stabilising climate change. Topics covered are: historical climate change; the principles of climate forcing; the role of modelling; responses of aquatic and terrestrial ecosystems, including impacts on humans; the political environment; and options for climate stabilization.

Computer Modelling in Science: Introduction (BIOS2016) – University Park

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Computing Workshops | Module Convenor: Dr D Stekel

Assessment (s): 100% Coursework (Patchwork assessments of computing assignmentsx5 & Reflective Piece)

Overview: Modern biological and environmental science includes the study of complex systems and large data sets, including imaging data. This necessitates the use of computer models and analyses in order to understand these systems. This module contains an introduction to computer programming and modelling techniques that are used in the biological and environmental sciences. Specifically, it contains: (i) An introduction to computer programming and algorithms, using the Python programming language. (ii) An introduction the construction of mathematical models for biological and environmental systems using difference and differential equations, with a particular emphasis on population dynamics, and the use of computing to simulate, analyze these models and fit these models to data. Throughout the module, the focus will be on relevant examples and applications, e.g. environmental pollution, growth of microbial populations, disease epidemics, or computer manipulation of images of plants, animals or the natural environment.

Patterns of Life (GEOG2009)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures & Small-group Discussions | Module Convenor: Dr A Algar

Assessment (s): 50% Coursework (2,000-word report) & 50% Exam

Overview: The course focuses on patterns in the distribution of organisms in space and time, and theories proposed to explain those patterns. The main themes are listed below. Teaching is via a mixture of lectures and small-group discussions, centred on discussion of current research. Exemplar topics include:

- Biodiversity patterns
- Island biogeography
- Biodiversity dynamics
- Speciation and extinction
- Evolution

Virtual Environmental Management Field Course (BIOS2003)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Practicals | Module Convenor: Dr R Blunt

Assessment (s): 100% Field Report (max 3,000 words)

Overview: During this field course module you will look at the concept of catchment management and we will examine the impact of local land use on soil health and water quality. You will become familiar with techniques used in environmental monitoring and gain practical skills and experience in analysing and interpreting environmental data sets focused on assessing pollution risks.

Maths Y2

Maths – Applied, Computation and Statistics Specialism

Module Title	Autumn	Spring
Vector Calculus	10	
Differential Equations and Fourier Analysis		10
Optional Modules - 40 credits from the following:		
Applied Statistics and Probability	20	
Introduction to Scientific Computing	20	
Modelling with Differential Equations	20	

Vector Calculus (MATH2005)

Core for: Natural Sciences Maths Y2

Semester Taught: Autumn — Credits: 10

Prerequisites: Calculus & Linear Algebra — Corequisites: None

Style of Teaching: Lectures & Problem Classes — Module Convenor: Prof K Krasnov

Assessment (s): 10% In-Class Test & 90% Exam (2hr)

Overview: This module provides a grounding in vector calculus methods that are widely used in Applied Mathematics and Mathematical Physics. The module introduces the vector differentiation operations of gradient, divergence and curl, develops integration methods of scalar and vector quantities over paths, surfaces and volumes, and relates these operations to each other via the integral theorems of Green, Stokes and Gauss. The methods are then applied to the solution of Laplace's equation under simple boundary conditions by separation of variables.

Differential Equations and Fourier Analysis (MATH2008)

Core for: Natural Sciences Maths Y2

Semester Taught: Spring — Credits: 10

Prerequisites: Calculus & Linear Algebra — Corequisites: None

Style of Teaching: Lectures & Problem Classes — Module Convenor: Dr R Graham

Assessment (s): 10% In-Class Test & 90% Exam (2hr)

Overview: This module is an introduction to Fourier series and integral transforms and to methods of solving some standard ordinary and partial differential equations which occur in applied mathematics and mathematical physics. The module describes the solution of ordinary differential equations using series and introduces Fourier series and Fourier and Laplace transforms, with applications to differential equations and signal analysis. Standard examples of partial differential equations are introduced and solution using separation of variables is discussed.

Applied Statistics and Probability (MTHS3003)

Semester Taught: Full Year — Credits: 20

Prerequisites: Calculus & Linear Algebra — Corequisites: None

Style of Teaching: Lectures and Computing Workshops — Module Convenor: N/A

Assessment (s): 60% Exam (2hr) & 40% Coursework (20% Portfolio; 20% Statistical Report)

Overview: The module covers introductory topics in statistics and probability that could be applied to data analysis in a broad range of subjects. Topics include common univariate probability distributions, joint and conditional distributions, parameter estimation (e.g. via maximum likelihood), confidence intervals, hypothesis testing and statistical modelling. Consideration is given to issues in applied statistics such as data collection and design of

experiments, and reporting statistical analysis. Topics will be motivated by solving problems and case studies, with much emphasis given to simulating and analysing data using computer software to illustrate the methods.

Introduction to Scientific Computing (MATH2019)

Semester Taught: Full Year | Credits: 20

Prerequisites: Calculus & Linear Algebra | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr K van der Zee

Assessment (s): 40% Coursework (x4 Assignments) & 60% Exam (2.5hr)

Overview: This course introduces basic techniques in numerical methods and numerical analysis which can be used to generate approximate solutions to problems that may not be amenable to analytical techniques. Specific topics include:

- Nonlinear equations (bisection method, fixed-point iteration, Newton's method, convergence);
- Linear systems of equations: Direct methods (Gaussian elimination, operation count, pivoting strategies, matrix factorisation, special matrices: diagonally dominant, symmetric positive definite);
- Linear systems of equations: Iterative techniques (matrix norms, Jacobi & Gauss-Seidel method, convergence. residual, conditioning);
- Polynomial interpolation (Lagrange polynomials, Lagrange form, error analysis);
- Numerical calculus (difference formulae, numerical quadrature: trapezoidal, Simpson & midpoint rule, composite rules, Richardson extrapolation);
- Numerical ODEs (Euler's method, wellposedness of IVPs, higher-order RK methods, local truncation error);
- Implementing algorithms in Matlab:
- Basic elements of finite arithmetic.

Modelling with Differential Equations (MATH2012)

Semester Taught: Full Year | Credits: 20

Prerequisites: Calculus & Linear Algebra | Corequisites: MATH2005 & MATH2008

Style of Teaching: Lectures and Problem Classes | Module Convenor: Dr R Nicks

Assessment (s): 20% In-Class Tests (x2) & 80% Exam (2.5hr)

Overview: The success of applied mathematics in describing the world around us arises from the use of mathematical models, often using ordinary and partial differential equations. This module continues the development of such models, building on the modules G11CAL and G11APP. It introduces techniques for studying linear and nonlinear systems of ordinary differential equations, using linearisation and phase planes. Partial differential equation models are introduced and analysed. These are used to describe the flow of heat, the motion of waves and traffic flow. Continuum models are introduced to describe the flow of fluids (liquids and gases, such as the oceans or the Earth's atmosphere).

Maths – Mathematical Physics Specialism

Module Title	Autumn	Spring
Introduction to Mathematical Physics	20	
Modelling with Differential Equations	20	
Vector Calculus	10	
Differential Equations and Fourier Analysis		10

Introduction to Mathematical Physics (MATH2013)

Semester Taught: Full Year

Credits: 20

Prerequisite: From Newton to Einstein & Calculus and Linear Algebra

Corequisites: MATH2005 & MATH2008

Style of Teaching: Lectures and Problem Classes

Module Convenor: Prof G Tanner

Assessment (s): 20% In-Class Tests (x2) & 80% Exam (2.5hr)

Overview: This module explores the classical and quantum mechanical description of motion. The laws of classical mechanics are investigated both in their original formulation due to Newton and in the mathematically equivalent but more powerful formulations due to Lagrange and Hamilton. Applications are made to problems such as planetary motion, rigid body motion and vibrating systems. Quantum mechanics is developed in terms of a wave function obeying Schroedinger's equation, and the appropriate mathematical notions of Hermitian operators and probability densities are introduced. Applications include problems such as the harmonic oscillator and a particle in a three-dimensional central force field.

Modelling with Differential Equations (MATH2012)

Semester Taught: Full Year

Credits: 20

Prerequisites: Calculus & Linear Algebra

Corequisites: MATH2005 & MATH2008

Style of Teaching: Lectures and Problem Classes

Module Convenor: Dr R Nicks

Assessment (s): 20% In-Class Tests (x2) & 80% Exam (2.5hr)

Overview: The success of applied mathematics in describing the world around us arises from the use of mathematical models, often using ordinary and partial differential equations. This module continues the development of such models, building on the modules G11CAL and G11APP. It introduces techniques for studying linear and nonlinear systems of ordinary differential equations, using linearisation and phase planes. Partial differential equation models are introduced and analysed. These are used to describe the flow of heat, the motion of waves and traffic flow. Continuum models are introduced to describe the flow of fluids (liquids and gases, such as the oceans or the Earth's atmosphere).

Vector Calculus (MATH2005)

Core for: Natural Sciences Maths Y2

Semester Taught: Autumn

Credits: 10

Prerequisites: Calculus & Linear Algebra

Corequisites: None

Style of Teaching: Lectures & Problem Classes

Module Convenor: Prof K Krasnov

Assessment (s): 10% In-Class Test & 90% Exam (2hr)

Overview: This module provides a grounding in vector calculus methods that are widely used in Applied Mathematics and Mathematical Physics. The module introduces the vector differentiation operations of gradient, divergence and curl, develops integration methods of scalar and vector quantities over paths, surfaces and volumes, and relates these operations to each other via the integral theorems of Green, Stokes and Gauss. The methods are then applied to the solution of Laplace's equation under simple boundary conditions by separation of variables.

Differential Equations and Fourier Analysis (MATH2008)

Core for: Natural Sciences Maths Y2

Semester Taught: Spring

Credits: 10

Prerequisites: Calculus & Linear Algebra

Corequisites: None

Style of Teaching: Lectures & Problem Classes

Module Convenor: Dr R Graham

Assessment (s): 10% In-Class Test & 90% Exam (2hr)

Overview: This module is an introduction to Fourier series and integral transforms and to methods of solving some standard ordinary and partial differential equations which occur in applied mathematics and mathematical physics. The module describes the solution of ordinary differential equations using series and introduces Fourier series and Fourier and Laplace transforms, with applications to differential equations and signal analysis. Standard examples of partial differential equations are introduced and solution using separation of variables is discussed.

Pharmacy Y2

This stream is likely to have clashes with your other subject, taking this stream is contingent on checking the severity of those clashes and agreeing a strategy to manage these clashes.

Module Title	Autumn	Spring
Advanced Drug Delivery	20	
Drug Design		20
Pharmaceutical Biotechnology		20

Advanced Drug Delivery (PHAR2029)

Core for: Natural Sciences Pharmaceutical Science Y2

Semester Taught: Autumn

Credits: 20

Prerequisite: Y1 Biology & Chemistry

Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals

Module Convenor: F Rawson

Assessment (s): 30% Coursework (Workbook) & 70% Exam (2hr)

Overview: This module provides:

- Novel materials for drug formulations
- Bioelectronic based drugs Design of drug delivery systems
- Physiological factors relevant to drug delivery technologies
- Modification of drug distribution by formulation
- You will study how novel materials are used for drug formulations and how delivery systems are designed.
- The physiological factors which affect particular drug delivery technologies will be discussed.
- You will learn how formulation can modify the distribution of a drug in the body and achieve its delivery to the preferred location.

Drug Design (PHAR2030)

Core for: Natural Sciences Pharmaceutical Science Y2

Semester Taught: Spring

Credits: 20

Prerequisite: Y1 Biology & Chemistry

Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals

Module Convenor: Dr C Laughton

Assessment (s): 30% Coursework (Poster Assessment) & 70% Exam (2hr)

Overview: This module provides:

- Introduction, development and reinforcement of key concepts relevant to drug design, including:
- principles of molecular recognition
- thermodynamics and kinetics
- terminology related to the drug discovery pipeline
- alternative discovery strategies
- Ligand-based drug design:
- cheminformatics-based approaches
- determination of structure-activity relationships
- Structure-based design: the determination, prediction, and evaluation of ligand-protein complexes
- molecular graphics and computational chemistry
- The prediction and control of ADME properties in drug design.

Pharmaceutical Biotechnology (PHAR2033)

Core for: Natural Sciences Pharmaceutical Science Y2

Semester Taught: Spring | Credits: 20

Prerequisite: Y1 Biology & Chemistry | Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals | Module Convenor: Dr G Mantovani

Assessment (s): 30% Coursework (Lab Report) & 70% Exam (2hr)

Overview: This module covers:

- The principles that underlie the manufacturing of biotechnology products ('biologics').
- The major physiological barriers to absorption of macromolecular drugs.
- The design of formulation of biologics and factors that affect their stability over time and in the presence of specific stressors.
- This module will introduce you to the main technologies for production of biological pharmaceuticals and how they can be formulated and delivered to be of therapeutic use.
- The materials, constructs and concepts behind technologies to produce, formulate and deliver biologics will be examined and factors governing the implementation of these technologies will be discussed.

Physics Y2

Physics – Experimental Specialism (compulsory with all subjects except Maths)

Module Title	Autumn	Spring
Classical Fields	20	
Experimental Techniques and Instrumentation	20	
The Quantum World	20	

Classical Fields (PHYS2003)

Core for: Natural Sciences Non-Maths Physics Y2

Semester Taught: Full Year

Credits: 20

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr K Edmonds

Assessment (s): 20% Continuous Assessments & 80% Exam

Overview: In From Newton to Einstein, you learnt about the idea of a field, a quantity which is defined at every point in space. In this module, the description of fields will be extended by introducing the mathematics of vector calculus. The module will begin with an introduction to vector calculus, illustrated in the context of the flow of ideal (non-viscous) fluids. The mathematics will then be used to provide a framework for describing, understanding and using the laws of electromagnetism. We discuss how electric and magnetic fields are related to each other and to electrical charges and electrical currents. The macroscopic description of electric fields inside dielectric materials and magnetic fields inside magnetizable materials will be described, including the boundary conditions that apply at material interfaces. The last section of the module will discuss Maxwell's equations of electrodynamics and how they lead to the vector wave equation for electromagnetic waves.

The module contains a number of topics:

- Introduction to Fields
- Vector calculus
- Fluid flow
- Dielectrics and Electrostatics
- Magnetostatics
- Electrodynamics

Experimental Techniques and Instrumentation (PHYS2006)

Core for: Natural Sciences Non-Maths Physics Y2

Semester Taught: Full Year

Credits: 20

Prerequisite: None

Corequisites: None

Style of Teaching: Laboratory Practicals and Supplementary Lectures

Module Convenor: Dr R Campion

Assessment (s): 100% Coursework (60% Continuous Assessment of Diaries & 40% Formal Lab Reports)

Overview: In this module students will receive:

- an introduction to the basic techniques and equipment used in experimental physics;
- training in the analysis and interpretation of experimental data;
- a basic practical introduction to geometrical and physical optics
- opportunities to observe phenomena discussed in theory modules;
- training in the skills of record keeping and writing scientific reports.

The Quantum World (PHYS2001)

Core for: Natural Sciences Non-Maths Physics Y2

Semester Taught: Full Year | Credits: 20

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr W Kockenberger

Assessment (s): 20% Continuous Assessments & 80% Exam

Overview: This module will provide an introduction to the theory and elementary applications of quantum mechanics, a theory that is one of the key achievements of 20th century physics. Quantum mechanics is an elegant theoretical construct that is both beautiful and mysterious. Some of the predictions of quantum mechanics are wholly counter-intuitive and there are aspects of it that are not properly understood but it has been tested experimentally for over 50 years and, wherever predictions can be made, they agree with experiment. Outline Syllabus

1. Introduction and review of 1st year material
2. Quantum Wells and Barriers
3. Basic Principles of Quantum Mechanics
4. Quantum Harmonic Oscillator
5. Motion in 3D & Angular Momentum
6. Hydrogen Atom
7. Many-Particle Systems
8. Quantum Mechanics of Intrinsic Spin
9. Entanglement and Other Conceptual Issues

Physics – Theoretical Specialism (Compulsory with Maths)

Module Title	Autumn	Spring
Optics and Electromagnetism	20	
Thermal and Statistical Physics	20	
Optional Modules - 20 credits from the following:		
Introduction to Scientific Computation	20	
Force and Function at the Nanoscale	10	
Structure of Stars	10	
Structure of Galaxies		10

Optics and Electromagnetism (PHYS2007)

Core for: Natural Sciences Physics Maths Y2

Semester Taught: Full Year | Credits: 20

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures, Workshops and Practical | Module Convenor: Dr K Edmonds

Assessment (s): 20% Continuous Assessments; 5% Practical Work & 75% Exams (1.5hr x2)

Overview: The first half of the module will focus on optics: the study of light. Topics to be covered will include: geometrical optics; wave description of light; interference and diffraction; optical interferometry. There will be a small number of practical sessions illustrating the ideas developed. The second half of the module will cover various aspects of electromagnetism including the treatment of dielectric and magnetic media, the propagation of electromagnetic waves and various techniques for the solution of electromagnetic problems.

Thermal and Statistical Physics (PHYS2002)

Core for: Natural Sciences Physics Maths Y2

Semester Taught: Full Year | Credits: 20

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr Y Mao

Assessment (s): 20% Continuous Assessment & 80% Exam

Overview: Macroscopic systems exhibit behaviour that is quite different from that of their microscopic constituents studied in isolation. New physics emerges from the interplay of many interacting degrees of freedom. In this module you will learn about the important physical properties of matter & the two main approaches to their description. One, thermodynamics, treats macroscopically relevant degrees of freedom (temperature, pressure & so on) & find relations between these and the fundamental laws which govern them, independent of their microscopic structure. The other approach, statistical mechanics, links the macroscopically relevant properties to the microphysics by replacing the detailed microscopic dynamics with a statistical description. The common feature of both of these methods is the introduction of two macroscopic quantities, temperature & entropy, that have no microscopic meaning.

Introduction to Scientific Computing (MATH2019)

Semester Taught: Full Year | Credits: 20

Prerequisites: Calculus & Linear Algebra | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr K van der Zee

Assessment (s): 40% Coursework (x4 Assignments) & 60% Exam (2.5hr)

Overview: This course introduces basic techniques in numerical methods and numerical analysis which can be used to generate approximate solutions to problems that may not be amenable to analytical techniques. Specific topics include:

- Nonlinear equations (bisection method, fixed-point iteration, Newton's method, convergence);
- Linear systems of equations: Direct methods (Gaussian elimination, operation count, pivoting strategies, matrix factorisation, special matrices: diagonally dominant, symmetric positive definite);
- Linear systems of equations: Iterative techniques (matrix norms, Jacobi & Gauss-Seidel method, convergence. residual, conditioning);
- Polynomial interpolation (Lagrange polynomials, Lagrange form, error analysis);
- Numerical calculus (difference formulae, numerical quadrature: trapezoidal, Simpson & midpoint rule, composite rules, Richardson extrapolation);
- Numerical ODEs (Euler's method, wellposedness of IVPs, higher-order RK methods, local truncation error);
- Implementing algorithms in Matlab:
- Basic elements of finite arithmetic.

Force and Function at the Nanoscale (PHYS3009)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr M Smith

Assessment (s): 20% Continuous Assessments & 80% Exam

Overview: This module will provide a comprehensive overview of how forces at the nanoscale are radically different to those observed in macroscopic systems and how they can be exploited in nanometre-scale processes and devices. Building from a comparison of microscopic and "nanoscopic" forces and phenomena (e.g. gravity, inertia, viscosity, friction, Brownian motion...), the module will focus on the physical basis and measurement of forces operating on the nanoscale. We will study the following topics;

1. Macroscopic and microscopic forces
2. Forces and potentials (2 lectures)
3. Van der Waals Interactions between atoms, molecules and macroscopic bodies (3-4 lectures)

4. Measurement of nanoscale forces (2 lectures)
5. Surface Energy, Adhesion and Capillary forces (2 lectures)
6. Double layer forces and entropic repulsion forces (3 lectures)
7. Special interactions
8. Aggregation and self-assembly
9. Micelles and membranes (3 lectures)

Structure of Stars (PHYS3007)

Semester Taught: Autumn

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof A Aragon-Salamanca

Assessment (s): 100% Exam

Overview: The module introduces the physics of stars, their structure and evolution. Outline Syllabus

1. Basic Properties: Mass, luminosity, effective temperature & radius; the Hertzsprung-Russell diagram and its importance; spectra and chemical composition; binary stars.
2. Gravity: Gravity in spherically-symmetric objects; gravitational collapse & dynamical timescale; pressure and hydrostatic equilibrium; inequalities for the central pressure; virial theorem.
3. Kinetic Theory: Equation of state: gas pressure & electron pressure; ionisation and the mean molecular weight; inequality for central temperature; degeneracy and conditions for its onset; Chandrasekhar mass; radiation pressure.
4. Energy Production: Timescales of stellar evolution; Nuclear Reactions; Hydrogen burning: the p-p chain, CNO cycle; He burning: triple-alpha process; energy production rates; beyond He burning.
5. Energy Transport: Radiative transport; opacity; convection; Schwarzschild criterion.
6. Models of Stars: Equations of stellar structure: differential equations, constitutive relations, boundary conditions. The Vogt-Russell Theorem; theory of main sequence; mass-luminosity and mass-radius relations; main sequence lifetime.
7. The Evolution of Stars. Descriptive account of pre- and post-main sequence evolution for stars of different mass, and their ultimate remnants as white dwarfs, neutron stars or black holes.

Structure of Galaxies (PHYS3011)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr S Dye

Assessment (s): 100% Exam

Overview: This module develops the current understanding of the various physical processes that dictate the formation, evolution and structure of galaxies. The layout of the course is as follows:

- The Milky Way (structure, components, HI kinematics);
- Basic Properties of Galaxies (morphology, classification schemes, constituents);
- The Dynamics of Galaxies (gaseous and stellar kinematics, galaxy rotation curves, spiral structure and bar formation, the virial theorem);
- Active Galaxies (Seyfert galaxies, unified model, radio galaxies, BL Lac objects, quasars, supermassive black holes);
- The Environment of Galaxies (The Local Group, galaxy clustering and large-scale structure, X-ray properties of clusters, galaxy mergers, the morphology-density relation);
- Galaxy Evolution (monolithic and hierarchical models, evidence for evolution from nearby galaxies, observations of distant galaxies).

Psychology Y2

Psychology - Cognitive Neuroscience Specialism

Module Title	Autumn	Spring
Research Methods and Analysis	20	
Cognitive Psychology 2	20	
Neuroscience and Behaviour		20

Research Methods and Analysis (PSGY2002)

Semester Taught: Full Year

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr C Madan

Assessment (s): 10% Coursework (x2) 90% ROGO Exam (x2)

Overview: This module will cover the basic concepts and assumptions with respect to univariate and multivariate statistics, as well as issues relating to field studies, ethics, the reliability and validity issues as well as basic qualitative techniques. The module will cover ANOVA, post-hoc tests, power, multiple linear regression, factor analysis, the nature of causality and field designs (both experimental and quasi-experimental), ethics, the reliability and validity of measures and field designs, as well as exploring some basic issues in questionnaire design and qualitative methods.

Cognitive Psychology 2 (PSGY2005)

Semester Taught: Autumn

Credits: 20

Prerequisites: Cognitive Psychology 1

Corequisites: None

Style of Teaching: Lectures and Tutorials

Module Convenor: Dr P Chapman

Assessment (s): 33% Coursework (2,000-word Essay) & 67% Exam (2hr - MCQs and Essay)

Overview: This module will examine:

- Perception, with particular emphasis on vision, but also hearing, taste, touch and smell;
- The Psychology of Language, including linguistic theory, speech, parsing,word meaning, and language production;
- The Psychology of Reading, including word recognition, theories of eye-movement control, and reading multi-media displays;
- Human Memory, covering the basics of encoding, storage and retrieval with particular reference to real-world applications of memory research;
- Thinking and Problem Solving, including heuristics, biases, evolutionary perspectives on human rationality, and group decision making.

Neuroscience and Behaviour (PSGY2007)

Semester Taught: Spring

Credits: 20

Prerequisite: Biological Psychology

Corequisites: None

Style of Teaching: Lectures and Tutorials

Module Convenor: Dr C Bonardi & C Gibson

Assessment (s): 30% Coursework (2,000-word Essay) & 70% ROGO Exam

Overview: This module will cover several issues in neuroscience and behaviour that are particularly relevant to understanding the biological bases of psychological functions. Among the topics to be covered are:

- psychopharmacology,
- psychobiological explanations of mental disorders such as schizophrenia and Alzheimers Disease,
- sexual development, emotion and behaviour,
- methods of studying neuropsychological processes,

- the effects of brain damage on mental functioning including amnesias,
- introduction to classical and instrumental conditioning,
- theories of associative learning and memory,
- what forgetting might tell us about learning, topics in comparative cognition and cognitive abilities,
- what can animals learn?

Psychology - Social and Developmental Specialism

Module Title	Autumn	Spring
Cognitive Psychology 2	20	
Conceptual and Historical Issues in Psychology	10	
Personality and Individual Difference		10
Social and Developmental Psychology		20

Cognitive Psychology 2 (PSGY2005)

Semester Taught: Autumn

Credits: 20

Prerequisites: Cognitive Psychology 1

Corequisites: None

Style of Teaching: Lectures and Tutorials

Module Convenor: Dr P Chapman

Assessment (s): 33% Coursework (2,000-word Essay) & 67% Exam (2hr - MCQs and Essay)

Overview: This module will examine:

- Perception, with particular emphasis on vision, but also hearing, taste, touch and smell;
- The Psychology of Language, including linguistic theory, speech, parsing,word meaning, and language production;
- The Psychology of Reading, including word recognition, theories of eye-movement control, and reading multi-media displays;
- Human Memory, covering the basics of encoding, storage and retrieval with particular reference to real-world applications of memory research;
- Thinking and Problem Solving, including heuristics, biases, evolutionary perspectives on human rationality, and group decision making.

Conceptual and Historical Issues in Psychology (PSGY2008)

Semester Taught: Autumn

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr S Stewart-Williams & R James

Assessment (s): 100% Exam (33& ROGO; 67% Written Exam)

Overview: The focus of psychology is one of the most interesting phenomena in the universe: the human mind. Psychology is, in effect, an effort to explain the mind to the mind. But psychology hasn't always existed. Where exactly did it come from? And what are the philosophical issues associated with this fascinating field?

Those are the questions this module aims to answer. In doing so, it surveys some of the most influential ideas in intellectual history, including those of the Ancients Greeks, various medieval thinkers, and philosophers and scientists from the seventeenth century to today.

Along the way, the module touches on some fascinating questions about the human mind. Is the mind something separate from the brain, or is it simply the activity of the brain? Is the mind a blank slate at birth, or do we have some innate knowledge or dispositions? Are humans naturally good or bad, peaceful or violent? Do we have an unconscious mind, full of repressed memories and hidden desires – or is that just a psychological myth? Can we measure the mind,

or should we just focus on behaviour? And what are some of the challenges and debates associated with the practice of psychology as a science?

Personality and Individual Difference (PSGY2009)

Semester Taught: Spring

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lecture

Module Convenor: Dr L Blackie

Assessment (s): 100% Exam

Overview: The module covers the psychological explanations of personality and individual differences. In this module the relationship between the individual and society will be highlighted. In particular the major personality theories are considered in detail and the application of these theories to areas such as abnormal psychology, criminal behaviour and health are discussed. IQ is also covered and evolutionary bases of traits.

Social and Developmental Psychology (PSGY2006)

Semester Taught: Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr A Spence

Assessment (s): 66% Coursework (2 x 750-word Assignment) & 34% ROGO Exam (x2)

Overview: This module will examine:

- Current Issues in Social Psychology
- Social cognition and social thinking
- Attribution
- Attitudes
- Persuasive communication and attitude change
- Social Influence
- Conformity and obedience
- Group Decision Making & Behaviour Change
- Culture
- Intergroup behaviour
- Perceptions and Motivations
- Evolution of Mentalising and Theory of Mind
- Oncology of Mentalising Development Theory of Mind in Children
- Mindblind: Autism Spectrum Disorder
- Phylogeny: The Mental world apes
- Development of synaesthesia
- Language acquisition
- Adult perceptual development: sensory substitution and augmentation
- Conceptual development: colour cognition
- Reading and spelling development

Year in Computer Science

Module Title	Autumn	Spring
Programming	20	
Systems and Networks	20	
Database Interfaces and Software Design	20	
Software Engineering Management		20
Students take 40 credits from the following:		
Data Modelling and Analysis		20
Fundamentals of Artificial Intelligence		20
Fundamentals of Information Visualisation		20
Fuzzy Logic and Fuzzy Systems		20
Introduction to Human Computer Interaction		20
Introduction to Image Processing		20
Simulation and Optimisation for Decision Support		20

Programming (COMP4008)

Compulsory for Year in Computer Science

Semester Taught: Autumn

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures, Tutorials and Computing Practicals

Module Convenor: Dr T Altenkirch & Dr I Triguero

Assessment (s): 50% Coursework (20% Programming Exercises (x4); 30% Programming Project (group)) & 50% Exam

Overview: This module gives you a comprehensive overview of the principles of programming, including such concepts as procedural logic, variables, flow control, input and output and the analysis and design of programs. Instruction will be provided in an object-oriented programming language. You will spend around five hours per week in lectures and computer classes studying for this module.

Systems and Networks (COMP4035)

Compulsory for Year in Computer Science

Semester Taught: Autumn

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: Dr G Hopkins

Assessment (s): 25% Coursework (Written Coursework) & 75% Exam

Overview: This module is part of the Operating Systems and Networks theme. The module gives an introduction to the role of the operating system and how it manages computer resources such as memory, processes and disks. Unix is introduced in terms of the Unix file structure, Input and Output and the Command Line Interface that is used to manipulate these. Computer communication is taught with respect to the Client-Server Architecture and applications that use this. Underlying protocols, such as those in the TCP/IP protocol suite, are introduced, as commonly used in the Internet to provide a universal service. This includes IPv4 and IPv6, the need for IPv6 and how the two differ. Types of computer networks are covered in terms of scale, such as LANs and WANs; and in terms of wired and wireless networks. Mechanisms for connecting networks such as routers, switches and bridges are covered. Other topics include the role of gateways, proxies, Virtual Private Networks and cloud computing. Potential security risks are examined them, including the use of firewalls.

Database Interfaces and Software Design (COMP4039)

Compulsory for Year in Computer Science

Semester Taught: Autumn | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr S Reeves & Mr J Clos

Assessment (s): 60% Coursework (20% Exercises; 40% Programming Assignment) & 40% Exam (1.5hr)

Overview: Databases are everywhere. We interact with many different databases every day, whether using the web, electronic calendars, diaries or timetables, searching for contact details, or looking for directions on a mobile phone. As such databases need to be both easy to use and fast. We focus on both the structure of databases, including how to make them fast, efficient and reliable and ways of interacting with them via user interfaces. We examine the fundamentals of the relational database model, its mathematical basis, as well as implementations of the model in database management systems (DBMS) and languages to interact with them such as Structured Query Language (SQL). We explore relevant software design principles such as understanding user requirements and specifications and how this relates to database design. Databases do not exist in isolation, and so will also examine how to design and build ways to interact with them, specifically via web development for which database access is key.

Software Engineering Management (COMP4024)

Compulsory for Year in Computer Science

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Workshops & Computing Practicals | Module Convenor: Dr G Hopkins

Assessment (s): 100% Coursework (40% Group Coursework; 60% Individual Coursework)

Overview: This module is part of the Software Engineering theme. This module covers the following topics: Management of the introduction of new software or IT systems; Software project management practices; Practical experience of use of an Agile software development project management process; Practical experience of use of Test Driven Development, pair programming and various approaches to software management tools, including the use of software versioning, project management planning tools and continuous integration and deployment.

Data Modelling and Analysis (COMP4030)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr M Torres

Assessment (s): 100% Coursework (25% Lab Submission; 75% Data Analysis Study)

Overview: This module will enable you to appreciate the range of data analysis problems that can be modelled computationally and a range of techniques that are suitable to analyse and solve those problems. Topics covered include: basic statistics; types of data; data visualisation techniques; data modelling; data pre-processing methods including data imputation; forecasting methods; clustering and classification methods (decision trees, naīve bayes classifiers, k-nearest neighbours); data simulation and model interpretation techniques to aid decision support. Spending around 4 hours each week in lectures and computer classes, appropriate software (eg. R, Weka) will be used to illustrate the topics you'll cover.

Fundamentals of Artificial Intelligence (COMP1008)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr R Qu

Assessment (s): 25% Coursework (Written Report) & 75% Exam (1.5hr)

Overview: Through a two hour lecture once a week, this module gives you a broad overview of the fundamental theories and techniques of Artificial Intelligence (Al). You will explore how computers can produce intelligent behaviour, and will consider topics such as the history of Al, search techniques, machine learning, game playing techniques, philosophical issues, and knowledge representation and reasoning, etc.

Fundamentals of Information Visualisation (COMP3021)

Semester Taught: Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: K Zhou

Assessment (s): 50% Coursework (Written Report) & 50% Exam (2hr)

Overview: Information Visualisation is the process of extracting knowledge from complex data, and presenting it to a user in a manner that this appropriate to their needs. This module provides a foundational understanding of some important issues in information visualisation design. You will learn about the differences between scientific and creative approaches to constructing visualisations, and consider some important challenges such as the representation of ambiguous or time-based data. You will also learn about psychological theories that help explain how humans process information, and consider their relevance to the design of effective visualisations.

If you want to learn how to design and implement your own interactive information visualisation, you should also take the linked module G53IVP (Information Visualisation Project). Together, these two modules form an integrated 20 credit programme of study.

Fuzzy Logic and Fuzzy Systems (COMP4033)

Semester Taught: Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: C Chen

Assessment (s): 25% Coursework (Implementation and Report) & 75% Exam

Overview: This module aims to provide a thorough understanding of fuzzy sets and systems from a theoretical and practical perspective. Topics commonly include: type-1 fuzzy sets, type-1 fuzzy logic systems, type-1 fuzzy set based applications, type-2 fuzzy sets, type-2 fuzzy logic systems, type-2 fuzzy set based applications. Students will also be exposed to some of the cutting-edge research topics in uncertain data and decision making, e.g., based on type-2 fuzzy logic as well as other fuzzy logic representations. Students will develop practical systems and software in a suitable programming language.

Introduction to Human Computer Interactions (COMP2004)

Semester Taught: Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: Dr G Hopkins

Assessment (s): 100% Coursework (50% 2,000-word Design and Prototype Exercise; 50% 3,000-word Evaluation)

Overview: This module is part of the Human Computer Interaction theme in The School of Computer Science. This module aims to teach an understanding of people's interactions with technology and how to apply this knowledge in the design of usable interactive computer systems. The module will introduce the concept of usability and will examine different design approaches and evaluation methods. Specifically, this module will cover an understanding of different styles of interaction with technology, an analysis of user needs, design standards, low fidelity prototyping techniques and a comparison of evaluation techniques.

Introduction to Image Processing (COMP2005)

Semester Taught: Spring

Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Computing Workshops | Module Convenor: Dr T Pridmore

Assessment (s): 40% Coursework (2,000-word Programming Assignment) & 60% Exam (1hr)

Overview: This module introduces the field of digital image processing, a fundamental component of digital photography, television, computer graphics and computer vision. You will cover topics including: image representation and compression, image filtering, enhancement and analysis and image processing applications. You will spend around three hours in lectures and computer classes each week for this module.

Simulation and Optimisation for Decision Support (COMP4038)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Workshops & Computing Practicals | Module Convenor: Dr P Siebers

Assessment (s): 75% Coursework (10% Lab Exercises; 65% Case Study) & 25% Exam (1hr)

Overview: This module offers insight into the applications of selected methods of decision support. The foundations for applying these methods are derived from Operations Research Simulation, Social Simulation, Data Science, Automated Scheduling, and Decision Analysis. Throughout the module, you will become more competent in choosing and implementing the appropriate method for the particular problem at hand. You will spend five hours per week in lectures, workshops, and computer classes for this module.

Natural Sciences Third Year Module

This module is compulsory for all Natural Sciences students in the third year.

Synoptic Module (NATS4001)

Recommended for: Natural Sciences & Liberal Arts Students

Semester Taught: Full Year | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Workshops & Project Work | Module Convenor: Dr C Brignell

Assessment (s): 100% Coursework (Article 10%, Literature Review 25%, Project Report 40%, Presentation 15%, Reflective Piece 10%)

Overview: The synoptic module gives students the opportunity to take part in a piece of interdisciplinary project work. The module will explore the interface between science, engineering, social science and the humanities. The synoptic module gives students the opportunity to combine knowledge and skills acquired in individual subject disciplines to carry out interdisciplinary projects. In addition, this module will provide students with an opportunity to learn and to demonstrate transferable skills such as creativity, reasoning, problem solving, communication, critical thinking, time-management, teamwork and research skills.

In the autumn semester students will write an article aimed at a general audience on a topic of their choice related to their subject specialism. This is followed by a writing a literature review - summarising and critiquing the latest interdisciplinary research into solving a problem. The problems may be connected to the UN's sustainable development goals. In the spring semester students identify new interdisciplinary research initiatives and write a research paper or plan a programme of research.

Archaeology Y3

Module Title	Autumn	Spring
Students take 40-60 credits from the following:		
Humans-Animals-Landscapes relationships	20	
Medieval Europe and the Mediterranean AD 500-1500	20	
The Silk Road: cultural interactions and perceptions	20	
Commodities, Consumption and Connections: the Global World of Things		20
Human Osteology		20
Rome and the Mediterranean		20
Through a Glass Darkly		20

Humans-Animals-Landscapes relationships (CLAR3014)

Semester Taught: Autumn — Credits: 20

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures and Fieldtrip — Module Convenor: Dr H Miller

Assessment (s): 100% Coursework (2,500 word Critical Report)

Overview: A module which critically explores human-(non-human)animal-landscape relationships through time, using archaeological data to reflect on themes in prehistory, history, anthropological and current interactions. Drawing directly from current research, the course would introduce resonant themes to be explored through lectures.

The aim of this module is to demonstrate how data can be drawn together from multiple sources to highlight closely interwoven human-(non-human)animal-landscape relationships. As these are often indivisible, in reality if not worldview, the themes studied in this course would allow for a nuanced understanding of past societies but also a critical reflection of our own interactions. The periods and contents covered in this module would be broad and could be tailored by the students to fit their individual interests, teaching and research needs.

Medieval Europe and the Mediterranean AD500-1500 (CLAR3091)

Semester Taught: Autumn — Credits: 20

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures and Seminars — Module Convenor: Dr C Loveluck

Assessment (s): 100% Coursework (3,000-word Essay)

Overview: This module considers the archaeological evidence for the development of British and European societies and their connections around the Mediterranean, Africa and across Eurasia in the medieval period (from c. AD 500-1500). This was a period of significant social, political, economic and climate change which laid the foundations of the modern world. . Key topics will include in-depth analysis of themes such as the transformation of European and Mediterranean landscapes and settlement patterns from the Fall of the Roman Empire to the Renaissance; the towns of western Europe, Byzantium and the Islamic world; the impact of climate change, epidemic disease and population growth; the rise of kingdoms, states and empires; and the development of nearly global trade networks in Europe, Africa and Asia, between AD 500 and 1500 that would culminate in permanent European settlement in the Americas. The lectures and seminars will explore interdisciplinary approaches to the examination of these topics and what they can tell us about social and economic change, ideologies and social identities over 1000 years of human history.

The Silk Road: cultural interactions and perspectives (CLAR3085)

Semester Taught: Autumn — Credits: 20

Prerequisites: None — Corequisites: None

Style of Teaching: Lectures and Seminars — Module Convenor: Prof J Henderson

Assessment (s): 100% Coursework (3,000 word Essay)

Overview: This discipline-bridging module will involve colleagues from across the three University campuses. The Silk Road will be presented as a range of archaeological, historical, geographical, political and scientific themes. Broad cultural themes will be balanced with the presentation of specific case studies, such as the Roman, Byzantine and (medieval) Islamic Silk Roads and their links with e.g. the Tang and Ming dynasties along the networks which made up the terrestrial and maritime silk and spice roads. Later examples will also be considered to provide a balance. The ways in which Silk Roads can be defined such as a consideration of trade and exchange of a wide range materials across central and eastern Asia will be considered. Furthermore scientific analysis and its role in the interpretation of trade and exchange will be considered between for example China, central Asia , Scandinavia and the Middle east. Nineteenth century and more recent perceptions of the Silk Road will be considered too. This cross-disciplinary approach will focus on a range of geographical areas during a range of time periods. Movement of peoples and things will therefore be considered from a wide range of viewpoints producing mutually enriching studies set in global contexts.

Commodities, Consumption and Connections: the Global World of Things 1500-1800 (HIST2060)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr C King

Assessment (s): 100% Coursework (2,500-word Essay 50%; Digital Project 50%)

Overview: The early modern period witnessed the birth of commodity culture and the transformation of the relationship between people and their material world. Expanding global trade networks and early colonial encounters brought a range of exotic products into early modern homes including spices, sugar, tea, tobacco, cotton, porcelain and mahogany, while the rise of capitalism and industrialisation revolutionised the manufacture and availability of necessities and luxuries across the social spectrum. The richness of this 'new world of goods' had profound consequences, transforming patterns of consumption, introducing new understandings of scientific knowledge and cultural production, and reshaping social identities and relationships based on class, gender and race.

This module takes advantage of a sweep of new interdisciplinary perspectives across a range of subject areas, including social, economic and cultural history, archaeology, anthropology and art history, which have focused on the role and significance of early modern 'things'. Students will gain a fresh and stimulating grounding of central themes in early modern history as well as a deeper understanding of the importance of looking at early modern Europe as part of a globalising world. Students will explore a range of textual sources including wills and inventories, account books, letters and diaries which tell us about expanding global connections, what people consumed and how they thought about their objects. They will also be taught key methods and approaches for using physical objects, archaeological finds, museum collections and visual culture as primary sources for understanding early modern culture through the lens of object meanings, agency and networks, with opportunities for hands-on and digital engagement with sources of evidence. This interdisciplinary approach will enable students to understand the ways in which the study of material culture can provide fresh insights into everyday lives in the past and can also illuminate larger cultural histories and concerns.

Human Osteology (CLAR3086)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals and Fieldtrip | Module Convenor: Dr H O'Regan

Assessment (s): 40% In-Class Lab Tests x 2; 60% 2,000-word Lab Report

Overview: This module will examine what we can learn from the human skeleton, about the lives of people who lived in the past. We will also include some basic zooarchaeology to understand the similarities and differences between these two specialisms. The module will involve handling real archaeological human and non-human skeletons, learning how to identify their age, sex, stature, pathologies and taphonomy. We will also examine the demography of 19th century Nottingham on a fieldtrip to one of the city's largest (and most atmospheric) cemeteries.

This module will introduce students to human and non-human skeletons, and the information that can be gained from them, including aging, sexing, stature, pathology and isotope analysis. Sampling strategies, data collection and analysis will also be covered using data collected by the students themselves on a fieldtrip. The aim of the module is to make students confident in handling human and zooarchaeological remains, to have the background necessary to undertake final year dissertations on either human remains or zooarchaeology, and to teach some basic data visualisation and analysis.

Rome and the Mediterranean (CLAR3007)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Dr W Bowden

Assessment (s): 100% Coursework (3,500 word Essay 75%; Presentation and Reflective Statement 25%)

Overview: The module will examine the archaeological evidence for the Roman period in Italy and the Mediterranean from c. 300 BC to c. AD 550, in the context of the major social, cultural and economic changes of the region in this period and in the context of wider historical and archaeological approaches to the Mediterranean. It is aimed in particular at developing students' skills in using and understanding source material. Subjects covered include the evidence for use of rural and urban landscapes, public and domestic building and the Mediterranean economy.

Through a Glass Darkly (CLAR3003)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures, Practicals and Seminars | Module Convenor: Prof J Henderson

Assessment (s): 100% Coursework (4,000-word Essay 70%; Seminar 30%)

Overview: Glass is a unique material with some unusual properties that were used in past societies in a wide range of ways. Archaeological, ethnographic, historical and scientific approaches will all be used to answer cultural questions about the production and use of glass in past societies. All seminars and lectures will consist of a rich interdisciplinary mix of approaches to ancient glass. The module uses archaeological case studies extensively and covers glass from the earliest made in the 3rd millennium BC up to the medieval period. Geographically we will cover glass that occurs in the West, the Middle East and as far away as China.

In practical sessions students will get the chance to handle ancient glass of a range of dates, including evidence for its production and to identify what it was used for. Students will work hot glass themselves in the Ancient Technology lab in Humanities – such as decorated glass bead making. They will also see at first hand through the use of University analytical equipment how the scientific analysis of glass can answer questions about ancient glass technology and provenance.

All lectures and discussion groups will be presented in a way that involves students and to encourage them to voice their opinions about different aspects of the study of ancient glass. The seminars in particular will give students the opportunities to develop a presentation and allow them think in detail about interpretations.

Biology Y3

Biology - Molecular Biology & Genetics Specialism

Module Title	Autumn	Spring
Gene Regulation	10	
Human Variation	10	
Molecular Biological Laboratory Skills		10
Optional Modules – 10-20 credits from the following:		
Advanced Developmental Biology	10	
Molecular and Cellular Neuroscience	10	
Pathogens	10	
Aging, Sex and DNA Repair		10
Cancer Biology		10

Gene Regulation (LIFE3029)

Semester Taught: Autumn — Credits: 10

Prerequisites: Genome & Human Disease — Corequisites: None

Core for: Natural Sciences Biology on the Molecular Biology & Genetics Specialism

Style of Teaching: Lectures — Module Convenor: Dr A Chambers

Assessment (s): 100% Exam (2hr)

Overview: This module will deal with the mechanisms through which eukaryotic genes are expressed and the ways in which the expression of genes is modulated. Gene regulation at different levels and by distinctive mechanisms will be illustrated by detailed consideration of examples drawn from a variety of eukaryote models. Particular emphasis will be placed on recent research into the molecular details of transcriptional control in yeast and post-transcriptional control in multicellular eukaryotes.

Human Variation (LIFE3009)

Semester Taught: Autumn — Credits: 10

Prerequisites: Recommended Genome & Human Disease — Corequisites: None

Core for: Natural Sciences Biology on the Molecular Biology & Genetics Specialism

Style of Teaching: Lectures — Module Convenor: Prof J Armour

Assessment (s): 60% Coursework (2,000 word review) 40% Exam (1.5hr ROGO exam)

Overview: The module aims overall to provide an up-to-date understanding of the variety and extent of diversity in human DNA, and of how analysis of diversity can be used to reconstruct population history. The module will cover recent advances in the analysis of human variation, and will describe both the patterns of genetic diversity present within and between modern populations, as well as the mechanisms by which diversity is created.

Molecular Biological Laboratory Skills (BIOS3037)

Semester Taught: Spring — Credits: 10

Prerequisites: None — Corequisites: None

Style of Teaching: Lab Practicals & Computing Workshop — Module Convenor: Dr R Swarup

Assessment (s): 60% Coursework (1,500-word Lab Report & Questionnaire) & 40% ROGO Test)

Overview: The course will begin with the introduction and overview of the course including recombinant DNA technology for the cloning, expression and purification of Insulin. They will start with cloning insulin gene in an

expression vector using gene cloning. Students will get hands on experience in plasmid DNA isolation, Gateway cloning, agarose gel electrophoresis and bacterial transformation.

In the following weeks, students will validate their cloning through colony PCR (Polymerase Chain Reaction). Successful colonies will then be used for extraction of the recombinant plasmid DNA containing insulin gene. This plasmid will then be transformed into E.coli expression strain and expression of the insulin gene will be checked by Reverse Transcription-PCR. Successful clones will then be used for insulin purification using affinity chromatography. The purified insulin will be analysed by SDS-Polyacrylamide gel electrophoresis and by western- immuno detection.

Later in the course, there will be a session on Molecular Diagnostics to give an idea of how molecular techniques can be used in applied research and their importance in solving real world problems.

Students will also learn about analytical techniques such as HPLC (High Performance Liquid Chromatography) and GC (Gas Chromatography) that can be used to detect a wide range of metabolites.

Besides, students will be exposed to the rapidly evolving area of bioinformatics and will get hands on experience of searching DNA (sequence) and RNA (expression) databases relevant to animals and other organisms.

Student will also get an overview of genome-wide methods of investigating gene expression including transcriptomics (genome-wide analysis of RNA) and proteomics (genome-wide analysis of proteins).

Advanced Developmental Biology (LIFE3031)

Semester Taught: Autumn | Credits: 10

Prerequisite: Developmental Biology/Building Brains | Corequisites: None

Style of Teaching: Lectures and Lab Practicals | Module Convenor: Prof A Johnson

Assessment (s): 100% Exam

Overview: Building on the 2nd year course 'Developmental Biology', the aim of this module is to describe the morphological events and molecular mechanisms of organogenesis in a variety of model organisms. We will cover the underpinning experimental work and emphasise the biology of stem cells and their niches. The stem cell concept will further be elucidated in the adult organism resulting in regeneration and/or repair of tissue under physiological as well as stress conditions. The concept of pluripotency in relation to the formation of the germ line as well as cellular reprogramming will be discussed. Practical classes will help students visualise (a) morphogenetic events and molecular mechanisms during embryogenesis and (b) experimental approaches in developmental biology. Lecture material will be accompanied by relevant literature for further reading.

Molecular and Cellular Neuroscience (LIFE3001)

Semester Taught: Autumn | Credits: 10

Prerequisites: Recommended Y2 neuroscience | Corequisites: None

Style of Teaching: Lectures & Lab Practicals | Module Convenor: Dr I Mellor

Assessment (s): 33% Coursework (Practical Report) & 67% Exam (2hr)

Overview: This module aims to explore the molecular components of the nervous system in relation to the way in which they allow neurons to communicate with one another and with the outside world, and how they may be targeted by natural toxins, drugs and pesticides. Ligand-gated and voltage-gated ion channels will be considered at the molecular level. Emphasis will be placed on the ways in which knowledge of their molecular structure is enabling neuroscientists to postulate mechanisms to explain such phenomena as ligand binding and pharmacological specificity, voltage sensitivity, ion channel selectivity and blocking, desensitization and their interactions with animal and plant neurotoxins. The potential applications of this information in drug and pesticide design will be highlighted. Ion channels involved in sensing the environment will also be considered. The molecular basis of neuronal function will also be examined including topics such as: the ways in which synthesis and transport of intracellular components including neurotransmitters are regulated; how synaptic vesicles are formed and released; the mechanisms and consequences of intracellular calcium regulation as well as the application of light sensing in imaging techniques used in the study of neuroscience

Pathogens (LIFE3035)

Semester: Autumn | Credits: 10

Prerequisites: Infection and Immunity & Bacterial Genes | Corequisites: None

Style of Teaching: Lectures & Workshops | Module Convenor: Prof. R.E. Sockett

Assessment (s): 35% Coursework (Group Poster Exercise) 65% Exam (2hr)

Overview: This course, taught by 5 lecturers will give students an in depth understanding of the genetics, evolution and biochemistry behind the pathogenic properties of parasites and micro-organisms that cause major human disease in the present day. As time is limited, we will concentrate mainly on microbial aspects with one week on the genetics of human susceptibility. Students will learn about the specialised features of parasites and micro-organisms that make them pathogenic, how the genes encoding these features are regulated, and how biological, genetic and chemical tools can be used to develop preventative and curative treatments (2wks). Model organisms to be studied include the agents of malaria (2 wks), leishmania (1 wk), candidiasis (1 wk), aspergillosis (1 wk), Salmonella, Escherichia and Shigella dysenteries (1 wk), and tuberculosis (1 wk). Students will also take part in a group-learning activity to produce a poster on an emerging or persistent pathogen explaining the molecular biology of its virulence. They will learn to use a questioning approach to gain an understanding of microbiological processes in the literature and how to present a scientific poster at a conference by presenting their group's work for peer and staff judging at a poster conference for 35% of the module mark.

Aging, Sex and DNA Repair (LIFE3002)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr T Allers

Assessment (s): 100% Exam (2hr)

Overview: Why do we age and succumb to cancer? Has human civilization exposed a process of cellular decay for which evolution never prepared us? The age-related onset of cancer provides a stark reminder that we cannot avoid damage to the genetic blueprint on which life depends, and suggests that ageing may be a consequence of cellular activities that limit DNA damage and malignant transformation.

To avoid the ravages of age on the 'disposable soma', the germline is refreshed each generation by means of reproduction. Sexual reproduction is underpinned by recombination, which shuffles the genome and ensures correct chromosome segregation in meiosis. The molecular mechanisms of recombination are conserved in bacteria, yeast and higher eukaryotes, and defects in recombination are linked to cancer pre-disposition and/or premature ageing in humans.

This module examines how studies in bacterial and yeast model systems have uncovered the relationship between the somatic ageing observed during a single lifespan, and the necessity to maintain the genome intact from one generation to the next. This is despite our continuous exposure to mutagens and carcinogens of both natural and human origin. We will focus on the nature and consequences of genotoxic damage, and learn how microbiology, including model organisms such as Escherichia coli and Saccharomyces cerevisiae, has informed us about the mechanisms that avoid, repair or tolerate such damage.

Cancer Biology (LIFE3005)

Semester Taught: Spring | Credits: 10

Prerequisite: Recommended Genome & Human Disease | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr P Scotting

Assessment (s): 100% Exam (2hr)

Overview: Cancer is one of the major diseases in Western societies, accounting for one third to one quarter of all deaths. Particular attention is focused on the main mechanisms by which cells progress to a tumour state, such as avoiding apoptosis or escaping cell cycle control, and these themes are returned to throughout the course. Recent advances in human molecular genetics have led to the identification of many genes that are responsible for, or

contribute towards, the development or progression of cancer. Examples will be provided of genes that are involved in both inherited and sporadic forms of cancer and the latest ideas of the molecular mechanisms underlying cancer will be discussed. Where appropriate, molecular understanding that is leading to new treatments and approaches for tackling cancer development will be discussed. Students will also learn about the experimental approaches to understanding cancer.

Biology – Evolutionary Biology & Ecology Specialism

Module Title	Autumn	Spring
Evolutionary Ecology	10	
Conservation		20
Optional Module – 10-20 credits from the following:		
Molecular and Cellular Neuroscience	10	
Molecular Biological Laboratory Skills		10
Molecular Evolution		10
Science and Society		10

Evolutionary Ecology (LIFE3023)

Semester Taught: Autumn — Credits: 10

Prerequisite: Recommended Ecology — Corequisite: None

Core for: Natural Sciences Biology on the Evolutionary Biology & Ecology Specialism

Style of Teaching: Lectures and Seminars — Module Convenor: Dr A MacColl

Assessment (s): 50% Coursework (online data interpretation and MCQ); 50% Essay Exam

Overview: This module will describe the workings of natural selection in wild populations, the ecology that drives it, the processes that constrain it and the microevolution that results. Students will be encouraged to explore different intellectual tools for addressing questions about nature such as models, observations, experiments and the comparative method, and to think about their strengths and weaknesses. The module comprises a series of lectures and associated, critical discussion of papers from the primary literature on the following topics:

- Natural selection and the causes of evolution.
- The genetic basis of variation and its maintenance.
- Evolutionary stable strategies.
- Evolution of life histories.
- Competition and evolution.
- Coevolution of predators and prey.
- Coevolution of hosts and parasites.
- Coevolution of mutualists.
- Ecology and the origin of species
- Genomics in Evolutionary Ecology

The module will consider current knowledge of, and research into, the ecological causes and evolutionary processes that govern natural selection, adaptation and microevolution in natural populations. Three approaches to the study of evolutionary ecology will be used: theoretical and optimality models; the comparative method and direct measurement of natural selection in the wild.

Conservation (LIFE3028)

Semester Taught: Spring — Credits: 20

Prerequisites: Recommended: Ecology & some animal behaviour — Corequisites: None

Core for: Natural Sciences Biology on the Evolutionary Biology & Ecology Specialism

Style of Teaching: Lectures & Practicals | Module Convenor: Prof F Gilbert

Assessment (s): 75% Coursework (1,500 word reports x3) & 25% Essay Exam

Overview: The module looks in detail at the ideas and concepts underpinning conservation, particularly the effects of scale. The major role of habitat loss and fragmentation is explored, and the inadequacies of local conservation measures. Conservation practitioners are brought in to speak about their jobs and how to work in conservation. Quantitative approaches are emphasized, and the skills needed to contribute are developed in a set of practical exercises.

Topics covered include:

1. Records, distributions
2. Mapping, predicting distributions
3. Fragmentation
4. Rarity, Extinction & Viability
5. Monitoring
6. Indicators, IUCN RDB
7. Invasives
8. Practical conservation in the UK
9. Rewilding. Practical conservation in the UK10. People and parks
11. Triage and prospects for the 21st century

Molecular and Cellular Neuroscience (LIFE3001)

Semester Taught: Autumn | Credits: 10

Prerequisites: Recommended Y2 Neuroscience | Corequisites: None

Style of Teaching: Lectures & Lab Practicals | Module Convenor: Dr I Mellor

Assessment (s): 33% Coursework (Practical Report) & 67% Exam (2hr)

Overview: This module aims to explore the molecular components of the nervous system in relation to the way in which they allow neurons to communicate with one another and with the outside world, and how they may be targeted by natural toxins, drugs and pesticides. Ligand-gated and voltage-gated ion channels will be considered at the molecular level. Emphasis will be placed on the ways in which knowledge of their molecular structure is enabling neuroscientists to postulate mechanisms to explain such phenomena as ligand binding and pharmacological specificity, voltage sensitivity, ion channel selectivity and blocking, desensitization and their interactions with animal and plant neurotoxins. The potential applications of this information in drug and pesticide design will be highlighted. Ion channels involved in sensing the environment will also be considered. The molecular basis of neuronal function will also be examined including topics such as: the ways in which synthesis and transport of intracellular components including neurotransmitters are regulated; how synaptic vesicles are formed and released; the mechanisms and consequences of intracellular calcium regulation as well as the application of light sensing in imaging techniques used in the study of neuroscience

Molecular Biological Laboratory Skills (BIOS3037)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lab Practicals & Computing Workshop | Module Convenor: Dr R Swarup

Assessment (s): 60% Coursework (1,500-word Lab Report & Questionnaire) & 40% ROGO Test)

Overview: The course will begin with the introduction and overview of the course including recombinant DNA technology for the cloning, expression and purification of Insulin. They will start with cloning insulin gene in an expression vector using gene cloning. Students will get hands on experience in plasmid DNA isolation, Gateway cloning, agarose gel electrophoresis and bacterial transformation.

In the following weeks, students will validate their cloning through colony PCR (Polymerase Chain Reaction). Successful colonies will then be used for extraction of the recombinant plasmid DNA containing insulin gene. This

plasmid will then be transformed into E.coli expression strain and expression of the insulin gene will be checked by Reverse Transcription-PCR. Successful clones will then be used for insulin purification using affinity chromatography. The purified insulin will be analysed by SDS-Polyacrylamide gel electrophoresis and by western- immuno detection.

Later in the course, there will be a session on Molecular Diagnostics to give an idea of how molecular techniques can be used in applied research and their importance in solving real world problems.

Students will also learn about analytical techniques such as HPLC (High Performance Liquid Chromatography) and GC (Gas Chromatography) that can be used to detect a wide range of metabolites.

Besides, students will be exposed to the rapidly evolving area of bioinformatics and will get hands on experience of searching DNA (sequence) and RNA (expression) databases relevant to animals and other organisms.

Student will also get an overview of genome-wide methods of investigating gene expression including transcriptomics (genome-wide analysis of RNA) and proteomics (genome-wide analysis of proteins).

Molecular Evolution: Constructing the Tree of Life (LIFE3041)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures & Lab Practicals | Module Convenor: Dr C Wade

Assessment (s): 100% Exam (2.5hr)

Overview: The module examines how we can use DNA and protein sequences to investigate evolutionary relationships among organisms. The subject matter includes the alignment of DNA and protein sequences, the way in which DNA and protein sequences evolve and how these processes can be modeled, the construction of evolutionary trees (phylogenies) to determine relationships among organisms, and the use of molecular clocks to place evolutionary events within a timeframe.

The course provides numerous examples of the uses of molecular sequence data in evolutionary studies, highlighting the way in which sequence data are revolutionising our understanding of the living world and shows how understanding molecular evolution to produce accurate trees is crucial to understanding evolutionary mechanisms. In depth examples include the uses of molecular data to resolve the deep-level relationships in the 'tree of life' (relationships among the 3 domains of life), the origins of mitochondria and chloroplasts, and the application of molecular data to study relationships in the Mammalia and in particular the Cetacea. The use of molecular data in understanding phylogeography is also discussed, with particular emphasis on the recolonisation of Europe following the retreat of the ice at the end of the last glacial period. We also discuss the uses of genomic data to examine evolution.

Science and Society (LIFE3044)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr S Goodacre & Dr J Stockdale

Assessment (s): 100% Coursework (60% 3,000 word Dissertation; 40% Group Presentation)

Overview: This module aims to enable students to think about the influence science has on society and vice versa, to understand the rules/conventions by which science abides, to learn how to discuss/consult with their peers, to appreciate how to form an informed, synoptic view of difficult subjects and to learn how to express their own views (verbally and written) within this framework. Scientific discoveries are not isolated from the society within which they exist. This module will explore the interactions between science and society through a series of lectures, discussion groups and workshops. Topics that will be explored include the ethical parameters that govern how scientific work is constrained, ways in which scientific discoveries can/should be disseminated to the wider community, the wider responsibilities that follow the acquisition of new knowledge and the concept of 'citizen science', where science takes place outside the traditional academic centres of work.

Chemistry Y3

Chemistry - Organic-Inorganic Specialism

Module Title	Autumn	Spring
Advanced Laboratory	10	
Organometallic and Asymmetric Synthesis	10	
Pericyclic Chemistry and Reactive Intermediates		10
Optional Modules – 10-20 credits from the following:		
Bioinorganic and Metal Coordination Chemistry	10	
Chemical Biology and Enzymes	10	
Protein Structure and Function, Biospectroscopy and Bioinformatics	10	
Catalysis		10

Advanced Laboratory Techniques (CHEM3015)

Core for: Natural Sciences Chemistry Y3

Semester Taught: Full Year

Credits: 10

Prerequisites: Core Laboratory Work

Corequisites: None

Style of Teaching: Workshops and Laboratory Practicals

Module Convenor: Dr A Bertram

Assessment (s): 100% Coursework (Written Practical Reports)

Overview: To teach advanced experimental techniques in chemistry. To provide experience in the recording, analysis and reporting of physical data. To put into practice methods of accessing, assessing and critically appraising chemical literature. Following initial workshops there will be a focused literature review culminating in a mini research project. Experience in:

a. Experimental design and methodology

b. Using advanced experimental techniques in chemistry

c. The recording, analysis and reporting of physical data

d. The reporting of experimental results in journal style

e. Team working

Organometallic and Asymmetric Synthesis (CHEM3016)

Core for: Natural Sciences Chemistry Y3 Organic and Inorganic Specialism

Semester Taught: Autumn

Credits: 10

Prerequisite: Y2 Organics Core

Corequisites: None

Style of Teaching: Lectures, Tutorials and Workshops

Module Convenors: Prof R Stockman

Assessment (s): 100% Exam (2hr)

Overview: Palladium catalysis in organis synthesis - Tsuji-Trost pi-allyl chemistry, Heck and Stille reaction, Suzuki, Buchwald-Hartwig and Sonagashira coupling, etc, with synthesis examples
Selectivity issues in organic synthesis Overview of reactivity principles. Synthesis of organometallics (mainly organolithiums) via metal-halogen exchange, metallation etc., including special methods of unsaturated types (Shapiro reaction, ortho-metallation) and heterosubstituted systems. Connective C=C bond formation, including Julia and Peterson olefinations (synthesis examples) and use of sulfur ylides for epoxidation and cyclopropanation. Cuprate chemistry, centred on conjugate addition-electrophilic quench sequences (regiospecfic enolates), but also including carbocupration and substitution. Protecting groups revisited, synthesis of amino acids and peptides. Stereochemistry revised, and an introduction to asymmetric synthesis, including chiral pool, chiral reagents, chial auxiliaries for enolate alkylation and amine synthesis, and catalytic asymmetric oxidation and reduction.

Pericyclic Chemistry and Reactive Intermediates (CHEM3019)

Core for: Natural Sciences Chemistry Y3 Organic and Inorganic Specialism

Semester Taught: Spring | Credits: 10

Prerequisite: Y2 Organic Core | Corequisites: None

Style of Teaching: Lectures, Tutorials and Workshops | Module Convenor: Prof C Hayes

Assessment (s): 100% Exam (2hr)

Overview: Use of frontier molecular orbital analysis to explain and predict stereochemical and regiochemical outcomes of pericyclic reactions (Woodward-Hoffmann rules etc). Examples will be drawn from Diels-Alder reactions, cycloadditions [4+2] and [2+2], [3,3]-sigmatropic rearrangements (e.g. Claisen and Cope), [2,3]-sigmatropic rearrangements (e.g. Wittig and Mislow-Evans). Generation and use of reactive intermediates in synthesis (i.e. radicals, carbenes, nitrenes).

Bioinorganic and Metal Coordination Chemistry (CHEM3003)

Semester Taught: Autumn | Credits: 10

Prerequisite: Fundamental Chemistry Theory and Practical | Corequisites: None

Style of Teaching: Lectures, Workshops and Tutorials | Module Convenor: Dr J McMaster

Assessment (s): 100% Exam (2hr)

Overview: Transition metal chemistry. The chelate effect. The physical methods used to study the electronic structure of transition metal centres. The roles of metalloproteins in dioxygen transport, electron transfer, photosynthesis and dinitrogen fixation. The use of polychelates in the synthesis of small molecule analogues of the active sites of metalloproteins. Supramolecular chemistry involving metal centres, the synthesis and characterisation of supramolecular arrays. Metal organic frameworks and gas storage. Molecular machines containing metal centres.

Chemical Biology and Enzymes (CHEM3012)

Semester Taught: Autumn | Credits: 10

Prerequisites: Recommended Y2 Molecular Biology and Genetics | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Prof P Soultanas

Assessment (s): 100% Exam (3hr - short/medium questions)

Overview: This module develops an understanding of the nature and structure of enzymes, the characteristics of enzyme catalysed reactions and their inhibition. The mechanisms of action and structures of specific proteases, DNA helicases (PcrA, DnaB and RecBCD), translocases, recombinases and molecular motors, FoF1ATPase and Rho transcriptional terminator are covered. Experimental methodology in biochemistry, molecular biology and chemical biology for cloning genes, expressing proteins in bacteria, strategies for purifying proteins, protein engineering through mutagenesis procedures, N-terminal protein sequencing, protein electrophoresis, determination of protein concentrations, probing biomolecular interactions, assaying the activity of ATPases, protein structure determination(X-ray crystallography and protein NMR) and the use of a range of biophysical techniques. At the end of the module the students should have an understanding of the basic principles of: protein expression, mutagenesis and purification, yeast two and three hybrid technology (Y2H, Y3H), equilibrium sedimentation and velocity sentimentation ultracentrifugation techniques, phage display, surface plasmon resonance (SPR), fluorescence resonance energy transfer (FRET), ATPase assays, microarrays, protein NMR and X-ray crystallography. The students should be able to understand the applications of the above technologies in life science research.

Protein Structure and Function, Biospectroscopy and Bioinformatics (CHEM3004)

Semester Taught: Autumn | Credits: 10

Prerequisite: Y2 Inorganic and Organic Core | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: L Ciao

Assessment (s): 100% Exam (2hr)

Overview: The course will develop an understanding of protein structure, stability, de-novo design and methods of structural analysis. The correlation between structure and function in proteins will be covered. The course will present bioinformatics tools useful for structural comparison. A range of experimental spectroscopic techniques will be introduced to probe protein structure and stability based on secondary structure and tertiary interactions and to probe the nature of the active site of metalloproteins. Case-studies encompassing relevant literature on the subject will be used to highlight key aspects of the course.

Catalysis (CHEM3002)

Semester Taught: Spring | Credits: 10

Prerequisite: Intermediate Inorganic Chemistry | Corequisite: None

Style of Teaching: Lectures, Tutorials and Workshops | Module Convenor: Prof D Kays

Assessment (s): 100% Exam (2hr)

Overview: This module increases the student's knowledge and understanding of (a) heterogeneous and homogeneous catalysis (b) catalyst promotion and the concept of catalytic cycles. The physical basis of the structure-property relationships of heterogeneous catalysts is explained and the link between various organo-transition metal complexes and homogenous catalysis is explored. Comparisons between homogeneous and heterogeneous catalysis are highlighted. A review of the 18- and 16- electron rules and fundamental metal-centred bond-forming and bond-breaking reactions is undertaken and applied to several catalytic cycles. The influence of catalyst design in homogeneous catalysts, with respect to choice of metal ion and ligands, is discussed relating to product selectivity, in particular chirality. A qualitative appreciation of scale up for industrial application.

Chemistry - Inorganic-Physical Specialism

Module Title	Autumn	Spring
Advanced Laboratory	10	
Chemical Bonding and Reactivity	10	
Solids, Interfaces and Surfaces		10
Optional Modules – 10-20 credits from the following:		
Bioinorganic and Metal Coordination Chemistry	10	
Catalysis		10
Structure Determination Methods		10
Topics in Inorganic Chemistry		10

Advanced Laboratory Techniques (CHEM3015)

Core for: Natural Sciences Chemistry Y3

Semester Taught: Full Year | Credits: 10

Prerequisites: Core Laboratory Work | Corequisites: None

Style of Teaching: Workshops and Laboratory Practicals | Module Convenor: Dr A Bertram

Assessment (s): 100% Coursework (Written Practical Reports)

Overview: **To teach advanced experimental techniques in chemistry. To provide experience in the recording, analysis and reporting of physical data.** To put into practice methods of accessing, assessing and critically appraising chemical literature. Following initial workshops there will be a focused literature review culminating in a mini research project. Experience in:

a. Experimental design and methodology

b. Using advanced experimental techniques in chemistry

c. The recording, analysis and reporting of physical data

d. The reporting of experimental results in journal style

e. Team working

Chemical Bonding and Reactivity (CHEM3017)

Core for: Natural Sciences Chemistry Y3 Inorganic and Physical Specialism

Semester Taught: Autumn | Credits: 10

Prerequisite: Energy, Spectroscopy & Solid State Chemistry | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr A Teale

Assessment (s): 20% Coursework (Class Test) & 80% Exam (2hr)

Overview: Potential energy surfaces. Vibrations of polyatomic molecules. Symmetry selection rules in vibrational spectroscopy. Anharmonicity and vibrational coupling. Density of states. Born-Oppenheimer approximation. Concepts in photophysics and the origin of photochemistry. Boltzmann distribution. Collisional activation. Simple collision theory and the Arrhenius equation. Partition functions. RRK and transition state theory. Concepts in reaction dynamics. Hartree-Fock theory. Basis sets. Electron correlation. Density functional theory. Calculation of infrared spectra.

Solids, Interfaces and Surfaces (CHEM3018)

Core for: Natural Sciences Chemistry Y3 Inorganic and Physical Specialism

Semester Taught: Spring | Credits: 10

Prerequisite: Energy, Spectroscopy & Solid State Chemistry | Corequisites: None

Style of Teaching: Lectures & Workshops | Module Convenor: Dr J Titman

Assessment (s): 100% Exam

Overview:

Solids

Relationship between structure and properties of solids. Structure of Solids: Common structural types, reciprocal lattice, Brillouin zones. Electronic Structure: Sommerfield model, Fermi energy, Femi-Dirac distribution, Electronic conductivity, Band Structure, Nearly free electron model, Tight binding model. Metals, Semi-metals, Semi-conductors, Insulators. Characterization: X-ray spectroscopies, photoelectric effect. Semi-conductors: intrinsic, extrinsic, optical properties, photoconductivity, junctions, devices, LEDs, solar cells.

Interfaces and Surfaces

General introduction. Getting UHV, surface techniques, electron spectrometer, Auger electron spectroscopy. Surface Structure. Miller indices, 2D Bravais nets, relaxation and reconstruction, Wood and matrix notation. X-ray photoelectron spectroscopy, Einstein's equation, chemical shift, Koopmans theorem. Fermi level, work function, contact potential difference, scanning tunnelling microscope. Ultra-violet photoelectron spectroscopy. Adsorption kinetics, accommodation, sticking, Langmuir and precursor state kinetics. Desorption, temperature programmed desorption, reaction mechanisms, Eley-Rideal, Langmuir-Hinshelwood.

Bioinorganic and Metal Coordination Chemistry (CHEM3003)

Semester Taught: Autumn | Credits: 10

Prerequisite: Fundamental Chemistry Theory and Practical | Corequisites: None

Style of Teaching: Lectures, Workshops and Tutorials | Module Convenor: Dr J McMaster

Assessment (s): 100% Exam (2hr)

Overview: Transition metal chemistry. The chelate effect. The physical methods used to study the electronic structure of transition metal centres. The roles of metalloproteins in dioxygen transport, electron transfer, photosynthesis and dinitrogen fixation. The use of polychelates in the synthesis of small molecule analogues of the active sites of

metalloproteins. Supramolecular chemistry involving metal centres, the synthesis and characterisation of supramolecular arrays. Metal organic frameworks and gas storage. Molecular machines containing metal centres.

Catalysis (CHEM3002)

Semester Taught: Spring | Credits: 10

Prerequisite: Intermediate Inorganic Chemistry | Corequisite: None

Style of Teaching: Lectures, Tutorials and Workshops | Module Convenor: Prof D Kays

Assessment (s): 100% Exam (2hr)

Overview: This module increases the student's knowledge and understanding of (a) heterogeneous and homogeneous catalysis (b) catalyst promotion and the concept of catalytic cycles. The physical basis of the structure-property relationships of heterogeneous catalysts is explained and the link between various organo-transition metal complexes and homogenous catalysis is explored. Comparisons between homogeneous and heterogeneous catalysis are highlighted. A review of the 18- and 16- electron rules and fundamental metal-centred bond-forming and bond-breaking reactions is undertaken and applied to several catalytic cycles. The influence of catalyst design in homogeneous catalysts, with respect to choice of metal ion and ligands, is discussed relating to product selectivity, in particular chirality. A qualitative appreciation of scale up for industrial application.

Structure Determination Methods (CHEM3062)

Semester Taught: Spring | Credits: 10

Prerequisites: Energy, Spectroscopy and Solid State Chemistry | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Prof T Wright

Assessment (s): 100% Exam (2hr)

Overview: Various structure determination methods will be presented, covering a selection of spectroscopic and scattering methods. Advanced light and neutron sources will be introduced, moving on to their use in determining the structures of both isolated molecules and of solids (both crystalline and amorphous) and liquids.

Topics in Inorganic Chemistry (CHEM3024)

Semester Taught: Spring | Credits: 10

Prerequisite: Intermediate Inorganic Chemistry | Corequisite: None

Style of Teaching: Lectures and Workshops | Module Convenor: Prof P Licence

Assessment (s): 100% Exam

Overview: This module covers Inorganic Mechanisms and the overarching fundamental principles of Greener and Sustainable Chemistry as applied to processes.

Topics covered for Inorganic Reaction Mechanisms include classification of the types of substitution reactions found in coordination and organometallic chemistry; explanation of how spectroscopic methods can be used to detect organometallic reaction intermediates.

Topics in-scope for discussion on the theme of Greener and Sustainable Chemistry include: The principles of green chemistry, scale-up in the chemicals industry with case studies, cleaner polymerisation, clean extraction, oxidation processes including supercritical water.

Environmental Sciences Y3

Module Title	Autumn	Spring
Students take 40-60 credits from the following:		
Environmental Pollutants	20	
Geological Hazards and Resources	20	
Quaternary Environments	20	
Computer Modelling in Science: Applications	20	
Paleobiology	10	
Environmental Biotechnology		10

Environmental Pollutants (BIOS3049) – University Park and Sutton Bonington

Semester Taught: Full Year — Credits:20

Prerequisite: Soils — Corequisites: None

Style of Teaching: Lectures, Field Visit & Demonstrations — Module Convenor: Dr EH Bailey

Assessment (s): 30% Reports (1,000 word x2), 70% Rogo Exam (2hr)

Overview: This module is concerned with the behaviour and effects of pollutants in terrestrial and aquatic environments and how their impacts can be ameliorated and managed. The focus is on both the scientific understanding of environmental pollutants and on the intervention strategies currently available. Topics covered include study of the common water and soil pollutants: heavy metal contamination of land; radionuclide behaviour in the environment; persistent organic contaminants and pesticides; nitrate pollution of groundwater; pollution of surface waters by agriculture; eutrophication of lakes; acidification of soils and freshwaters; biological monitoring of rivers; ecotoxicology and environmental epidemiology; quantitative risk assessment; land reclamation, including landfill sites.

Geological Hazards and Resources (GEOG3035)

Semester Taught: Full Year — Credits: 20

Prerequisites: Y1 Environmental Science or Geography — Corequisites: None

Style of Teaching: Lectures, Lab Work and Interactive Learning — Module Convenor: Dr R Field

Assessment (s): 35% Coursework (Group presentation); 65% Exam (2hr)

Overview: A geohazard is a natural process or phenomenon that has the potential to adversely affect humanity by endangering life or property. A georesource is a substance or commodity that can be extracted from the subsurface for use by humanity. This module focuses on these two important issues for environment and society. The following topics are indicative of what the module may contain:

- Earthquakes
- Tsunamis
- Volcanos
- Soils, Erosion, shrink-swell, heave& liquefaction
- Landslides and mass movements
- Subsidence - natural and anthropogenic cavities
- Flooding - surface& groundwater
- Ground water
- Contamination of coastal cities
- Oil and gas– conventional
- Unconventional hydrocarbons: tar sands and shale gas
- Coal - deep and shallow
- Minerals for high-tech applications and renewable energy

- Precious minerals: Au Ag Pt, diamonds
- Infrastructure minerals: iron, copper
- Geothermal Energy
- Georesources and the law
- Geology of the built environment.

Quaternary Environments (GEOL3001)

Semester Taught: Full-Year | Credits: 20

Prerequisite: Environmental Change or Climate Change Science | Corequisites: None

Style of Teaching: Field Work & Lectures

Module Convenor: Prof S Metcalfe

Assessment (s): 100% Coursework (40% Project, 60% Essays x 2)

Overview: This module considers the Quaternary evolution, environmental and settlement history of three regions (low, mid and high latitudes) building on material covered in Environmental Change or Climate Change Science. The module will combine lecture based material, with laboratory based exercises and a field course where the practical aspects of this sort of work will be developed.

Course content will include:

- An overview of climate change records in the three study regions (the Americas, the Mediterranean, northern hemisphere high latitudes);
- Consideration of human – environment interactions over a range of timescales in those study regions;
- Critical review of methods of environmental reconstruction, dating techniques and sampling methods (waters, soils, sediments) in different contexts;
- Archives of change relevant to the study areas;
- Project design to understand past climate and environmental change.

*** Students are required to make a financial contribution towards the cost of field trips.**

Computer Modelling in Science: Applications (BIOS3036) – University Park

Semester Taught: Autumn | Credits: 20

Prerequisite: Computer Modelling in Science: Introduction | Corequisites: None

Style of Teaching: Computing Workshops | Module Convenor: Dr D Stekel

Assessment (s): 100% Coursework (Patchwork assessments of computer practical sessions x5)

Overview: Modern biological and environmental science includes the study of complex systems and large data sets, including imaging data. This necessitates the use of computer models and analyses in order to understand these systems. This module contains an introduction to computer programming and modelling techniques that are used in the biological and environmental sciences. Specifically, it contains: (i) Development, simulation and analysis for models in space and time, using the Python language, with applications in the biological and environmental sciences; (ii) Analysis of long term behaviour of models in two or more dimensions; (iii) Methods for fitting models to experimental and environmental data; (iv) analysis of image data. The module will focus on relevant applications in environmental and biological science, e.g. chemical, radioactive and biological pollution, crop development and pathogens and microbiology. The module will use the Python programming language throughout and be assessed by a patchwork assessment consisting of write-ups of assignments from during the semester.

Paleobiology (BIOS3041) – University Park

Semester Taught: Autumn | Credits: 10

Prerequisite: Climate Change Science | Corequisites: None

Style of Teaching: Lectures and Lab Practicals | Module Convenor: Dr B Lomax

Assessment (s): 50% Reports (1,000 word x2) & 50% Essay Exam (1.5hr)

Overview: Palaeobiology explores the relationship between life and the Earth's physical and chemical environment over geological/ evolutionary time. The module will focus on the geological consequences of evolution and how life has influenced physical and chemical environment. Topics covered will include: Origins and evolution of life; Evolution of the atmosphere and biosphere; the geobiology of critical intervals in both palaeobiology and evolutionary ecology. Students will gain an in depth knowledge of the mechanisms that control changes in the physiochemical environmental and their impact upon evolution. In order to gain a broad understanding the module will explore past changes as seem in the fossil record, together with present day processes that underpin these responses. The lectures and course work will give students knowledge of the tools that are used to reconstruct past environmental conditions and the effect of future changes in the abiotic stimuli that drive environmental change.

Environmental Biotechnology (BIOS3026) – University Park and Sutton Bonington

Semester Taught: Spring

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr H West

Assessment (s): 100% Exam (2hr)

Overview: This module provides training in environmental biotechnology, with particular emphasis on the interaction between microorganisms and the environment. The main topics covered will be wastewater treatment, bioremediation of organic and inorganic pollutants, microbes as indicators of risk factors in the environment, microbes in agriculture (biocontrol and biofertilisers) and the role of microorganisms in bioenergy production. Each topic will be introduced by a formal lecture followed by workshops during which students will study the topics in greater detail through problem-based learning techniques facilitated by the Convenor and by independent research. Knowledge and understanding of the lecture material will be assessed by Rogo examination and students will present the problem based exercises and case studies within an individual portfolio during the final week of the module.

Geography Y3

Module Title	Autumn	Spring
Students take 40-60 credits from the following:		
Geological Hazards and Resources	20	
Geophysics and Geological Mapping	20	
Global Climate Change	20	
Mineralogy and Petrology	20	
Quaternary Environments	20	
Freshwater Management	20	
Emerging Challenges in Biogeography		20
Environmental Modelling		20

Geological Hazards and Resources (GEOG3035)

Semester Taught: Full Year

Credits: 20

Prerequisites: Y1 Environmental Science or Geography

Corequisites: None

Style of Teaching: Lectures, Lab Work and Interactive Learning

Module Convenor: Dr R Field

Assessment (s): 35% Coursework (Group presentation); 65% Exam (2hr)

Overview: A geohazard is a natural process or phenomenon that has the potential to adversely affect humanity by endangering life or property. A georesource is a substance or commodity that can be extracted from the subsurface for use by humanity. This module focuses on these two important issues for environment and society. The following topics are indicative of what the module may contain:

- Earthquakes
- Tsunamis
- Volcanos
- Soils, Erosion, shrink-swell, heave& liquefaction
- Landslides and mass movements
- Subsidence - natural and anthropogenic cavities
- Flooding - surface& groundwater
- Ground water
- Contamination of coastal cities
- Oil and gas– conventional
- Unconventional hydrocarbons: tar sands and shale gas
- Coal - deep and shallow
- Minerals for high-tech applications and renewable energy
- Precious minerals: Au Ag Pt, diamonds
- Infrastructure minerals: iron, copper
- Geothermal Energy
- Georesources and the law
- Geology of the built environment.

Geophysics and Geological Mapping (GEOG3033)

Semester Taught: Full Year

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures, Practicals, Field Trips & Project Work

Module Convenor: Dr R Field

Assessment (s): 100% Coursework (50% Geophysics Coursework; 50% Geological Map)

Overview: The following topics are indicative of what the module is likely to contain:

- Definition and context of geophysics
- Electrical resistivity tomography
- Electromagnetics
- Ground penetrating radar
- Geophysical modelling
- Seismic methods
- Gravity
- Magnetics
- Radiometrics
- Borehole & airborne geophysics
- Integrated geophysical surveys
- Geological field mapping & techniques
- Geological map construction (field slip & fair copy maps)
- Feature mapping
- Health & safety for field workers
- Interpretation of aerial photography

***** Students are required to make a financial contribution towards the cost of field trips.

Global Climate Change (GEOL3002)

Semester Taught: Full Year — Credits: 20

Prerequisite: Environmental Change — Corequisites: None

Style of Teaching: Lectures, Computing Workshops & Poster Session — Module Convenor: Dr S Gosling

Assessment (s): 100% Coursework (20% Poster Presentation; 30% Group Poster; 50% Climate Change Summary)

Overview: The aim of this module is to introduce students to the science and issues that surround present and future climate change and its impacts on human society and the natural environment. The module will cover the scientific basis for global climate change together with its impact on society, policy, mitigation and adaptation.

Topics include:
1. A review of modern climate systems and climate forcings.
2. Climate modelling, projections of future climate change and their uncertainty.
3. Controversies around climate change and the way climate change is communicated to and perceived by the public.
4. Impacts of climate change on the oceans, food security, forests, water scarcity, extreme events and human health.
5. Mitigation and adaptation to future climate change including the role played by policy-makers and NGOs.

Mineralogy and Petrology (GEOL3003)

Semester Taught: Full Year — Credits: 20

Prerequisite: Physical Landscapes — Corequisites: None

Style of Teaching: Lectures, Practical and Field Trips — Module Convenor: Dr M Jones

Assessment (s): 40% Coursework (Lab/Practical Handbook) & 60% Essay Exam (2hr)

Overview: The aim of this module is to introduce students to the principal rock-forming minerals from the major different rock types. The module will also consider economic mineral deposits.

Specifically the module will include discussion of: the rock forming minerals and the major rock types and their formation (igneous, sedimentary and metamorphic); their identification and bulk materials. Economic mineralogy will include discussion around the types of ore deposit and critical metals, how they form, and their economic importance. The module will cover these issues theoretically and practically.

Module Contributors to this module are from the British Geological Survey: Dr L Field, Dr S Parry and Mr P Lusty.

***** Students are required to make a financial contribution towards the cost of field trips.

Quaternary Environments (GEOL3001)

Semester Taught: Full-Year | Credits: 20

Prerequisite: Environmental Change or Climate Change Science | Corequisites: None

Style of Teaching: Field Work & Lectures

Module Convenor: Prof S Metcalfe

Assessment (s): 100% Coursework (40% Project, 60% Essays x 2)

Overview: This module considers the Quaternary evolution, environmental and settlement history of three regions (low, mid and high latitudes) building on material covered in Environmental Change or Climate Change Science. The module will combine lecture based material, with laboratory based exercises and a field course where the practical aspects of this sort of work will be developed.

Course content will include:

- An overview of climate change records in the three study regions (the Americas, the Mediterranean, northern hemisphere high latitudes);
- Consideration of human – environment interactions over a range of timescales in those study regions;
- Critical review of methods of environmental reconstruction, dating techniques and sampling methods (waters, soils, sediments) in different contexts;
- Archives of change relevant to the study areas;
- Project design to understand past climate and environmental change.

*** Students are required to make a financial contribution towards the cost of field trips.**

Freshwater Management (GEOG3015)

Semester Taught: Autumn | Credits: 20

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures. Field Work and Workshops | Module Convenor: Dr M Johnson

Assessment (s): 100% Coursework (60% Group Project on Field Work; 40% Short Essay)

Overview: This module considers human attempts to manage and restore freshwater environments,specifically rivers, lakes and wetlands. It considers changes in the fluvial system that occur in response to river management and engineering and examines approaches to restoring the natural functions of rivers that have been heavily degraded by human impacts. The module examines some of the main stressors on lakes and wetlands lake management, and approaches for their management using an ecosystem-scale approach. The principles by which restoration practice is guided will be considered, and criteria for selection between alternative strategies will be introduced. The module will consider water quality and legislative requirements for freshwater bodies.

The module includes a field trip where students will visit a local nature reserve and develop a management plan with input from management practitioners and land-owners. Students will also be able to engage with river management practitioners in a series of guest lectures.

*** Students are required to make a financial contribution towards the cost of field trips.**

Emerging Challenges in Biogeography (GEOG3057)

Semester Taught: Spring | Credits: 20

Prerequisite: Previous ecology modules | Corequisites: None

Style of Teaching: Lectures, Practicals and Tutorials | Module Convenor: Dr F Schrodt

Assessment (s): 100% Coursework (70% 3,000-word essay; 30% Group Debate/Presentation)

Overview: The course will engage students in current issues and problems related to biogeography and environmental change, including both 'blue skies' and applied research, reflecting the active research areas of the module staff.

Focus will be placed on linking theory and applied questions, and gathering and evaluating evidence to inform debate and reach scientifically valid conclusions. Topics may change yearly in response to emerging research advances, but example topics include:

- Carbon sequestration and forest ecology
- Ecosystem services and conflicts between conservation and resource use
- Species' endemism and its conservation
- Thermal vulnerability of organisms to climate and land use change

The module will be divided into blocks, each focusing on a specific emerging challenge in biogeography. Each block will include lectures, a practical session, a tutorial, and 1-2 student-led debates (2 hrs). Lectures will deliver key theory and background content. Practicals involve a range of activities, examples including conservation problem solving through games, data collection, data analysis and modelling. Tutorials will engage students in critical discussions of primary research literature. For each block, two groups will prepare and engage in a moderated debate, arguing perspectives set by the session leader.

Environmental Modelling (GEOG3028)

Semester Taught: Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures, Computing Practicals and Seminars

Module Convenor: Dr S Gosling

Assessment (s): 50% Coursework (2,000-word Essay) & 50% Exam (1.5hr)

Overview: This module will expose students to current practices, technologies and ideas existing at the forefront of environmental modelling. The module offers an opportunity for students to experience the theory and practice associated with key developments that are occurring in major modelling domains and the most recent advances from the research community. The module will comprise 4 parts. Part 1 is composed entirely of 1-hour lectures, with parts 2-4 incorporating an alternating programme of lecture and practical classes.

Part 1: Introduction to key concepts in environmental modelling.

Part 2: River modelling.

Part 3: Modelling climate change and its impacts on society.

Part 4: Modelling species distributions.

Maths Y3

Maths – Applied, Computation and Statistics Specialism

Module Title	Autumn	Spring
Students take 40-60 credits from the following:		
Coding and Cryptography	10	
Mathematical Medicine and Biology	20	
Optimization	20	
Fluid Dynamics		20
Game Theory		10
Scientific Computation and Numerical Analysis		20

Coding & Cryptography (MATH3011)

Semester Taught: Autumn

Credits: 10

Prerequisites: Calculus & Linear Algebra

Corequisites: None

Style of Teaching: Lectures & Problem Classes

Module Convenor: Dr A Kasprzyk

Assessment (s): 100% Exam (2hr)

Overview: This module consists of two main topics of coding theory: error-correction codes and cryptography. In digital transmission (as for mobile phones), noise that corrupts the message can be very harmful. The idea of error-correcting codes is to add redundancy to the message so that the receiver can recover the correct message even from a corrupted transmission. The module will concentrate on linear error-correcting codes (such as Hamming codes), where encoding, decoding and error correction can be done efficiently. We will also discuss cyclic codes, which are the ones most frequently used in practice.

In cryptography, the aim is to transmit a message such that an unauthorised person cannot read it. The message is encrypted and decrypted using some method, called a cipher system. There are two main types of ciphers: private and public key ciphers. We will discuss basic classical mono and polyalphabetic ciphers as more modern public key cipher like, for instance, RSA and the elementary properties from number theory needed for them. Key exchange protocols and digital signatures (DSA) are included.

Mathematical Medicine and Biology (MATH3009)

Semester Taught: Autumn

Credits: 20

Prerequisite: Modelling with Differential Equations

Corequisites: None

Style of Teaching: Lectures & Problem Classes

Module Convenor: Dr R Thul

Assessment (s): 100% Exam (3hr)

Overview: Mathematics can be usefully applied to a wide range of applications in medicine and biology. Without assuming any prior biological knowledge, this module describes how mathematics helps understand topics such as population dynamics, biological oscillations, pattern formation and nonlinear growth phenomena. There is considerable emphasis on model building and development.

Optimization (MATH3027)

Semester Taught: Autumn

Credits 20

Prerequisites: Applied Statistics and Probability

Corequisites: None

Style of Teaching: Lectures and Computing Workshops

Module Convenor: D Kalise

Assessment (s): 40% Coursework (2x Assignments) & 60% Exam (2.5hr)

Overview: This is an introduction to fundamental aspects in mathematical optimization, with an emphasis on continuous and convex optimization and an outlook towards computational/applied mathematics and data science.

The module is structured around the following topics:

- Introduction to optimization: mathematical formulation and classification, examples, and convexity. (1 week)
- Unconstrained optimization: gradient descent and line search methods, trust-region methods, linear and nonlinear least-squares problems. (4 weeks)
- Constrained optimization: optimality conditions and Lagrange multipliers, linear programming and duality, penalties and the Augmented Lagrangian method. (4 weeks)
- Stochastic optimization: stochastic gradient descent and nature-inspired optimization. (2 weeks)

Fluid Dynamics (MATH3017)

Semester Taught: Spring | Credits: 20

Prerequisite: Modelling with Differential Equations | Corequisites: None

Style of Teaching: Lectures and Problem Classes | Module Convenor: Dr M Scase

Assessment (s): 10% Coursework & 90% Exam (3hr)

Overview: The dynamics of fluids is important in many different areas, including weather forecasting, engineering, and biology. This module includes solutions of the full, nonlinear equations describing fluid motion, and several examples of approximate solution techniques in circumstances where full analytical solutions are not available. Topics include:

- Inviscid fluid motion and wave propagation.
- Understanding of and solutions to the Navier-Stokes equations.
- Boundary layers, jets and wakes.
- Slow flow.
- Lubrication theory.
- Rotating flows.

Game Theory (MATH3004)

Semester Taught: Spring | Credits: 10

Prerequisites: Calculus & Linear Algebra | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr M Kurth

Assessment (s): 100% Exam (2hr)

Overview: Game theory contains many branches of mathematics (and computing); the emphasis here is primarily algorithmic. The module starts with an investigation into normal-form games, including strategic dominance, Nash equilibria, and the Prisoner's Dilemma. We look at tree-searching, including alpha-beta pruning, the 'killer' heuristic and its relatives. It then turns to mathematical theory of games; exploring the connection between numbers and games, including Sprague-Grundy theory and the reduction of impartial games to Nim.

Scientific Computation and Numerical Analysis (MATH3036)

Semester Taught: Spring | Credits: 20

Prerequisite: Introduction to Scientific Computation | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr M Hubbard

Assessment (s): 40% MATLAB Coursework (x2) & 60% Exam (2.5hr)

Overview: Differential equations play a crucial modelling role in many applications, such as fluid dynamics, electromagnetism, biomedicine, astrophysics and financial modelling. Typically, the equations under consideration are so complicated that their solution may not be determined by purely analytical techniques; instead one has to resort to computing numerical approximations to the unknown analytical solution. In this module we study numerical techniques for approximating data, ordinary and partial differential equations, and solving, or finding eigenvalues and eigenvectors of, the large linear systems of equations that result from these approximations. The module covers:

- Initial value problems (ODEs): multistage and multistep methods; convergence and stability; higher order ODEs; systems of first order ODEs; implicit methods.
- Partial differential equations: finite differences for elliptic, parabolic and hyperbolic PDEs; truncation error and stability analysis; finite volume methods.
- Approximation theory: least squares approximation; trigonometric polynomial approximation.
- Eigenvalues and eigenvectors: power method; inverse iteration; Householder transformations; QR algorithm; singular value decomposition.
- Large linear systems: Krylov subspace methods; conjugate gradient method; preconditioning.

Maths - Mathematical Physics Specialism

Module Title	Autumn	Spring
Students take 50 credits from the following:		
Advanced Quantum Theory	20	
Coding and Cryptography	10	
Differential Equations	20	
Fluid Dynamics		20
Game Theory		10
Relativity		20

Advanced Quantum Theory (MATH3010)

Semester Taught: Autumn

Credits: 20

Prerequisite: Introduction to Mathematical Physics

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr S Weinfurtner

Assessment (s): 100% Exam (3hr)

Overview: This course builds on the foundations of quantum mechanics introduced in the module MATH2013. It further develops the fundamental theory so that it applies to more general problems, such as those involving spin, and introduces key calculational approaches, such as those underlying angular momentum, the hydrogen atom, scattering problems and approximation methods such as perturbation theory.

The module begins with a description of the quantum theory of angular momentum, using ladder operators and introducing the concept of spin. The quantum theory of the Hydrogen atom is then described, incorporating aspects of angular momentum such as spin. The fundamental formalism of quantum mechanics is set out in a more general setting than considered in MATH2013, introducing concepts such as bra-ket notation, symmetries, unitary operators and the Heisenberg picture. Approximation methods such as perturbation theory and variational approaches are described and scattering theory is introduced in the context of three-dimensional wave propagation in a central potential.

Coding & Cryptography (MATH3011)

Semester Taught: Autumn

Credits: 10

Prerequisites: Calculus & Linear Algebra

Corequisites: None

Style of Teaching: Lectures & Problem Classes

Module Convenor: Dr A Kasprzyk

Assessment (s): 100% Exam (2hr)

Overview: This module consists of two main topics of coding theory: error-correction codes and cryptography.
In digital transmission (as for mobile phones), noise that corrupts the message can be very harmful. The idea of error-correcting codes is to add redundancy to the message so that the receiver can recover the correct message even from a corrupted transmission. The module will concentrate on linear error-correcting codes (such as Hamming codes),

where encoding, decoding and error correction can be done efficiently. We will also discuss cyclic codes, which are the ones most frequently used in practice.

In cryptography, the aim is to transmit a message such that an unauthorised person cannot read it. The message is encrypted and decrypted using some method, called a cipher system. There are two main types of ciphers: private and public key ciphers. We will discuss basic classical mono and polyalphabetic ciphers as more modern public key cipher like, for instance, RSA and the elementary properties from number theory needed for them. Key exchange protocols and digital signatures (DSA) are included.

Differential Equations (MATH3016)

Semester Taught: Autumn | Credits: 20

Prerequisite: Modelling with Differential Equations | Corequisites: None

Style of Teaching: Lectures & Problem Classes | Module Convenor: Prof J King

Assessment (s): 100% Exam (3hr)

Overview: Mathematical models based on systems of ordinary or partial differential equations are used in a vast range of disciplines, ranging from classical fields such as fluid and solid mechanics to more recent applications in mathematical biology and finance. The complexity of these models is often so great that numerical methods are the only ones available to construct solutions. However, in this module we will learn how to make analytical progress in the presence of a small parameter using asymptotic methods, to determine similarity solutions and to obtain qualitative information using the techniques of dynamical systems theory. Topics will include:

- Asymptotic expansions and order symbols.
- Asymptotic solutions of algebraic equations.
- Laplace's method and the method of stationary phase.
- The method of matched asymptotic expansions.
- The method of multiple scales.
- The Wentzel-Kramers-Brillouin-Jeffreys (WKBJ) expansion.
- The centre manifold theorem.
- Lyapunov's theorems.
- Bifurcation theory for first order ODEs.
- Hopf bifurcations.
- Similarity solutions.

Fluid Dynamics (MATH3017)

Semester Taught: Spring | Credits: 20

Prerequisite: Modelling with Differential Equations | Corequisites: None

Style of Teaching: Lectures and Problem Classes | Module Convenor: Dr M Scase

Assessment (s): 10% Coursework & 90% Exam (3hr)

Overview: The dynamics of fluids is important in many different areas, including weather forecasting, engineering, and biology. This module includes solutions of the full, nonlinear equations describing fluid motion, and several examples of approximate solution techniques in circumstances where full analytical solutions are not available. Topics include:

- Inviscid fluid motion and wave propagation.
- Understanding of and solutions to the Navier-Stokes equations.
- Boundary layers, jets and wakes.
- Slow flow.
- Lubrication theory.
- Rotating flows.

Game Theory (MATH3004)

Semester Taught: Spring | Credits: 10

Prerequisites: Calculus & Linear Algebra | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr M Kurth

Assessment (s): 100% Exam (2hr)

Overview: Game theory contains many branches of mathematics (and computing); the emphasis here is primarily algorithmic. The module starts with an investigation into normal-form games, including strategic dominance, Nash equilibria, and the Prisoner's Dilemma. We look at tree-searching, including alpha-beta pruning, the 'killer' heuristic and its relatives. It then turns to mathematical theory of games; exploring the connection between numbers and games, including Sprague-Grundy theory and the reduction of impartial games to Nim.

Relativity (MATH3018)

Semester Taught: Spring | Credits: 20

Prerequisite: Intro to Mathematical Physics | Corequisites: None

Style of Teaching: Lectures and Problem Classes | Module Convenor: Dr A Schenkel

Assessment (s): 100% Exam (3hr)

Overview: The course is an introduction to Einstein's theory of special and general relativity. When velocities are a significant fraction of the speed of light, the concepts of spatial distance and elapsed time need to be modified; they become relative to the observer. In this course the relativistic laws of mechanics are described in a unified framework of space and time and some implications, such as Einstein's famous equation E=mc2, are explained. Gravitational effects require that space-time is warped or curved. The relevant mathematical machinery to describe this curvature is introduced and is used to discuss its physical effects. Topics covered:

- Lorentz transformations.
- Minkowski space.
- Relativistic particle mechanics.
- Special relativity continuum mechanics.
- Elementary differential geometry.
- Newtonian gravitation.
- General relativity.
- Einstein field equations.
- Examples of spacetimes, including Schwarzschild geometry.

Pharmaceutical Science Y3

This stream is likely to have clashes with your other subject, you must check the severity of those clashes against the other modules you want to take and agree a strategy to manage these clashes.

Module Title	Autumn	Spring
Contemporary Drug Discovery	10	
Biologics	20	
Natural Products	20	

Contemporary Drug Discovery (CHEM3022)

Semester Taught: Full Year

Credits: 10

Prerequisite: Y2 Pharmaceutical Science

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr A Nortcliffe

Assessment (s): 50% Report (3,000-word) & 50% Exam (1.5hr)

Overview: Examines modern approaches to drug discovery, emphasising that an understanding of the relationship between chemical structure and drug properties is vital. Following an overview of how a new medicine is discovered and brought to market, there will be a discussion of the following key topics: The types of drug target; how drugs bind to their targets; how drug activity is measured; sources of lead compounds; rational strategies for improving drug potency and selectivity; pharmacophores; physicochemical properties (e.g. lipophilicity and pKa); pharmacokinetics; bioisosteres; how to design drugs that are safe; pharmaceutical properties (e.g. stability and solubility). Examples from case histories of successful (and unsuccessful) medicines will be used to illustrate the underlying chemical principles.

Biologics (PHAR3023)

Semester Taught: Autumn

Credits: 20

Prerequisite: Y2 Pharmaceutical Science

Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals

Module Convenor: Dr K Spriggs

Assessment (s): 20% Coursework (Assignment related to labs) & 80% Exam (2hr)

Overview: This module provides:

- Advances in protein and antibody technologies;
- New biological entities, including RNA and cell-based therapeutics
- Advances in gene therapy, including genome-editing techniques;
- Biosimilars;
- Chemical synthesis and modification as well as formulation of biological products.

Natural Products (PHAR3024)

Semester Taught: Autumn

Credits: 20

Prerequisite: Y2 Pharmaceutical Science

Corequisites: None

Style of Teaching: Lectures, Workshops and Lab Practicals

Module Convenor: Dr C de Moor

Assessment (s): 70% Coursework (Essay & Lab Report) & 30% Exam (1hr)

Overview: This module provides:

- An overview of natural products as a source for drug discovery;
- Biological sources, chemical modification and synthesis, as well as formulation of natural products;
- Extraction and chromatographic techniques for the isolation of natural products;
- Analytical techniques for the characterisation of natural products and quality control of drug molecules.

Physics Y3

Physics – Experimental Physics Specialism

Module Title	Autumn	Spring
Atoms, Photons and Fundamental Particles	20	
Thermal and Statistical Physics	20	
Physics Project		10

Atoms, Photons and Fundamental Particles (PHYS3001)

Core for: Natural Sciences Physics Y3

Semester Taught: Full Year

Credits: 20

Prerequisite: Y2 Physics Core

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr A Moss

Assessment (s): 20% Continuous Assessment & 80% Exam (2hrs)

Overview: This module introduces students to the physics of atoms, nuclei & the fundamental constituents of matter and their interactions. The module will also develop the quantum mechanical description of these. Topics covered:

- approximation techniques – first order perturbation theory, degeneracies, second order perturbation theory, transition rates, time-dependent perturbation theory, Fermi's golden rule;
- Particle Physics – protons and neutrons, antiparticles, particle accelerators and scattering experiments, conservation laws, neutrinos, leptons, baryons and hadrons, the quark model and the strong interaction, weak interactions, standard model;
- Introduction to atomic physics – review of simple model of hydrogen atom, Fermi statistics and Pauli principle, aufbau principle, hydrogenic atoms, exchange, fine structure and hyperfine interactions, dipole interaction, selection rules and transition rates;
- Lasers – optical polarization and photons, optical cavities, population inversions, Bose statistics and stimulated emission, Einstein A and B coefficients;
- Nuclear Physics – Radioactivity, decay processes, alpha, beta and gamma emission, detectors, stability curves and binding energies, nuclear fission, fusion, liquid drop and shell models.

Thermal and Statistical Physics (PHYS2002)

Core for: Natural Sciences Physics Maths Y2

Semester Taught: Full Year

Credits: 20

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr Y Mao

Assessment (s): 20% Continuous Assessment & 80% Exam

Overview: Macroscopic systems exhibit behaviour that is quite different from that of their microscopic constituents studied in isolation. New physics emerges from the interplay of many interacting degrees of freedom. In this module you will learn about the important physical properties of matter & the two main approaches to their description. One, thermodynamics, treats macroscopically relevant degrees of freedom (temperature, pressure & so on) & find relations between these and the fundamental laws which govern them, independent of their microscopic structure. The other approach, statistical mechanics, links the macroscopically relevant properties to the microphysics by replacing the detailed microscopic dynamics with a statistical description. The common feature of both of these methods is the introduction of two macroscopic quantities, temperature & entropy, that have no microscopic meaning.

Physics Project (PHYS3014)

Core for: Natural Sciences Physics Y3

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Laboratory Practicals

Module Convenor: Dr J Sharp

Assessment (s): 30% Continuous Assessment of Project Diary & 70% Final Project Report

Overview: The students will carry out a project drawn from diverse areas of physics. The project may be experimental or theoretical in nature. Many of the projects reflect the research interests of members of academic staff. Students work in pairs and are expected to produce a plan of work and to identify realistic goals for their project. Each pair has a project supervisor responsible for setting the project.

Physics – Theoretical Physics Specialism

Module Title	Autumn	Spring
Atoms, Photons and Fundamental Particles	20	
Solid State Physics	20	
Physics Project		10

Atoms, Photons and Fundamental Particles (PHYS3001)

Core for: Natural Sciences Physics Y3

Semester Taught: Full Year

Credits: 20

Prerequisite: Y2 Physics Core

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr A Moss

Assessment (s): 20% Continuous Assessment & 80% Exam (2hrs)

Overview: This module introduces students to the physics of atoms, nuclei & the fundamental constituents of matter and their interactions. The module will also develop the quantum mechanical description of these. Topics covered:

- approximation techniques – first order perturbation theory, degeneracies, second order perturbation theory, transition rates, time-dependent perturbation theory, Fermi's golden rule;
- Particle Physics – protons and neutrons, antiparticles, particle accelerators and scattering experiments, conservation laws, neutrinos, leptons, baryons and hadrons, the quark model and the strong interaction, weak interactions, standard model;
- Introduction to atomic physics – review of simple model of hydrogen atom, Fermi statistics and Pauli principle, aufbau principle, hydrogenic atoms, exchange, fine structure and hyperfine interactions, dipole interaction, selection rules and transition rates;
- Lasers – optical polarization and photons, optical cavities, population inversions, Bose statistics and stimulated emission, Einstein A and B coefficients;
- Nuclear Physics – Radioactivity, decay processes, alpha, beta and gamma emission, detectors, stability curves and binding energies, nuclear fission, fusion, liquid drop and shell models.

Solid State Physics (PHYS3002)

Core for: Natural Sciences Physics Maths Y3

Semester Taught: Full Year

Credits: 20

Prerequisite: Y2 Physics Core

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr J O'Shea

Assessment (s): 20% Continuous Assessment & 80% Exam (2hrs)

Overview: This module will provide a general introduction to solid state physics. Topics to be covered will include:

- bonding – nature of chemical bonds, thermodynamics of solid formation;
- crystal structures – description of crystal structures, k-space, reciprocal lattice, Bragg diffraction, Brillouin zones;
- Nearly-free electron model - Bloch's theorem, band gaps from electron Bragg scattering, effective masses;
- Band theory – Fermi surfaces, qualitative picture of transport, metals, insulators and semiconductors;
- Semiconductors - doping, inhomogeneous semiconductors, basic description of pn junction;
- Phonons – normal modes of ionic lattice, quantization, Debye theory of heat capacities, acoustic and optical phonons;
- Optical properties of solids – absorption and reflection of light by metals, Brewster angle, dielectric constants, plasma oscillations;
- Magnetism.- Landau diamagnetism, paramagnetism, exchange interactions, Ferromagnetism, antiferromagnetism, neutron scattering, dipolar interactions and domain formation, magnetic technology

Physics Project (PHYS3014)

Core for: Natural Sciences Physics Y3

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Laboratory Practicals

Module Convenor: Dr J Sharp

Assessment (s): 30% Continuous Assessment of Project Diary & 70% Final Project Report

Overview: The students will carry out a project drawn from diverse areas of physics. The project may be experimental or theoretical in nature. Many of the projects reflect the research interests of members of academic staff. Students work in pairs and are expected to produce a plan of work and to identify realistic goals for their project. Each pair has a project supervisor responsible for setting the project.

Psychology Y3

Psychology - Cognitive Neuroscience Subpathway

Module Title	Autumn	Spring
Neuropsychology and Applied Neuroimaging	10	
Neuropsychology of Action	10	
The Visual Brain: Evolution, Development, Learning and Adaptation		10
Optional Modules – 10-20 credits from the following:		
Mechanisms of Learning and Psychopathology	20	
Social Neuroscience Research	20	
Altruism, Cooperation and Helping		10
Cognitive Development and Autism		10

Neuropsychology and Applied Neuroimaging (PSGY3009)

Semester Taught: Autumn

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr M Schuerman

Assessment (s): 100% Exam (2hr)

Overview: This course examines the deficits seen in individuals who have suffered brain damage. Students will learn about the impairments of language, memory, perception, attention, motor control, executive control and emotion. This course evaluates both the clinical and theoretical aspects of these syndromes. In particular, this course will evaluate the implications regarding how the healthy brain functions.

Neuropsychology of Action (PSGY3006)

Semester Taught: Autumn

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof S Jackson

Assessment (s): 100% Exam (2hr)

Overview: This module examines the psychological and neural basis for the planning and control of human action, . Students will be introduced to scientific research, through their guided exploration of the neuropsychological bases for human action . During the course students will experience the multi-disciplinary nature of research into human behaviour, and by the end of the course, will understand how a single issue can be addressed from multiple perspectives including: experimental psychology, neurophysiology, neuroanatomy, neuropsychology, and functional brain-imaging.

The Visual Brain (PSGY3021)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof P McGraw

Assessment (s): 100% Exam

Overview: The central theme of this module is to explore how the architecture and function of the visual brain has been designed and shaped by experiences over a range of timescales. The innate properties of the eye and visual brain that are present at birth have been designed over millions of years of evolution. The brain continues to physically change it structure and function within a lifetime – a property termed “brain plasticity”. Over the years of development, brain plasticity is the driving force for the maturation of different visual brain functions. Even well into

adulthood, plasticity is retained in the form of learning, which can optimise performance for certain visual tasks and be exploited for therapeutic uses. Another prominent form of plasticity in the visual brain is that caused by adaptation – effects of visual experience over the preceding tens of milliseconds to minutes. The module will examine the consequences of evolution, development, learning and adaptation for visual brain function and perception.

Mechanisms of Learning and Psychopathology (PSGY3018)

Semester Taught: Full Year

Credits: 20

Prerequisite: Neuroscience and Behaviour

Corequisites: None

Style of Teaching: Lectures, Seminars & Tutorials

Module Convenor: Dr M Haselgrove

Assessment (s): 50% Coursework (4,000-word Essay) & 50% Exam (2hr)

Overview: Supported by lectures, seminars and tutorials, this module aims to provide students with an understanding of the mechanisms of learning and memory in human and non-human animals, and an analysis of pathological conditions involving these systems. Students will study topics that include perceptual learning, the contextual and attentional modulation of learning and behaviour as well as more neuroscientifically focused topics such as the role of the hippocampus in memory. Clinical topics include the acquisition of phobias, memory discords, the psychological side effects of cancer treatment, and depression.

Social Neuroscience Research (PSGY3016)

Semester Taught: Full Year

Credits: 20

Prerequisite: Practical Methods

Corequisite: None

Style of Teaching: Lectures

Module Convenor: Dr L Marsh

Assessment (s): 50% Coursework (2,700 word Research Proposal; 500-word Science Articles; 1 Post) & 50% Exam

Overview: This course focuses on the investigation of evidence supporting recently reported research as well as the planning of better future research and the dissemination of that research to a non-academic audience. It combines student-led investigations of cutting-edge, meaningful, psychological research relevant to cognitive, developmental or social neuroscience, through self-learning, with the creative application of research and psychological literacy skills. The course material will introduce examples of recent research and discuss the supporting evidence for that research and its subsequent reporting. Students will receive introductory lectures and workshops on relevant research and study skills as well as detailed guidance on assessment criteria.

Altruism, Cooperation and Helping (PSGY3019)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof EMP Ferguson

Assessment (s): 100% Exam (2hr)

Overview: The course will cover theories and models of altruism, cooperation and helping form the perspective of psychology, economics and evolutionary biology. Among the theories examined will be reputation based, strong-reciprocity, warm-glow and crowding and altruistic punishment from economics; kin selection, reciprocity, coercion, mutualism, cooperative breeding from biology; and empathy, personality, sexual selection and situational constraints from psychology. The course will consider why people sometimes don't help and actively try to benefit from others (e.g., Free-riding) and apply these models to anti-social behaviour, and how we cooperate to inflict injury on other groups. The course will also examine not just models of helping others, but also why people ask for help. The course will finally look at how charities implement some of these principles and if they are successful.

Cognitive Development and Autism (PSGY3011)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr D Ropar

Assessment (s): 100% Exam

Overview: This module will cover modern versions of nativist and empiricist theories of cognitive development. It will also give an overview of current theories, which have been proposed to explain Autism Spectrum Disorder. It will provide an evaluation of these theories using behavioural, clinical and neurophysiological evidence from a range of domains including: Sensory and visual processing; drawing and musical skills (savant skills); social and emotional processing; imitation.

Psychology - Social and Developmental Specialism

Module Title	Autumn	Spring
Understanding Developmental Disorders	10	
Developmental Dyslexia		10
Optional Modules – 20-30 credits from the following:		
Social Neuroscience Research	20	
Educational Psychology	10	
Forensic and Mental Health	10	
Altruism, Cooperation and Helping		10
Clinical Psychology		10
Cognitive Development and Autism		10

Understanding Developmental Disorders (PSGY3007)

Semester Taught: Autumn

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr L Cragg

Assessment (s): 100% Exam (2hr)

Overview: This module explores how psychologists study and understand disorders of cognitive development. The course focuses largely on disorders which include impairments in attention, memory and/or executive function. Disorders covered include attention deficit hyperactivity disorder (ADHD), autism, reading disorders and Down Syndrome. List of lectures 1. General introduction and research methods 2. Typical development of attention/memory and executive function 3. ADHD 4. Autism 5. Developmental Coordination Disorder 6. Fragile X Syndrome 7. Down Syndrome 8. Preterm Birth 9. Interventions 10. Revision

Developmental Dyslexia (PSGY3017)

Semester Taught: Spring

Credits: 10

Prerequisite: Social & Developmental Psychology

Corequisites: None

Style of Teaching: Lectures

Module Convenor: NA

Assessment (s): 100% Exam (2hr)

Overview: This module explores psychological theories of developmental dyslexia and educational issues pertaining to this pervasive developmental disorder. It examines the cognitive characteristics and educational attainments of pupils with developmental dyslexia and addresses the ways in which individual educational needs might be met at both the classroom and whole school level. This module should be of interest to students with an interest in developmental, cognitive, and/or educational psychology, and those wishing to pursue a career in child psychology, educational psychology, general teaching practice, and/or special needs education.

Key questions to be considered are:

- what criteria should be used to diagnose developmental dyslexia?

- how variable are the characteristics of developmental dyslexia?
- to what extent can developmental disorders of reading be interpreted within models of typical literacy acquisition?
- does developmental dyslexia reflect delayed or deviant behaviour?
- what are the specific educational issues pertaining to the provision of educational policy and practice for pupils with developmental dyslexia
- how should pupils with developmental dyslexia be supported in the classroom?

Social Neuroscience Research (PSGY3016)

Semester Taught: Full Year | Credits: 20

Prerequisite: Practical Methods | Corequisite: None

Style of Teaching: Lectures | Module Convenor: Dr L Marsh

Assessment (s): 50% Coursework (2,700 word Research Proposal; 500-word Science Articles; 1 Post) & 50% Exam

Overview: This course focuses on the investigation of evidence supporting recently reported research as well as the planning of better future research and the dissemination of that research to a non-academic audience. It combines student-led investigations of cutting-edge, meaningful, psychological research relevant to cognitive, developmental or social neuroscience, through self-learning, with the creative application of research and psychological literacy skills. The course material will introduce examples of recent research and discuss the supporting evidence for that research and its subsequent reporting. Students will receive introductory lectures and workshops on relevant research and study skills as well as detailed guidance on assessment criteria.

Educational Psychology (PSGY3014)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr S Atkinson

Assessment (s): 100% Exam (2hr)

Overview: This course provides an introduction to the contexts in which educational psychologists operate by examining the historical development of this profession within a set of major legislative and policy contexts, such as the recent drive to increase social inclusion. In particular, successes in, and barriers to, establishing a role as scientist-practitioners in educational settings will be explored. The module will concentrate on assessment & intervention work with specific populations such as young people who display challenging behaviour in schools, vulnerable adolescents, and bilingual learners. Additionally the course will examine psychological approaches to group work with teachers and pupils as well as the application of system theory in helping transform aspects of schools & other organisations.

Forensic and Mental Health (PSGY3013)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr C Lawrence

Assessment (s): 100% Exam (2hr)

Overview: The area of forensic mental health is extremely pertinent in both the criminal justice system & mental health services, and the integration of the two. It is a growing area of research in Psychology and an area many students interested in working following their degree. The module will concentrate on offending behaviours, typical categorisation of those who commit crimes or harm themselves, standard interventions for offenders and the neuroscience of offending. The course will also cover the current research on specific offending behaviours, and examine the role of the criminal justice system and health service in dealing with individuals who offend.

Altruism, Cooperation and Helping (PSGY3019)

Semester Taught: Spring | Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof EMP Ferguson

Assessment (s): 100% Exam (2hr)

Overview: The course will cover theories and models of altruism, cooperation and helping form the perspective of psychology, economics and evolutionary biology. Among the theories examined will be reputation based, strong-reciprocity, warm-glow and crowding and altruistic punishment from economics; kin selection, reciprocity, coercion, mutualism, cooperative breeding from biology; and empathy, personality, sexual selection and situational constraints from psychology. The course will consider why people sometimes don't help and actively try to benefit from others (e.g., Free-riding) and apply these models to anti-social behaviour, and how we cooperate to inflict injury on other groups. The course will also examine not just models of helping others, but also why people ask for help. The course will finally look at how charities implement some of these principles and if they are successful.

Clinical Psychology (PSGY3005)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof E Townsend

Assessment (s): 30% Coursework (1 x Assignment) & 700% Exam (1hr)

Overview: The aim of the course is to introduce the students to the concept of abnormal psychology and the application of psychology in clinical settings. The course will illustrate how psychological models are developed and how they are applied in developing interventions. The emphasis will be on examining theory and evaluation of interventions for a number of disorders/clinical issues.

Cognitive Development and Autism (PSGY3011)

Semester Taught: Spring

Credits: 10

Prerequisite: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr D Ropar

Assessment (s): 100% Exam

Overview: This module will cover modern versions of nativist and empiricist theories of cognitive development. It will also give an overview of current theories, which have been proposed to explain Autism Spectrum Disorder. It will provide an evaluation of these theories using behavioural, clinical and neurophysiological evidence from a range of domains including: Sensory and visual processing; drawing and musical skills (savant skills); social and emotional processing; imitation.

Archaeology Y4

Module Title	Autumn	Spring
Natural Sciences Dissertation	60	
Optional Modules: 20-40 credits from the following:		
Special Topics in Archaeology 1	20	
Special Topics in Archaeology 2		20

Natural Sciences Dissertation (NATS4002)

Core for: Natural Sciences Y4 - discipline of study dictated by the supervisor

Semester Taught: Full Year

Credits: 60

Prerequisites: None

Corequisites: None

Style of Teaching: Supervisions and Project Work

Module Convenor: Dr C Brignell

Assessment (s): 100% Coursework (30% Literature Review, 60% Dissertation, 10% Presentation)

Overview: The aim of the module is to provide training for the description, planning and conduct of a programme of research in order to solve or report on a specific scientific problem. The student will work with the supervisor to devise a project by identifying an appropriate topic before focusing on a specific scientific problem. Once devised the students will undertake the main body of work for the project which may be experimental, computer, literature or theoretically based (or various combinations of these). The student will have regular, normally weekly, supervisor meetings. The module is assessed by a dissertation in the style of a scientific paper, a literature review and a poster presentation.

Special Topics in Archaeology 1 (CLAR4011) & Special Topics in Archaeology 2 (CLAR4012)

Core for: Students taking Archaeology in Y4 must take at least 1 special topics module

Semester Taught: both Autumn & Spring

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Meetings and Research

Module Convenor: Dr C Gallou

Assessment (s): 100% Coursework (5,000 word projects - may include essays, practicals and reports)

Overview: This module aims to provide in depth coverage of a topic selected jointly by the specialist member of staff and the students concerned. It is designed to meet the needs of postgraduate students for study tailored to their specific requirements, and will be particularly useful for students intending to proceed to doctoral research.

Previous topics have included:
Practical Archaeobotany
Practical Zooarchaeology
Reconstructing Ancient Technologies
Animals: The Bones of Society
Human Evolution

Biology Y4

Module Title	Autumn	Spring
Life Sciences Fourth Year Project	60	
Research Planning and Preparation	20	
Research Presentation Skills	20	
Optional Modules: 0-20 credits from the following:		
Advanced Experimental Design and Analysis	10	
Cutting Edge Research Technologies and Ideas in Molecular Biology	10	
Process and Practice in Science	10	

Biology Project (LIFE4108)

Core for: Natural Sciences Biology Y4

Semester Taught: Full year — Credits 60

Prerequisite: Y3 Biology — Corequisite: Research Planning & Prep & Research Presentation Skills

Style of Teaching: Meetings & Project Work — Module Convenor: Dr M Brock

Assessment (s): 100% Coursework (80% 7,000-word Report; 10% 15min Presentation; 10% Viva Voce)

Overview: The project is a year-long module. Preparatory work (familiarisation with laboratory/field safety protocols etc.) will occur in autumn, with the bulk of practical work in spring. The topic of the project will be chosen from a list of suggestions relevant to the degree subject, and will be finalised after consultation with a member of staff, who will act as a supervisor. The project involves an extensive piece of detailed research on the topic chosen after discussion with the supervisor. The practical component will involve collection of data from a laboratory or field investigation and appropriate analysis. The findings will be interpreted in the context of previous work and written-up in a clear and concise final report in the form of a research paper manuscript or end-of-grant report. The main findings will also be delivered in an assessed oral presentation and discussed with two assessors in a viva voce.

Research Planning and Preparation (LIFE4109)

Core for: Natural Sciences Biology Y4

Semester Taught: Full Year — Credits: 20

Prerequisite: Y3 Biology — Corequisite: Project

Style of Teaching: Meetings & Project Work — Module Convenor: Dr M Brock

Assessment (s): 100% Coursework (12-page Grant Proposal)

Overview: This is a year-long module, but with most of the work being complete by the end of January. The module focuses on the preparing students to engage in substantial independent research in Biology, and is supported by lecture content in Research Presentation Skills (C14705). Students choose a research topic from a list provided the previous academic year, and are allocated an individual research supervisor accordingly. In regular meetings, student and supervisor discuss relevant research literature and design a practical research project addressing a specific hypothesis. Assessment is via a substantial research proposal.

Research Presentation Skills (LIFE4051)

Core for: Natural Sciences Biology Y4

Semester Taught: Full year — Credits: 20

Prerequisite: Y3 Biology — Corequisite: Project

Style of Teaching: Lectures and Workshops — Module Convenor: Dr A Renault

Assessment (s): 100% Coursework (30% Blog; 30% Poster; 20% Workshop assignment; 20% Presentation)

Overview: An introduction to the presentation skills required in a modern scientific career. A series of workshops will provide training in best practice for oral, written and graphical research communication to a variety of audiences. Journal clubs will require students to present and discuss with peers recent key papers in their broad field of study, and also to produce a written summary of a paper for a lay audience. Over the year each student will write at least three scientific blog posts. Students will be asked to prepare a poster based on their research project findings.

Advanced Experimental Design and Analysis (LIFE4049)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisite: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr T Reader

Assessment (s):100% Coursework (50% 1,500-word Coursework; 50% 1,000-word Coursework)

Overview: An advanced level biological statistics course, building on basic undergraduate training. This module will outline a range of statistical techniques that students are likely to encounter during their research projects. We will also discuss the most common experimental design problems faced by biologists. Lectures discuss concepts in experimental design, biological probability, generalised linear modelling and multivariate statistics. Practical sessions build on this conceptual outline, giving hands on experience of problem solving and analytical software, and some basic programming skills.

Cutting Edge Research Technologies and Ideas in Molecular Biology (LIFE4048)

Semester Taught: Autumn | Credits: 10

Prerequisite: Y3 Biology | Corequisite: None

Style of Teaching: Lectures

Module Convenor: Dr A Huett

Assessment (s): 35% Coursework (2 x 25-30min presentations), 65% Exam (3hr)

Overview: This course will bring students up to date with the latest technological developments in molecular biology that they are unlikely to have encountered in detail in the first three years. We will also discuss and explore how new technologies with broad implications come into existence and follow the process of establishment, acceptance and dissemination through the scientific community. The actual content of the course will be updated each year to reflect the latest advances, for example a course running now would certainly consider the latest developments in high through-put sequencing technologies and genome engineering. During the module a disruptive technology that has developed rapidly over the last five years (e.g. high-throughput DNA sequencing) will be considered as a case study. During the course students will practice their presentation skills and also their ability to accurately and succinctly summarise content in written form.

Process and Practice in Science (LIFE4050)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisite: None

Style of Teaching: Lectures

Module Convenor: Dr S Evison

Assessment (s): 100% Coursework (40% 1,500-word Essay; 40% Communication to Lay-audience; 20% Presentation)

Overview: A consideration of science ‘as a process’. There will be brief introductions to the history, philosophy and sociological norms of science. Aspects of the scientific literature and scientific communication, peer review, 'metrics’, including citation analysis, journal impact factors, and the 'h' and other indices of measuring scientists' performances will be dealt with. Ethics in science and the distinctions between ‘science’, ‘pseudo-science‘, ‘pathological science‘ and ‘fraudulent science’ will be discussed. The module will end with consideration of recent trends, such as the changing relationship between scientists, government and the public, the RAE/REF systems of university funding and the emergence of 'post-academic' science.

Chemistry Y4

Module Title	Autumn	Spring
Chemistry Research Project	60	
Optional Modules: 20-60 credits from the following:		
Enterprise for Chemists	10	
Advanced Physical Chemistry	10	
Contemporary Organic Synthesis	10	
Inorganic and Materials Chemistry A	10	
Inorganic and Materials Chemistry B	10	
Advanced Biocatalysis, Biosynthesis and Chemical Biology		10
Advanced Physical Chemistry 2		10
Medicines from Nature/Pharmaceutical Process Chemistry		10
Molecular Interactions and Supramolecular Assembly		10
Nucleic Acids and Bioorganic Mechanisms		10

Chemistry Research Project (CHEM4007)

Core for: Natural Sciences Chemistry Y4

Semester Taught: Full Year

Credits: 60

Prerequisite: Advanced Lab Techniques N

Corequisites: None

Style of Teaching: Supervisions and Project Work

Module Convenor: Prof R Stockman

Assessment (s): 100% Coursework (25% Lit Review, 15% Project Proposal, 20% Experimental Work, 40% Report)

Overview: This module will give students the opportunity to undertake a research project in Chemistry. A wide range of projects will be available and students will be offered a selection of research areas. All projects will require a review of relevant published work and the planning and execution of a research topic under the guidance of two supervisors. Students will present their findings orally and in a written report.

Enterprise for Chemists (CHEM4006)

Semester Taught: Full Year

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures, Seminars and Workshops

Module Convenor: Dr T Farren

Assessment (s): 15% Dragon's Den Exercise/Presentation; 10% Group Exercise/Presentation; 75% Exam (1hr)

Overview: Students will learn about the factors that lead to successful commercial innovation and how to take a technical idea and convert it into a successful commercial venture. They are shown routes to market for innovative ideas available from an academic/industrial viewpoint Assessment in SEM 1 will be via group exercise and presentation; teams have 3 weeks to develop the business case for a new innovation as a Dragon's Den Style Pitch which is given in late November.

Students will also learn about different types of business and how they contribute to the global economy. Some of the basic business skills will be covered (selling, marketing, customer awareness and finance) as well as the aspects which drive innovation and success.

We also give students an understanding of intellectual property, how it is used to create value in the business context. Aspects of IP law are highlighted with reference to different types of IPR including patents, trademarks, copyright, design rights and trade secrets including their everyday application within chemistry using industries.

This course demonstrates utilisation of this IP to give a company a competitive advantage within their market place.

At the end of the course students participate in a one day business exercise led by professionals from a chemicals company that tests all of the above skills in an interesting and realistic approach to commercial problem solving.

Advanced Physical Chemistry 1 (CHEM4021)

Semester Taught: Autumn | Credits: 10

Prerequisite: Chemical Bonding and Reactivity | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr D Walsh

Assessment (s): 100% Exam

Overview: The module covers topics of current importance in advanced electrochemistry, including:

(1) Fundamentals of electrochemistry. Overview of electrode processes and electrode potentials. Structure of the electrode/electrolyte interface. Modern theories of electron transfer and the origin of overpotentials. Mass-transport in electrochemical cells. Analytical electrochemistry using potential-step and potential-sweep methods.

(2) Electrochemical Devices. Potentiometric and amperometric sensors. Chemically-modified electrodes. Electrocatalysis. Electrochemical energy storage and conversion in batteries, supercapacitors, and fuel cells.

Contemporary Organic Synthesis (CHEM4020)

Semester Taught: Autumn | Credits: 10

Prerequisite: Y3 Organic Core Modules | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr R Denton

Assessment (s): 100% Exam

Overview: The module will focus on the synthesis of a variety of natural (and unnatural) compounds of relevance to biology and medicine, with particular reference to the goals and achievements of contemporary organic synthesis as illustrated by a range of case studies. There will be particular emphasis on the use of modern synthetic methodology to address problems such as chemoselectivity, regiocontrol, stereoselectivity, atom economy and sustainability. The module will focus on the application of new methodology for the rapid, efficient and highly selective construction of a range of target compounds, particularly those that display significant biological activity (e.g. anticancer compounds). The module will also address how a greater understanding of mechanism is important in modern organic chemistry.

Inorganic and Materials Chemistry A (CHEM4024)

Semester Taught: Autumn | Credits: 10

Prerequisite: Catalysis | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Prof A Khlobystov

Assessment (s): 100% Exam

Overview: Carbon Nanostructures: This part of the module considers the structural diversity of inorganic carbon nanostructures, the physicochemical properties of carbon nanomaterials and their technological applications. Polymer Materials: This part of the module considers the synthesis of different polymer structures, characterisation methods and the importance of structure property relationships for materials.

Topics include:

a) Bonding rules in carbon nanostructures: structural relationship between diamond, graphene, fullerenes and carbon nanotubes.
b) Fullerenes as 0D carbon nanostructures: structural diversity and chemical reactivity.
c) Nanotubes as 1D carbon nanostructures: physicochemical properties and technological applications.
d) Graphene as 2D carbon nanostructure: physicochemical properties and technological applications.
e) Introduction to polymeric properties, outlining the modern approaches to advanced materials manufacture.
f) Introduction to the key analytical techniques required for modern polymeric materials characterisation.
g) Modern polymer synthetic strategies and detailed mechanisms of controlled polymer synthesis.

h) An understanding of the most important structure property relationships and how these can be controlled and exploited.

Inorganic and Materials Chemistry B (CHEM4023)

Semester Taught: Autumn | Credits: 10

Prerequisite: Catalysis and Bioinorganic and Metal Coordination Chemistry | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: Prof M Poliakoff

Assessment (s): 100% Exam

Overview: This module builds on the previous years' modules on both transition metal chemistry and structural chemistry and focuses on Inorganic Photochemistry, Molecular Machines and the applications of photochemistry to chemical manufacture. Photochemistry topics covered include Electron transfer pathways; dynamics and energies; biological systems; mixed valence compounds; principles of molecular and supramolecular photochemistry; applications of inorganic photochemistry; probes for DNA, ion sensors, artificial photosynthesis, photocatalysis, photodynamic therapy of cancer treatment. Molecular machine topics covered include an introduction and overview; a survey of key background concepts; synthesis, applications and future developments. Photochemical manufacture topics covered include the concept of reagentless chemistry, understanding why photochemistry has potential advantages over more traditional chemistry, identifying the problems of scaling up these reactions and considering how some of those problems can be overcome by engineering.

Advanced Biocatalysis, Biosynthesis and Chemical Biology (CHEM4030)

Semester Taught: Spring | Credits: 10

Prerequisite: Y3 Organic Core | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr N Mitchell

Assessment (s): 100% Exam

Overview: "This module consists of three separately taught topics unified by advanced biomolecular chemistry: Advanced Chemical Biology (Dr. Nick Mitchell), Biocatalysis (Dr. Elaine O'Reilly) and Biosynthesis (Dr. James Dowden). Advanced Chemical Biology: explores protein synthesis with non-canonical amino acids, chemical genetics approaches to drug discovery, probing cellular functions and protein-protein interactions with small molecules, bio-orthogonal reactions (affinity probes; non-denaturing fluorescent labelling; cleavable purification tags), and activity based profiling/ proteomics. Biocatalysis: An overview of the application of enzymes in organic synthesis will be examined including key examples of the application of biocatalysts in industry. Modern methods for designing new biocatalysts will be considered, including directed evolution and rational design. Biosynthesis: A molecular view of the biosynthetic pathways to give both primary metabolites (e.g. fatty acids) and secondary metabolites belonging to the polyketide, terpenoid and non-ribosomal peptide families will be described.

Advanced Physical Chemistry 2 (CHEM4022)

Semester Taught: Spring | Credits: 10

Prerequisite: Chemical Bonding and Reactivity | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr N Besley

Assessment (s): 100% Exam (2hr)

Overview: The study of advanced topics in Physical Chemistry: Advanced Computational Modelling, Quantum Mechanics and Spectroscopy. This includes key concepts in quantum mechanics, time-independent perturbation theory, treatment of the hydrogen atom and tunnelling. The module will also cover computational modelling of nanomaterials imaged by transmission electron microscopy, resolution in optical and electron microscopes, elastic electron scattering, principles of molecular dynamics, molecular dynamics and statistical mechanics as sampling techniques.

Medicines from Nature/Pharmaceutical Process Chemistry (CHEM4025)

Semester Taught: Spring

Credits: 10

Prerequisite: Y3 Organic Core

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr A Nortcliffe

Assessment (s): 100% Exam (2hrs)

Overview: This module consists of two separately taught topics in advanced organic chemistry: Medicines from Nature (Dr Francesca Paridisi) and Pharmaceutical Process Chemistry (Dr Andrew Nortcliffe).

Medicines from Nature. To provide an appreciation of the importance of natural products from plants, micro-organisms and marine life in providing leads for today's drugs and medicines in the fight against cancer, blood pressure, pain, inflammation, bacterial infection, AIDS, Alzheimer's, Parkinson's and other diseases. How the discovery of biological activity in a natural product can be turned into a useful medicine. The topic will include descriptions of the biosynthesis and total synthesis of natural products.

Pharmaceutical Process Chemistry. This topic explores the role of the chemist in developing a viable commercial synthesis of medicines starting from a small scale. After a description of the place process chemistry takes within drug discovery as a whole, the topic will cover the following: Selection of chemical routes to medicines and assessment of their worth; Safety; Reagent selection; synthesis of chirally pure compounds; How reactions and reaction workups may be optimised.

Molecular Interactions and Supramolecular Assembley (CHEM4003)

Semester Taught: Spring

Credits: 10

Prerequisite: Bioinorganic and Metal Coordination Chemistry

Corequisites: none

Style of Teaching: Lectures

Module Convenor: Prof D Amabilino

Assessment (s): 100% Exam

Overview: The module will provide a fundamental understanding of the nature of intermolecular forces, across a wide cross-section of subject areas, in particular with respect to their application from biology through to designed supramolecular chemical systems. The module will present a firm theoretical foundation in the nature and thermodynamics of (covalent and weak non-covalent) intermolecular forces, including solvation effects and co-operativity, illustrated with examples of molecular organisation, assembly and recognition in biological and supramolecular systems. In addition to appreciating the rich chemistry underlying self-assembling systems, students will gain an insight into fundamental quantitative aspects of a variety of physical phenomena that impact on the properties of materials, stability of assemblies, effects of solvation and solubility, complex assemblies and ligand interactions in biology.

Nucleic Acids and Bioorganic Mechanisms (CHEM4026)

Semester Taught: Spring

Credits: 10

Prerequisite: Y2 Organic Core

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Prof N Thomas

Assessment (s): 100% Exam

Overview: Nucleic Acids: The module explores the structure, chemistry and molecular recognition of nucleic acids. Solid-phase methods for the synthesis of DNA and RNA oligonucleotides will be covered in detail. The chemical reactivity of DNA towards mutagens, carcinogens and ionising radiation and anti-tumour drugs is explored in mechanistic detail. The effects of free radicals in generating DNA lesions and leading to strand breaks will be described in detail alongside mechanistic studies of the mode of action of chemically reactive anti-tumour (ene-diyne) natural products. The structural features of the DNA double helix will be presented and mechanisms for recognition by non-covalent binding ligands will be discussed. Aspects of formation of the higher-order DNA triplex and quadruplex structures, along with selective ligand recognition, will also be covered.

Bioorganic Mechanisms: The chemistry of the coenzymes derived from vitamins is covered in detail including the biological importance, nutrition and deficiency diseases. Full mechanistic details are provided on reactions involving the coenzymes: Retinol, thiamine pyrophosphate, pyridoxal 5'-phosphate, cobalamin, flavins (FAD/FMN), nicotinamides (NAD(P)H, folic Acid, phylloquinone and pantothenic acid. Examples of mechanism-based inhibitors for a number of the enzymes are also described.

Environmental Science Y4

Module Title	Autumn	Spring
MSci Research Project	60	
Project Management	10	
Statistics and Experimental Design for Bioscientists	10	
Writing and Reviewing Research Proposals	20	
Communication and Public Engagement for Scientists		10
Optional Modules: 0-10 credits from the following:		
Climate Change Mitigation		10

MSci Research Project (BIOS4147)

Core for: Natural Sciences Environmental Science Y4

Semester Taught: Full Year

Credits: 60

Prerequisites: Y3 Environmental Science

Corequisites: Project Management

Style of Teaching: Supervisions and Project Work

Module Convenor: Dr N Mack

Assessment (s): 100% Coursework (10% Student Engagement, 20% Presentation, 70% Report)

Overview: The aim of the module is to provide training for the description, planning and conduct of a programme of research in order to solve or report on a specific scientific problem. The MSci project is taken in both the autumn and spring semesters and comprises 60 credits. In the autumn the student will work with the supervisor to devise a project by identifying an appropriate topic before focusing on a specific scientific problem. This will involve regular planning meetings and individual research by the student. In the spring semester the students will undertake the main body of work for the project which may be experimental, computer, literature or theoretically based (or various combinations of these). The student will continue to have, as a minimum, monthly supervisor meetings and document all progress in their project notebooks. The module is assessed by a project write up in the style of a scientific paper, the project notebook and a poster presentation with an oral component to the staff and the student cohort.

Project Management (BIOS4071)

Core for: Natural Sciences Environmental Science Y4

Semester Taught: Full Year

Credits: 10

Prerequisites: None

Corequisites: Bioscience Research Project

Style of Teaching: Seminars

Module Convenor: Dr D Stekel

Assessment (s): 100% Coursework (45% 1,000-word Report, 55% Presentation)

Overview: Project management skills are a highly transferable skill directly relevant to employment sectors. The module will cover project lifecycles, leadership in project management, managing risk in projects, analysis of project successes and failures and project Management software. Students will produce a professional presentation and project management report tailored to their research project to identify the key constraints, bottlenecks and milestones. This will be supplemented by the production of appropriate project management visualisation diagram, i.e. a Gantt or PERT chart. They will also present an interim verbal report to their supervisors and the module convenor to rehearse such reporting skills.

Statistics and Experimental Design for Bioscientists (BIOS4001)

Core for: Natural Sciences Environmental Science Y4

Semester Taught: Full Year

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures & Computing Workshops

Module Convenor: K Alskaf

Assessment (s): 100% Coursework

Overview: Principles of experimentation in crop science, basic statistical principles, experimental design, hypothesis testing, sources of error, analysis of variance, regression techniques, presentation of data, use of Genstat for data analysis. There are two routes through the module; one focusing on crop improvement and one focusing on more general issues.

Writing and Reviewing Research Proposals (BIOS4064)

Core for: Natural Sciences Environmental Science Y4

Semester Taught: Full Year | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr H West

Assessment (s): 100% Coursework (30% Reviews x2; 70% 4,000-word Research Proposal)

Overview: The overall aim is to consider, and practice, writing and assessing research proposals. In the real world, one may have to communicate the importance of a research/scientific idea to experts within your discipline or to non-specialist professionals. The module aims to develop your skills in analysis and writing of research proposals. Specific areas covered include: communicating with awarding bodies (how to develop a research idea and write a grant application) and peer review of research proposals.

Communication and Public Engagement for Scientists (BIOS4117)

Core for: Natural Sciences Environmental Science Y4

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures & Field Trip | Module Convenor: Dr S Lydon

Assessment (s): 100% Coursework (Portfolio of 4 science communication assets)

Overview: This module considers:

- The importance of engaging publics with cutting edge research
- Methods of engagement that are suitable for varying audiences
- How to write for varied audiences
- How to engage with policymakers and industry
- Public speaking skills
- The planning, development and delivery of an engagement event for the public/policymakers

Climate Change Mitigation (BIOS4049)

Semester Taught: Spring | Credits: 10

Prerequisites: Climate Change Science | Corequisites: None

Style of Teaching: Seminars | Module Convenor: Dr S Sjögersten

Assessment (s): unknown

Overview: The module will address the need for climate change mitigation and will investigate the frameworks for achieving mitigation on a range of levels, e.g. global, national, organisational. During the module students will examine a range of topics including: carbon capture and storage, nature based solutions, renewable energy, national greenhouse gas accounting, organisational emission quantification and reductions, carbon foot printing, and off setting.

Geography Y4

Module Title	Autumn	Spring
Natural Sciences Dissertation	60	
Optional Modules: 0-20 credits from the following:		
Advances in Managing Rivers and Catchments	10	
Ecosystem Function, Management and Conservation		10

Natural Sciences Dissertation (NATS4002)

Core for: Natural Sciences Y4 - discipline of study dictated by the supervisor

Semester Taught: Full Year

Credits: 60

Prerequisites: None

Corequisites: None

Style of Teaching: Supervisions and Project Work

Module Convenor: Dr C Brignell

Assessment (s): 100% Coursework (30% Literature Review, 60% Dissertation, 10% Presentation)

Overview: The aim of the module is to provide training for the description, planning and conduct of a programme of research in order to solve or report on a specific scientific problem. The student will work with the supervisor to devise a project by identifying an appropriate topic before focusing on a specific scientific problem. Once devised the students will undertake the main body of work for the project which may be experimental, computer, literature or theoretically based (or various combinations of these). The student will have regular, normally weekly, supervisor meetings. The module is assessed by a dissertation in the style of a scientific paper, a literature review and a poster presentation.

Advances in Managing Rivers and Catchments (GEOG4088)

Semester Taught: Autumn

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr S Dugdale

Assessment (s): 100% Coursework (3,000 word report)

Overview: Topics include:

- Key river and catchment processes
- Impacts of anthropogenic (ie. climate, land-use) change on rivers and catchments
- Current and historic river/catchment management practises
- Tools and techniques for monitoring and mapping rivers and catchments
- Modelling rivers and catchments to test management scenarios

Ecosystem Function, Management and Conservation (GEOG4093)

Semester Taught: Spring

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures, Discussions & Group Work

Module Convenor: Dr G van der Heijden

Assessment (s): 100% Coursework (2,500-word report)

Overview: In this module we will present key concepts to understand ecosystem function and processes, humans place in natural systems, and basic tools and goals for ecosystem management and conservation.

A general outine of the module will include:

1. Introduction to biodiversity and ecosystem function and processes

2. Ecosystem services - how humans depend on ecological systems

3. Human impacts on biodiversity and ecological systems

4. Consequences of the conservation crisis

5. Ecosystem management and conservation - goals and tools for sustainability and conservation of biodiversity and ecological systems

6. In-depth case studies of management and conservation, including but not limited to (i) fragmentation and dispersal in urban areas (AL) (ii) Human-wildlife conflict (ACA) (iii) restoring aquatic ecosystems? (CG)

The module will include lectures, discussions, and group work. The focus will be on the link between conservation science (i.e. understanding how natural systems work) and application (managing and conserving natural systems).

Maths Y4

Module Title	Autumn	Spring
Mathematics Dissertation	40	
Optional Modules: 40-80 credits from the following:		
Advances Techniques for Differential Equations	20	
Differential Geometry	20	
Financial Mathematics	20	
Introduction to Quantum Information Science	20	
Scientific Computing and C++	20	
Statistical Foundations	20	
Black Holes		20
Computational Applied Mathematics		20
Time Series Forecasting		20
Topics in Biomedical Mathematics		20

Mathematics Dissertation (MATH4001)

Core for: Natural Sciences Maths Y4

Semester Taught: Full Year | Credits: 40

Prerequisites: Y3 Mathematics | Corequisites: None

Style of Teaching: Supervisions and Project Work | Module Convenor: Dr C Wuthrich

Assessment (s): 85% Report, 10% Presentation, 5% Progress Report

Overview: This course will consist of self-directed but supervised study of an appropriate area of mathematics for the whole year. The study should result in a sustained piece of work assessed by an interim report, an oral presentation and a dissertation. A list of possible topics will be supplied by the School. Students choose a topic of interest to them, work under the supervision of a member of staff, and write a dissertation on their work. The students give an oral presentation of their work. Further advice and information is available from the convener and will be given to students at appropriate stages of their course.

Advances Techniques for Differential Equations (MATH4012)

Semester Taught: Autumn | Credits: 20

Prerequisite: Differential Equations | Corequisites: None

Style of Teaching: Lectures & Problem Classes | Module Convenor: Dr A Kalogirou

Assessment (s): 100% Exam (3hr)

Overview: The development of techniques for the study of nonlinear differential equations is a major worldwide research activity. This module covers a number of state-of-the-art methods, namely:

- use of Green function methods in the solution of linear partial differential equations;
- characteristic methods, classification and regularization of nonlinear partial differentiation equations;
- bifurcation theory.

These will be illustrated by applications in the biological and physical sciences.

Differential Geometry (MATH4015)

Semester Taught: Autumn | Credits: 20

Prerequisite: Relativity | Corequisites: None

Style of Teaching: Lectures and Problem Classes Module Convenor: Prof K Krasnov

Assessment (s): 100% Exam (3hr)

Overview: The course introduces notions of topology and differential geometry which are required for modern research in relativity and other topics involving geometry. The course will be illustrated with a body of concrete geometrical examples drawn from general relativity. The modern study of general relativity requires familiarity with a number of tools of differential geometry, including manifolds, symmetries, Lie Groups, differentiation and integration on manifolds. These are introduced using examples of curved space-times whose context is familiar from the study of general relativity, the presentation of geometric concepts will be significantly more abstract and powerful than in Relativity MATH3018.

Financial Mathematics (MATH4060)

Semester Taught: Autumn Credits: 20

Prerequisite: Calculus & Linear Algebra Corequisite: None

Style of Teaching: Lectures and Problem Classes Module Convenor: Dr Chris Brignell

Assessment (s): 100% Exam (3hr)

Overview: The first part of the course introduces no-arbitrage pricing principle and financial instruments such as forward and futures contracts, bonds and swaps, and options.

The second part of the course considers the pricing and hedging of options and discrete-time discrete-space stochastic processes. The final part of the module focuses on the Black-Scholes formula for pricing European options and also introduces the Wiener process. Ito integrals and stochastic differential equations.

Introduction to Quantum Information Science (MATH4049)

Semester Taught: Autumn Credits: 20

Prerequisite: Introduction to Mathematical Physics Corequisites: None

Style of Teaching: Lectures and Problem Classes Module Convenor: Dr M Guta

Assessment (s): 100% Exam

Overview: The paradigm of Quantum Information Science (QIS) is that quantum devices made of systems such as atoms and photons, can outperform the present day technology in key applications ranging from computing power and communication security to precision measurements. Quantum information processing and the measurement and control of individual quantum systems are central topics in QIS, lying at the intersection of quantum mechanics with "classical" disciplines such as information theory, probability and statistics, computer science and control engineering.

This module gives an introduction to QIS, emphasising the differences and similarities between the classical and the quantum theories. After a short review of the necessary probabilistic notions, the first part introduces the operational framework of quantum theory involving the fundamental concepts of states, measurements, quantum channels, instruments. This includes some of the influential results in the field such as entanglement and quantum teleportation, Bell's theorem and the quantum no-cloning theorem. The second part covers at least two topics from: quantum Markovian evolutions, quantum statistics, continuous variable systems.

Scientific Computing and C++ (MATH4063)

Semester Taught: Autumn Credits: 20

Prerequisite: Introduction to Scientific Computing Corequisites: None

Style of Teaching: Lectures and Computing Classes Module Convenor: M Hubbard

Assessment (s): 100% Coursework (2x 45% assignments & 10% In-Class Test)

Overview: This course presents an introduction to the programminglanguage C++, with a strong emphasis on scientific computing applications. A detailed list of key topics covered by this module is given below.

C++ Language:

- Basic types and control structures, program design and implementation, program comprehension and modification, program testing and documentation;
- Pointers, functions, and reference variables;
- Classes, inheritance and derived classes;
- Templates.

Applications:

- Computer roundoff and its effect on the design of algorithms;
- Polynomial interpolations;
- Numerical integration.
- Computational linear algebra, including direct and iterative methods.

In addition, a training session covering the oral presentation assessment criteria and some elements of good practice will be included as part of this course.

Statistical Foundations (MATH4065)

Semester Taught: Autumn | Credits: 20

Prerequisite: None | Corequisite: None

Style of Teaching: Lectures, Computing and Problem Classes | Module Convenor: Prof P O'Neil

Assessment (s): 20% Coursework; 80% Exam (3hr)

Overview: In this course the fundamental principles and techniques underlying modern statistical and data analysis will be introduced. The course will cover a 'common core' consisting of:

- statistical concepts and methods;
- linear models;
- probability techniques;
- Markov chains.

Students will gain experience of using a statistical package and interpreting its output. The common core material will be covered primarily at the beginning of the semester.

Black Holes (MATH4016)

Semester Taught: Spring | Credits: 20

Prerequisite: Differential Geometry | Corequisites: None

Style of Teaching: Lectures & Problem Classes | Module Convenor: Dr T Sotiriou

Assessment (s): 100% Exam (3hr)

Overview: General relativity predicts the existence of black holes which are regions of space-time into which objects can be sent but from which no classical objects can escape. This course uses techniques learnt in MATH4015 to systematically study black holes and their properties, including horizons and singularities. Astrophysical processes involving black holes are discussed, and there is a brief introduction to black hole radiation discovered by Hawking.

This course aims to introduce the physics of black holes and its mathematical description, giving insight into problems of research interest. It provides an opportunity to apply techniques and ideas learned in previous modules to important astrophysical problems. Students will acquire knowledge and skills to a level sufficient to begin research in general relativity.

Computational Applied Mathematics (MAT4064)

Semester Taught: Spring | Credits: 20

Prerequisite: Introduction to Scientific Computing | Corequisites: None

Style of Teaching: Lectures, Computing and Problem Classes | Module Convenor: Dr K van der Zee

Assessment (s): 40% Computing Exercises (x2), 60% Exam (2.5hr)

Overview: Four major topics for the computational solution of problems in applied mathematics are considered in this module:

- Approximate theory,
- numerical solution of nonlinear problems,
- numerical solution of ODEs and
- numerical solution of PDEs.

The focus is on formulating and understanding computational techniques with illustrations on elementary models from a variety of scientific applications. Specific contents include

- Approximation theory, multivariate polynomial approximation, Gauss quadrature, splines,
- trigonometric polynomials, DFTs, FFTs;
- Numerical solution of (systems of) nonlinear equations;
- Numerical differentiation and numerical solution of ODEs;
- Introduction to PDEs, finite difference methods including error analysis.

Time Series and Forecasting (MATH4022)

Semester Taught: Spring | Credits: 20

Prerequisite: Applied Statistics and Probability | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Prof I Dryden

Assessment (s): 20% Coursework (Individual Computing Investigation); 80% Exam (2.5hr)

Overview: This course will provide a general introduction to the analysis of data that arise sequentially in time. Several commonly occurring models will be discussed and their properties derived. Methods for model identification for real time series data will be described. Techniques for estimating the parameters of a model, assessing its fit and forecasting future values will be developed. Students will gain experience of using a statistical package and interpreting its output. The course will cover:

- concepts of stationary and non-stationary time-series;
- philosophy of model building in the context of time series analysis;
- simple time series models and their properties;
- the model identification process;
- estimation of parameters;
- assessing the goodness of fit;
- methods for forecasting;
- use of a statistical package.

Topics in Biomedical Mathematics (MATH4014)

Semester Taught: Spring | Credits: 20

Prerequisite: Mathematical Medicine and Biology | Corequisites: None

Style of Teaching: Lectures and Problem Classes | Module Convenor: Dr B Brook

Assessment (s): 100% Exam (3hr)

Overview: This course illustrates the applications of advanced techniques of mathematical modelling using ordinary and partial differential equations. A variety of medical and biological topics are treated bringing students close to active fields of mathematical research. Topics to be investigated will be drawn from the following areas:

- theoretical neuroscience;
- biomechanical modelling (surface tension effects in the lung, muscle mechanics and peristalsis, physiological flow-structure interactions;
- multiphase models for growing tissues);
- biomedical transport processes (boundary layers, facilitated transport);
- spiral waves in reaction-diffusion systems.

Physics Y4

Module Title	Autumn	Spring
Physics Project	60	
Solid State Physics for Natural Sciences (Compulsory for all non-Maths)	20	
Optional Modules: 20/40-60 credits from the following:		
Atmospheric and Planetary Physics	10	
From Accelerators to Imaging	10	
Introduction to Cosmology	10	
Soft Condensed Matter	10	
Extreme Astrophysics		10
Semiconductor Physics		10
Theoretical Elementary Particle Physics		10

Physics Project (PHYS4024)

Core for: Natural Sciences Physics Y4

Semester Taught: Full Year

Credits: 60

Prerequisites: Y3 Physics

Corequisites: None

Style of Teaching: Weekly Supervisions & Project Work

Module Convenor: Prof A Kent

Assessment (s): 15% Project Diaries, 20% Plan & Lit Review, 10% Interview, 45% Final Report & 10% Presentation

Overview: The module will consist of a project the aim of which is to solve a practical or theoretical problem. Practical problems will be undertaken either in one of the department's research laboratories. The nature of the project undertaken will be appropriate to the course taken by the student. Background work and literature surveys are the main work carried out in semester one and the bulk of the project work in semester 2.

Solid State Physics (Compulsory for non-Maths students) (PHYS4023)

Semester Taught: Full Year

Credits: 20

Prerequisite: Y2 Physics Core

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr J O'Shea

Assessment (s): 20% Continuous Assessment & 80% Exam (2hrs)

Overview: This module will provide a general introduction to solid state physics. Topics to be covered will include:

- bonding – nature of chemical bonds, thermodynamics of solid formation;
- crystal structures – description of crystal structures, k-space, reciprocal lattice, Bragg diffraction, Brillouin zones;
- Nearly-free electron model - Bloch's theorem, band gaps from electron Bragg scattering, effective masses;
- Band theory – Fermi surfaces, qualitative picture of transport, metals, insulators and semiconductors;
- Semiconductors - doping, inhomogeneous semiconductors, basic description of pn junction;
- Phonons – normal modes of ionic lattice, quantization, Debye theory of heat capacities, acoustic and optical phonons;
- Optical properties of solids – absorption and reflection of light by metals, Brewster angle, dielectric constants, plasma oscillations;
- Magnetism.- Landau diamagnetism, paramagnetism, exchange interactions, Ferromagnetism, antiferromagnetism, neutron scattering, dipolar interactions and domain formation, magnetic technology

Atmospheric and Planetary Physics (PHYS4004)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr J Bolton

Assessment (s): 100% Exam

Overview: Planet formation: introduction to planets, exoplanet detection methods, proto-planetary disks and the formation of terrestrial and giant planets. Solar system atmospheres: atmospheric structure and temperature, the greenhouse effect, radiative and convective heat transport, atmospheric heating by UV radiation, radiative transfer. Atmospheric dynamics: the approximate equation of motion in a rotating frame, Coriolis and centrifugal forces, the geostrophic approximation, the Ekman boundary layer, atmospheric vorticity and Rossby waves. Escape of atmospheric gases. Exoplanetary atmospheres and their detection, biosignatures.

From Accelerators to Imaging (PHYS4005)

Semester Taught: Autumn | Credits: 10

Prerequisite: Differential Equations & Fourier Analysis | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr M Brookes

Assessment (s): 100% Exam

Overview: The first half of this module will describe radiation sources and detectors, with particular reference to those used in the medical imaging applications described in the second half. It will include the physics of accelerators such as linacs, cyclotrons and synchrotrons, of detectors such as ionization chambers, scintillators and solid-state detectors and of X-ray imaging, nuclear imaging and positron emission tomography (PET).

Introduction to Cosmology (PHYS4003)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr A Green

Assessment (s): 100% Exam

Overview: Cosmology is the scientific study of the Universe as a whole. The module provides an introduction to modern cosmology, including some of the more recent observational and theoretical developments. No prior knowledge of General Relativity is required. Topics covered include: observed features of the Universe; the Cosmological Principle; Newtoniaan and Relativistic cosmology; the Friedmann Models; cosmic expansion; the cosmological constant; evidence for the big bang model; the thermal history of the Big Bang; the early Universe and inflation; the classical cosmological tests; structure formation (brief treatment only).

Soft Condensed Matter (PHYS4006)

Semester Taught: Autumn | Credits: 10

Prerequisite: None | Corequisites: None

Style of Teaching: Lectures and Workshops | Module Convenor: Dr J Sharp

Assessment (s): 100% Exam

Overview: The aim of this module will be to give students a basic grounding in key concepts in soft condensed matter physics, with emphasis being placed on the dynamic, structural and kinematic properties of these materials. Key differences and similarities between ‘soft’ matter, ‘hard’ matter and liquid systems will be highlighted and discussed throughout the module. Material includes:

1) Introduction to Soft Matter
2) Forces, energies and timescales in soft matter
3) Liquids and glasses
4) Phase transitions in soft matter (solid-liquid and liquid-liquid demixing)

5) Polymeric materials
6) Gelation
7) Crystallisation in soft systems
8) Liquid crystals
9) Molecular order in soft systems
10) Soft Nanotechnology

The structure of the proposed module will be based on the book 'Soft Condensed Matter' by R.A.L. Jones (OUP, 2002).

Extreme Astrophysics (PHYS4009)

Semester Taught: Spring | Credits: 10

Prerequisites: Recommended Stars and Galaxies | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Prof O Almaini

Assessment (s): 100% Exam

Overview: This module explores the physical processes involved in the most extreme environments and explosive events known to astronomy.

- Introduction: overview of key phenomena; introduction to high-energy astrophysics and X-ray astronomy (1 lecture)
- Degenerate stars: revision of stellar evolution; stellar death; degenerate matter; Chandrasekhar limit; white dwarfs; neutron stars; pulsars; extreme magnetic fields; magnetic braking (3 lectures)
- Radiation processes: synchrotron radiation; bremsstrahlung; Thomson scattering; compton scattering and inverse scattering (5 lectures) Hot gas and galaxy clusters: the astrophysics of hot gas; hydrostatic models; gas cooling; mass estimation; dark matter; applications to cosmology; Sunyaev-Zeldovich effect (3 lectures)
- Supernovae and supernova remnants: core-collapse; supernova remnants; shocks; Sedov-Taylor expansion; snow-plough models; chemical enrichment (2 lectures)
- Accretion and compact binary stars: Roche lobes; spherical accretion model; Eddington limit; magnetized accretion; binary pulsars; gamma-ray bursts (2 lectures)
- Introduction to black holes: Newtonian definition; black holes in General Relativity; Hawking radiation; singularities; black hole binaries (1 lecture)
- Quasars and supermassive black holes: active galaxies; quasars; evidence for black holes; accretion disk models; disk coronae; links to galaxy formation (2 lectures)

Semiconductor Physics (PHYS4014)

Semester Taught: Spring | Credits: 10

Prerequisite: Solid State Physics | Corequisites: None

Style of Teaching: Lectures | Module Convenor: Dr O Makarovsky

Assessment (s): 100% Exam

Overview: This module introduces you to the physical properties of semiconductors and low-dimensional systems, such as quantum wells, wires and dots. The aim is to explain the physics that underlies optical and transport properties of these structures and and their applications in advanced technologies. This course is structured in two main parts. The first part focuses on the foundation of quantum mechanics and solid-state physics needed to describe a low dimensional system. The module then moves on describing the physical principles of semiconductor junction and devices. List of topics

1) Semiconductors and quantum confined structures: semiconductor materials and band structure; semiconductor heterostructures and band alignment; low dimensional structures: Quantum wells, wires and dots.
2) Semiconductor statistics and doping: density of states in 3D, 2D and 1D structures; Intrinsic and extrinsic semiconductors.
3) Optical and electrical properties: absorption and emission; radiative and non-radiative recombination; carrier drift, diffusion and injection; continuity equation.

4) Semiconductor junctions: p-n junction; metal-semiconductor junction; examples of applications.
5) Tunneling transport: transfer matrix formalism; potential step, single barrier and double barrier.

Theoretical Elementary Particle Physics (PHYS4013)

Semester Taught: Spring

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures

Module Convenor: Dr P Saffin

Assessment (s): 100% Exam

Overview: This module will provide an introduction to theoretical aspects of the standard model of particle physics.
Syllabus

1. Groundwork: natural units; relativistic notation.
2. Relativistic particles: Klein-Gordon equation; Dirac equation; Weyl equation; spin, chirality and helicity.
3. Group theory: angular momentum; isospin; classical Lie groups; multiplets.
4. Standard model: leptons, quarks, baryons and mesons.
5. Feynman diagrams: perturbative techniques; allowed scattering processes; action functionals.
6. Gauge theory: electromagnetism; Zeeman Effect; global and local symmetry; covariant derivatives; non-Abelian gauge theory.
7. Discrete symmetries: charge conjugation; parity; time reversal; discrete symmetry violation.
8. Quantum mixing: K-meson; Cabibbo process; neutrino oscillations
9. Symmetry breaking: Higgs mechanism; grand unification.

Psychology Y4

Module Title	Autumn	Spring
Dissertation	40	
Optional Modules: 40-80 credits from the following:		
Introduction to Matlab Programming	10	
Psychological Assessment	20	
Advanced Methods in Psychology		20
Current Issues in Cognitive Neuroscience		10
Data Analysis for Neuroimaging		10
Childhood Clinical and Behavioural Disorders		20

Dissertation (PSGY4034)

Semester Taught: Full Year

Credits: 40

Prerequisites: None

Corequisites: None

Style of Teaching: Supervisions & Project Work

Module Convenor: Dr P Chapman

Assessment (s): 100% Coursework (10,000-word Dissertation)

Overview: This module will provide students with: The opportunity to research in depth a topic of their choice, under the direction of a subject specialist. The skills and methodologies required to carry out sustained independent research.

Introduction to Matlab Programming (PSGY4014)

Semester Taught: Autumn

Credits: 10

Prerequisites: None

Corequisites: None

Style of Teaching: Practicals

Module Convenor: Dr D Shluppeck

Assessment (s): 100% Coursework (Programming Assignment)

Overview: Problem-based learning to support lectures on neuroimaging topics. Topics covered include an introduction to computer programming with MATLAB, the design and analysis of behavioural experiments, and the analysis of functional MRI data.

Psychological Assessment (PSGY4057)

Semester Taught: Autumn

Credits: 20

Prerequisites: None

Corequisites: None

Style of Teaching: Lectures and Workshops

Module Convenor: Dr S Einav & Dr E Birkett

Assessment (s): 100% Coursework (10% Mini Essay, 20% Test Review, 5% Observation of Assessment Simulation Exercise, 5% Class Test, 50% 4,000-word Assessment Simulation)

Overview: This module provides students with the knowledge to be able to select, administer, score, interpret, and provide feedback on educational tests of the kind used when assessing individuals with learning difficulties. They will learn about the advantages and disadvantages of different types of assessment and how to make decisions about test selection for assessments. Students will gain an understanding of test theory including the concepts of reliability, validity and the standardization of tests. The module will provide a skill set that will be useful to students completing their project in which they may have to administer psychometric tests. It will also be useful to students wishing to pursue a career in education or educational psychology.

Advanced Methods in Psychology (PSGY4002)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Workshops | Module Convenor: Dr M Bauer

Assessment (s): 100% Coursework (2 x 2,500-word Practical Reports)

Overview: The module provides an insight into some more advanced or specialised techniques of data collection, organisation and analysis in psychological research (e.g., eye-tracking, EEG, fMRI, TMS, computational modelling, diary methodologies and Workshops Lectures will include implementation of analytical procedures in for example specialised data management and statistical packages and on specialised data gathering equipment and software.

Current Issues in Cognitive Neuroscience (PSGY4008)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Seminars | Module Convenor: Dr J Derrfuss

Assessment (s): 100% Coursework (4,000-word Mini Review)

Overview: This module is an opportunity to work in depth on a specific topic in Cognitive Neuroscience. Students explore their chosen topic and its related methodological issues to their own research interests. The topic is based on a seminar provided in the School of Psychology, with approval from the convenor. The module concerns independent study in addition to supervision sessions.

Data Analysis for Neuroimaging (PSGY4003)

Semester Taught: Spring | Credits: 10

Prerequisites: None | Corequisites: None

Style of Teaching: Workshops | Module Convenor: Dr D Shluppeck

Assessment (s): 100% Coursework (Programming/Data Set Assignment)

Overview: Topics include more advanced concepts in MATLAB programming and the analysis of functional MRI data.

Childhood Clinical and Behavioural Disorders (PSGY4055)

Semester Taught: Spring | Credits: 20

Prerequisites: None | Corequisites: None

Style of Teaching: Lectures and Seminars | Module Convenor: NA

Assessment (s): Unknown

Overview: This module will examine: Conduct disorder – Oppositional Defiant Disorder – Depression – Anxiety – Childhood onset schizophrenia – Therapies for young people – Pharmacological interventions – Comorbidity of mental health problems and developmental disorders