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COURSE SYLLABI
Heriot Watt University

This file contains syllabi for the most frequently requested courses at Heriot Watt University (HWU). Additional syllabi are available upon request (should you need them for credit approval at your university/college). Send an email to info@KEIabroad.org indicating the term of your study at HWU (Fall, Spring, Summer & year), course title(s) and course number(s).

Note that course descriptions are available for all courses by visiting www.KEIaroad.org//scotland/academics.php.

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	Synthesis in Organic Chemistry	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	8	Module Code	B18OB	Semester	2	Credits	15

1. Pre-requisites	Minimum D grade in Stage 1 Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)	Organic Structural Identification, Stereochemistry & Reaction Mechanisms (synoptic)		
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	All Chemistry degrees		

7. Aims

The module aims to :

- **provide an understanding of the major types of reactivity of carbonyl compounds**
- **describe the use of enolates derived from carbonyl compounds in the formation of carbon-carbon bonds**
- **discuss the chemistry of alkynes with particular reference to their use in the assembly of carbon skeletons**
- **show the principles of retrosynthetic analysis and the use of the methods described in this module in the design of organic syntheses.**

8. Syllabus

- **Introduction** – structure and bonding in carbonyl compounds; fundamental reactions with nucleophiles and electrophiles; types of carbonyl compounds; aldehydes/ketones compared with eg esters, where substitution can occur.
- **Nucleophilic Addition to Aldehydes/Ketones** – including cyanohydrins, Grignard reagents, hydride reductants, hydration, acetal formation, reactions with amines and their derivatives.
- **Nucleophilic Substitution in Carbonyl Compounds** – relative reactivities of acyl halides, anhydrides, esters, amides, and reasons for this; formation and hydrolysis of esters, including triglycerides; synthesis of amides and polyamides; formation of acyl halides; reactions of esters with Grignard and hydride reagents; some routes to carboxylic acids.
- **Introduction to Retrosynthetic Analysis (RSA) methods** for target molecule synthesis
- **Reactions of Enolates** – general principles and relative acidities; keto-enol tautomerism and halogenation of ketones; alkylation of enolates from simple ketones etc and from 1,3-dicarbonyl compounds; the aldol condensation, including intramolecular variants; the Claisen condensation and related reactions, including acylation of enamines; the Michael reaction and Robinson annulation; retrosynthetic analysis of 1,n-dicarbonyl compounds and enones, and examples of target synthesis.
- **The Wittig Reaction** – including stabilised and non-stabilised ylids; RSA of alkenes; Wittig versus aldol reactions for enone synthesis.
- **Chemistry of Alkynes** – structure, bonding, and acidity of terminal alkynes; addition reactions of alkynes; formation of alkynyl organometallics (Groups I and II) and their use in C-C bond formation; examples of the use of alkynes in target synthesis.

Module Title	**Synthesis in Organic Chemistry**	**School**	**Engineering and Physical Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Dr J.H. Cameron**	**SCQF Level**	**8**	**Module Code**	**B18OB**	**Semester**	**2**	**Credits**	**15**

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)	
Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** **On completion of this module, the learner will be able to:** • **Understand the main patterns of reactivity of compounds containing the carbonyl group** • **Convert carboxylic acids into acyl chlorides, anhydrides, esters and amides, and interconvert these acyl derivatives** • **Display an understanding of the use of enolates derived from carbonyl compounds in the formation of carbon-carbon bonds in the context of target synthesis** • **Apply the concept of retrosynthetic analysis (RSA) to target structures which are amenable to synthesis using enolate chemistry, together with methods from prior knowledge, and to design syntheses of such target compounds** • **Understand the use and power of the Wittig reaction in the synthesis of alkenes** • **Appreciate the use of alkynes in organic synthesis, particularly for C-C bond formation** • **Apply RSA to targets amenable to synthesis using alkyne chemistry and/or the Wittig reaction, and design syntheses of such targets** • **Integrate previous knowledge from across all of chemistry with the topics discussed in the module**

Module Title	Synthesis in Organic Chemistry	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	8	Module Code	B18OB	Semester	2	Credits	15

Personal Abilities	*Industrial, Commercial & Professional Practice* *Autonomy, Accountability & Working with Others* *Communication, Numeracy & ICT* **Personal abilities are embedded in the module. The module provides the opportunity to :** • **Critically review and consolidate knowledge, skills and practices in chemistry** • **Analyse a problem in a systematic manner, and construct a solution** • **Interpret, use and evaluate a wide range of data to solve problems of both a familiar and unfamiliar nature** • **Present a logical summary of a complex topic** • **Use ICT skills with on-line materials, assessments (formative and summative) and web links to support the learning process** • **Apply strategies for appropriate selection of relevant information from a wide source and large body of knowledge** • **Exercise initiative and independence in carrying out learning activities** • **Manage time effectively, work to deadlines and prioritise workloads** • **Develop oral communication abilities through small group tutorials** • **Use and evaluate spectroscopic data for problem solving and structural elucidation** • **Use molecular models and molecular modeling packages to visualize and understand structure** • **Practice the extensive use of problem solving approach to encourage consolidation and application of structural concepts** • **Use a VLE and other on-line Web sites and resources to enhance the student learning experience and promote independent learning** • **Participate in tutorial sessions designed to promote discussion of course-related topics with professional-level colleagues.** • **Use and evaluate numerical and graphical data** • **Demonstrate numerical, graphical and problem-solving skills in a range of areas** • **Communicate complex ideas and information effectively to a group of peers** • **Practise the use of standard methods in the solution of routine chemical problems within familiar contexts** • **Exercise some initiative and independence in carrying out defined problem solving activities** • **Critically use mathematical methods to analyse various chemical reactions variables** • **Interpret, use and evaluate a wide range of data to solve problems of both a familiar and unfamiliar nature** • **Evaluate numerical and graphical data and apply them to the solution of chemical problems** • **Manage resources in defined areas of activity** • **Work with peers in small groups in the discussion of chemical problems**

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Synoptic Examination	3h	50%	B18OA
Class test	2h	15%	
Continuous Assessment		15%	
Laboratory Work		20%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Synoptic Examination (100%)	3h

Module Title	**Synthesis in Organic Chemistry**	**School**	**Engineering and Physical Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Dr J.H. Cameron**	**SCQF Level**	**8**	**Module Code**	**B18OB**	**Semester**	**2**	**Credits**	**15**

12. Date and Version							
Date of Proposal	24 August, 2007	**Date of Approval by School Committee**		**Date of Implementation**	15 September, 2008	**Version Number**	1.0

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	**Chemical Thermodynamics & Introductory Chemical Kinetics**	**School**	**Engineering and Physical Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Dr J.H. Cameron**	**SCQF Level**	**8**	**Module Code**	**B18PA**	**Semester**	**1**	**Credits**	**15**

1. Pre-requisites	Minimum D grade in Stage 1 Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)	Atomic & Molecular Spectroscopy (synoptic)		
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	All Chemistry degrees		

7. Aims

The module aims to:

- **introduce the students to concepts in chemical thermodynamics and related electrochemistry**
- **provide an introduction to chemical kinetic**
- **show how the rates of reaction depend upon concentration, temperature and time and other variables**
- **to explore the relationship between reaction rate law and the mechanism of reaction**
- **to examine complex reactions such as enzyme reaction, chain and branched chain reaction.**

8. Syllabus

- **The First Law of Thermodynamics**
- **The Second Law of Thermodynamics**
- **The Third Law of Thermodynamics**
- **Free Energy**
- **Chemical Equilibrium including the Phase Rule**
- **Ideal and Non-Ideal Solutions**
- **Electrochemistry**
- **Rate Law and Reaction Order** – Rates of Reaction and Rate Laws; Order and Molecularity; Differential and Integral Rate Laws; Complex and Elementary Reactions; Consecutive and Equilibrium Reactions
- **Effect of Temperature**– Arrhenius Expression and Activation Energy; Maxwell Distributions, Collisions and Activation
- **Complex Reactions** – Introduction to the steady state approximation and the fast pre-equilibrium treatment of complex reactions.
- **Models of Gas Phase Reactivity** - Simple Collision Theory, Lindemann Theory
- **Models of Solution Reactivity** – Diffusion versus activation control; Kinetics in the Diffusion Limit

Module Title	**Chemical Thermodynamics & Introductory Chemical Kinetics**	**School**	**Engineering and Physical Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Dr J.H. Cameron**	**SCQF Level**	**8**	**Module Code**	**B18PA**	**Semester**	**1**	**Credits**	**15**

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)	
Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** **On completion of this module, learners will be able to discuss knowledgeably the following concepts:** • **First Law: To gain insight into heat and work and their relationship to energy changes in physical and chemical processes** • **The Enthalpy: To appreciate the use of the enthalpy in describing heat changes in physical and chemical processes at constant pressure** • **The Enthalpy of Chemical Change: To apply standard enthalpies of formation to calculate reaction enthalpies** • **The Second Law: To appreciate that The Second Law of Thermodynamics dictates the course of all spontaneous physical and chemical changes** • **The Third Law: To appreciate that the Third Law of Thermodynamics allows the determination of absolute entropies** • **The Free Energy: To appreciate that the Free Energy change of a *system* predicts whether a chemical reaction is spontaneous** • **Chemical Equilibrium: To appreciate the relationship between Free Energy and equilibrium constants and to utilise thermodynamic relationships to calculate the chemical composition of chemical processes at equilibrium.** • **Ideal Solutions: To appreciate that intermolecular forces dictate ideal and non-ideal behaviour in solution** • **Electrochemistry: To apply the concepts learned in chemical thermodynamics to electrochemical systems** • **Appreciate the evolving nature of knowledge and understanding, informed by research work, in a chemical context** • **Define and measure rates of chemical reactions** • **Demonstrate how to find the experimental rate law** • **Analyse and evaluate possible reaction mechanism against the experimental rate law** • **Use fundamental principles to solve both qualitative and numerical problems of an advanced nature** • **Evaluate and analyse the temperature variation of rates in terms of current theories** • **Display a critical understanding of the concepts, theories and principles discussed in the module** • **Integrate previous knowledge from across all of chemistry with the topics discussed in the module** • **Analyse, evaluate and interpret experimental evidence of chemistry**

Module Title	Chemical Thermodynamics & Introductory Chemical Kinetics	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	8	Module Code	B18PA	Semester	1	Credits	15

Personal Abilities	*Industrial, Commercial & Professional Practice* *Autonomy, Accountability & Working with Others* *Communication, Numeracy & ICT* **Personal abilities are embedded in the module. The module provides the opportunity to :** • **Demonstrate numerical, graphical and problem-solving skills in a range of areas** • **Manage time effectively, work to deadlines and prioritise workloads** • **Communicate complex ideas and information effectively to a group of peers** • **Apply strategies for appropriate selection of relevant information from a body of knowledge** • **Practise the use of standard methods in the solution of routine chemical problems within familiar contexts** • **Exercise some initiative and independence in carrying out defined problem solving activities** • **Critically use mathematical methods to analyse various chemical reactions variables** • **Interpret, use and evaluate a wide range of data to solve problems of both a familiar and unfamiliar nature** • **Use ICT skills with on-line materials, assessments (formative and summative) and web links to support the learning process** • **Evaluate numerical and graphical data and apply them to the solution of chemical problems** • **Manage resources in defined areas of activity** • **Work with peers in small groups in the discussion of chemical problems**

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Synoptic Examination	3h	50%	B18PB
Class test	2h	15%	
Continuous Assessment		15%	
Laboratory Work		20%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Synoptic Examination (100%)	3h

12. Date and Version

Date of Proposal	24 August, 2007	Date of Approval by School Committee		Date of Implementation	15 September, 2008	Version Number	1.0

Module Title	Atomic & Molecular Spectroscopy	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	8	Module Code	B18PB	Semester	2	Credits	15

1. Pre-requisites	Minimum D grade in Stage 1 Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)	Chemical Thermodynamics & Introductory Chemical Kinetics (synoptic)		
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	All Chemistry degrees		

7. Aims

The module aims to :

- **provide an introduction to the quantum mechanical models of molecular rotation and vibration**
- **show how microwave and IR spectra arise from these**
- **explore the use of spectroscopy to give chemical structure information**
- **introduce the atomic term symbols and electronic selection rules**
- **provide an introduction to the electronic spectra of transition metal ions**

8. Syllabus

- **Pure Rotational Spectroscopy** – Introduction to molecular rotation; moments of inertia; rotational angular momentum; diatomic rotational energy levels; rigid rotor and centrifugal distortion; Microwave spectra of diatomic molecules and their interpretation for bond length. Boltzmann distribution and spectral intensity
- **Pure Vibrational Spectroscopy** – Simple Harmonic Oscillator and potential energy curves; Anharmonic oscillator; Force constants and the flexibility of bonds Gas phase infrared spectra and their interpretation using the simple harmonic oscillator and the anharmonic oscillator models. The use of potential energy diagrams to graphically represent the internal energy quantum states of molecules. Degrees of freedom and polyatomic vibrations. IR spectra of small polyatomic molecules and the occurrence of combination bands, overtones and hot bands in spectra
- **Vibration-Rotation Spectroscopy** – Band structure P,Q and R branches; Interpretation of parallel and perpendicular vibration modes. Beer-Lambert law
- **Electronic Spectroscopy** – Russell-Saunders term symbols for the quantum description of electrons in atoms. Hund's three rules for ordering equivalent electronic states. Russell-Saunders selection rules for electronic transitions
- **Electronic Spectra of Transition Metal Complexes** – d-d transitions – effects of e/e repulsion within the d subshell ; microstates, electronic states and application of Russell-Saunders Term Symbols for free Transition Metal ions (no ligand field) ; splitting of free ion states by a ligand field – octahedral and tetrahedral cases ; Orgel and Tanabe-Sugano diagrams and their application ; selection rules in electronic spectroscopy – band intensity

Module Title	Atomic & Molecular Spectroscopy	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	8	Module Code	B18PB	Semester	2	Credits	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of this module, the learner will be able to:

- **Demonstrate an understanding and familiarity with quantized energy levels and introductory spectroscopy**
- **Use fundamental principles to solve both qualitative and numerical problems**
- **Analyse and evaluate possible models against experimental spectra**
- **Display a critical understanding of the concepts, theories and principles discussed in the module**
- **Integrate previous knowledge from across all of chemistry with the topics discussed in the module**
- **Analyse, evaluate and interpret experimental evidence of chemistry**
- **Use the Russell-Saunders Coupling Scheme to determine the electronic spectroscopic properties of transition metal ions**
- **Both analyse and predict the electronic spectra of complexes using Orgel and Tanabe-Sugano diagrams**
- **Discuss the relative intensity of electronic spectra using the Selection Rule principle**
- **Appreciate the evolving nature of knowledge and understanding in the light of the results of chemical research**
- **Adapt routine methods, within accepted standards, to the solution of chemical problems**
- **Carry out routine laboratory manipulations leading to the gathering and analysis of experimental data**

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Personal abilities are embedded in the module. The module provides the opportunity to :

- **Critically use mathematical methods to analyse various chemical spectroscopy variables**
- **Interpret, use and evaluate a wide range of data to solve problems of both a fundamental and analytical nature**
- **Use ICT skills with on-line materials, assessments (formative and summative) and web links to support the learning process**
- **Evaluate numerical and graphical data and apply them to the solution of chemical problems**
- **Demonstrate numerical, graphical and problem-solving skills in a range of areas**
- **Manage time and resources effectively, work to deadlines and prioritise workloads**
- **Communicate complex ideas and information to a group containing both academic staff and fellow students**
- **Apply strategies for the appropriate selection of relevant information from a wide body of chemical knowledge**
- **Practise the use of standard chemical methodology in the solution of practical and theoretical problems in both familiar and unfamiliar contexts**
- **Exercise initiative and independence in the carrying out of defined activities relevant to the module**
- **Work in groups to discuss and identify solutions to chemical problems, taking the lead in some of the discussions**

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Synoptic Examination	3h	50%	B18PA
Class test	2h	15%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Synoptic Examination (100%)	3h

Module Title	**Atomic & Molecular Spectroscopy**		**School**	**Engineering and Physical Sciences**				**On or Off-Campus**	**On**
Module Co-ordinator	**Dr J.H. Cameron**		**SCQF Level**	**8**	**Module Code**	**B18PB**	**Semester**	**2**	**Credits**	**15**

Continuous Assessment		**15%**			
Laboratory Work		**20%**			
12. Date and Version					
Date of Proposal	24 August, 2007	**Date of Approval by School Committee**		**Date of Implementation**	15 September, 2008	**Version Number**	1.0

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	Chemistry of Materials	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr A. Kraft	SCQF Level	9	Module Code	B19MA	Semester	1	Credits	15

1. Pre-requisites	Minimum D grade in Stage 2 core Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)			
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	**MChem and BSc(Hons) Chemistry with Materials, MChem, BSc(Hons) and BSc(Ord) Chemistry, MChem Chemistry with a Year in North America, MChem Chemistry with a Year in Europe, MChem Chemistry with Forensic Science, MChem Chemistry with Industrial Experience, MChem Chemistry with Nanotechnology**		

7. Aims

The module aims to :

- **provide an advanced discussion in key topics in Inorganic Materials Chemistry, with particular emphasis on the concept of selectivity in framework solids and the technological applications that result**
- **present the concepts of polymer synthesis, structure, properties, mechanical behaviour and characterisation**

8. Syllabus

- **Introduction.** Polyhedral representations of inorganic solid-state structures.
- **Zeolites –** occurrence, preparation and characterisation. Structural properties of zeolites. Technological applications of zeolites.
- **Hybrid (inorganic-organic) Materials Chemistry-** General terminology: coordination complex, ligand, metal-organic framework, topology. Important ligands and building blocks. Synthesis and characterisation. Technological applications of metal-organic frameworks
- **Polymer Chemistry: Basic Concepts** – General terminology: monomers, polymers, polymerisation. Technically important monomers and polymers. Polymer synthesis: free radical polymerisation, step-growth polymerisation. Chain architecture: tacticity, isomerism, branching, cross-linking, copolymers (random/block/graft). Copolymerisation and reactivity ratios. Thermoplastics and thermosets. Synthesis of copolymers and thermosets.
- **Polymer Properties** – Semicrystalline and amorphous polymers; Tg (glass transition temperature) and Tm (melting temperature) with respect to chain architecture; service temperature ranges for various applications. Mechanical properties: introduction to (Young's) modulus; modulus-temperature behaviour; effect of structure (including two-phase morphologies). Plasticisation, brittleness and local motions.
- **Polymer Characterisation** – Molecular size and molar mass distribution. Thermal transitions in amorphous and crystalline polymers (Tg and Tm). Mechanical testing of polymers: strength, stiffness, toughness, stress-strain behaviour.

Module Title	Chemistry of Materials	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr A. Kraft	SCQF Level	9	Module Code	B19MA	Semester	1	Credits	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of this module, the learner will be able to:

- **demonstrate broad and integrated knowledge and understanding in the main areas and boundaries of Inorganic and Polymer Materials Chemistry**
- **display a critical understanding of the main concepts, theories, principles and terminology discussed in the module**
- **integrate previous knowledge from across all of chemistry with the topics discussed in the module**
- **appreciate how chemistry, learned in previous modules, is developed to make materials with useful properties**
- **practise routine skills, techniques and methods in materials characterisation in workshops**
- **understand how techniques such as differential scanning calorimetry, gel-permeation chromatography and stress-strain measurements may be used to characterise polymeric materials**

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Personal abilities are embedded in the module. The module provides the opportunity to :

- **critically analyse, evaluate and review the connection between structure and properties of materials**
- **identify and analyse routine professional problems, with special emphasis on structural, thermal, mechanical and molar-mass characterisation**
- **practise the use of standard methods in the solution of routine polymer characterisation problems within familiar contexts**
- **interpret, use and evaluate a range of data to achieve this goal**
- **use ICT skills with on-line materials, assessments and web links to support the learning process and to analyse data**
- **manage time effectively, work to deadlines and prioritise workloads**
- **exercise initiative and independence in carrying out learning activities**
- **demonstrate problem-solving skills and the ability to critically evaluate ideas and information**
-

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Examination	2h	70%	
Continuous Assessment		30%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination (100%)	2h

12. Date and Version

Date of Proposal	27 August, 2010	Date of Approval by School Committee		Date of Implementation	13 September, 2010	Version Number	1.1

Module Title	Organic Reactions 1	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	9	Module Code	B19OC	Semester	1	Credits	15

1. Pre-requisites	Minimum D grade in Stage 2 core Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)	Organic Reactions 2 (synoptic)		
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	All chemistry degrees		

7. Aims

The module aims to :

- **provide a range of methods for the interconversion of key functional groups, emphasising issues of regio- and stereocontrol**
- **discuss an extended range of reactions for the formation of carbon-carbon bonds**
- **develop the concept of retrosynthetic analysis (RSA) in a structured manner**
- **illustrate how RSA, together with knowledge from this module and its prerequisites, can be used for the design of syntheses of organic molecules. Of moderate complexity**

8. Syllabus

- **Substitution Reactions** – Formation of alkyl halides, including Ph_3P/CX_4; formation of sulfonates; Use of alkyl halides and sulfonates to prepare amines, nitriles, ethers, etc; the Mitsunobu reaction.
- **Addition Reactions** – Revision of Markownikoff addition to alkenes, with further examples; mercuric-catalysed hydration of alkenes and alkynes; hydroboration of alkenes and alkynes, including mechanism, stereochemistry, hindered boranes.
- **Reductions in Organic Chemistry** – Catalytic reduction, including hydrogenolysis; Hydride reductants including DIBAL; Dissolving metal reductions of alkynes, aromatics and enones; reductive alkylation.
- **Oxidations in Organic Chemistry** – Oxidation of alcohols and of aldehydes; oxidation of alkenes to diols, and diol cleavage; direct oxidative cleavage of alkenes; use of cleavage products in overall ring expansion or contraction processes; formation of epoxides.
- **Carbon-Carbon Bond Formation Reactions** – simple chemistry of organolithium and Grignard reagents; organocopper reagents; Pd-catalysed coupling reactions; revision of alkylation, aldol condensation, Claisen condensation, Michael reaction; the Wittig reaction, including mechanism and stereochemistry; the Horner-Wadsworth-Emmons reaction; the Diels-Alder reaction, including stereo- and regio-chemistry.
- **Heterocyclic Chemistry –structure, reactivity and synthesis of simple 5- and 6-membered heterocyclic systems (pyrrole, furan, thiophene, pyridine) with 1 heteroatom**
- **Retrosynthetic Analysis** – Further application of retrosynthetic analysis to target molecule synthesis.

Module Title	Organic Reactions 1	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	9	Module Code	B19OC	Semester	1	Credits	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of this module, the learner will be able to:

- **Demonstrate detailed knowledge of a range of functional group transformations**
- **Show awareness of the major oxidative and reductive reactions used in synthetic organic chemistry**
- **Display an understanding of stereochemical and regiochemical selectivity associated with the above points**
- **Demonstrate knowledge of the key reactions used in carbon-carbon bond formation**
- **Discuss the terminology and methodology of retrosynthetic analysis (RSA)**
- **Analyse a synthetic target using RSA and thus design a synthesis of that target**
- **Integrate previous knowledge from across all of chemistry with the topics discussed in the module**

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Personal abilities are embedded in the module. The module provides the opportunity to :

- **Critically review and consolidate knowledge in chemistry**
- **Analyse a problem in a systematic manner, and construct a solution**
- **Interpret, use and evaluate a wide range of data to solve problems of both a familiar and unfamiliar nature**
- **Use ICT skills with on-line materials and web links to support the learning process**
- **Apply strategies for appropriate selection of relevant information from a wide source and large body of knowledge**
- **Exercise initiative and independence in carrying out learning activities**
- **Work with groups of peers to discuss chemical problems and identify solutions**
- **Manage time effectively, work to deadlines and prioritise workloads**

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Synoptic Examination	3h	50%	B19OD
Class test	2h	15%	
Continuous Assessment		15%	
Laboratory Work		20%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Synoptic Examination (100%)	3h

12. Date and Version

Date of Proposal	27 August, 2007	Date of Approval by School Committee		Date of Implementation	15 September, 2008	Version Number	1.0

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	Organic Reactions 2	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	9	Module Code	B19OD	Semester	2	Credits	15

1. Pre-requisites	Minimum D grade in Stage 2 core Chemistry modules, or the equivalent		
2. Linked Modules (specify if synoptic)	Organic Reactions 1 (synoptic)		
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☑ **No** ☐
6. Degrees for which this is a core module	All chemistry degrees		

7. Aims

The module aims to :

- **Understand the nature of pericyclic reactions including electrocyclic, cycloaddition, and sigmatropic rearrangements**
- **Extend ideas on aromaticity from benzene to non-benzenoid aromatic systems**
- **Provide further study of heterocyclic chemistry**
- **Provide applications of aspects of physical organic chemistry**

8. Syllabus

- **Pericyclic Reactions – applications of FMO theory to pericyclic reactions including electrocyclic reactions, cycloadditions and sigmatropic rearrangements.**
- **Aromaticity** – Applications of Hückel's [4n+2] rule to non-benzenoid aromatic systems
- **Heterocyclic chemistry – structure, reactivity and synthesis of 5- and 6-membered heterocyclic systems with 2 or more heteroatoms; extension of study to poly-fused heterocyclic ring systems.**
- **Physical Organic Chemistry – molecular rearrangements, solvent effects, isotope effects, structure-activity relationships, deduction of reaction mechanism**

Module Title	Organic Reactions 2	School	Engineering and Physical Sciences					On or Off-Campus	On
Module Co-ordinator	Dr J.H. Cameron	SCQF Level	9	Module Code	B19OD	Semester	2	Credits	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of this module, the learner will be able to:

- **Apply simple ideas of Frontier Molecular Orbital theory to understand the chemistry of a range of pericyclic reactions**
- **Demonstrate knowledge of some of the key chemistry of heterocyclic compounds**
- **Appreciate the importance of some aspects of Physical Organic Chemistry**
- **Integrate previous knowledge from across all of chemistry with the topics discussed in the module**

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Personal abilities are embedded in the module. The module provides the opportunity to :

- **Critically review and consolidate knowledge in chemistry**
- **Analyse a problem in a systematic manner, and construct a solution**
- **Interpret, use and evaluate a wide range of data to solve problems of both a familiar and unfamiliar nature**
- **Use ICT skills with on-line materials and web links to support the learning process**
- **Apply strategies for appropriate selection of relevant information from a wide source and large body of knowledge**
- **Exercise initiative and independence in carrying out learning activities**
- **Work with groups of peers to discuss chemical problems and identify solutions**
- **Manage time effectively, work to deadlines and prioritise workloads**

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Synoptic Examination	3h	50%	B19OC
Class test	2h	15%	
Continuous Assessment		15%	
Laboratory Work		20%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Synoptic Examination (100%)	3h

12. Date and Version

Date of Proposal	27 August, 2007	Date of Approval by School Committee		Date of Implementation	15 September, 2008	Version Number	1.0

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Biology Practical	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Professor M Schweizer	**SCQF Level**	7	**Course Code**	A17BP	**Semester**	2	**Credits**	15

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)	A17IB and A17IO		
3. Excluded Courses	None		
4. Replacement Course	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☐ **No** ☑
6. Degrees for which this is a core Course	A111-BRD, A191-BIS, A1A1-FST, A1MB-AMB, A1C1-BSM, A1E1-BSH, A1D1-BSF, A1F1-BSC, A312-SES, A371-SES		

7. Aims

The aims of this Course are to:

- provide training and experience in core practical techniques in biology, including biochemistry, microbiology, food science and related areas;
- provide training and experience in the use of laboratory instruments and equipment;
- provide training in the acquisition, interpretation and presentation of experimental data;
- foster an understanding of the importance of health and safety in the laboratory.

8. Syllabus

The following topics are included in the syllabus:

- DNA extraction and analysis;
- enzyme preparation;
- enzyme assay;
- spectroscopy;
- light microscopy;
- digestion – analysis of enzymes involved in the digestive system;
- analysis of foodstuffs;
- microbiology (identification, growth, analysis and counting of microorganisms).

Course Title	Biology Practical	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Professor M Schweizer	**SCQF Level**	7	**Course Code**	A17BP	**Semester**	2	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

After completing this Course, the learner will be able to:

- perform a range of essential practical techniques in biochemistry, microbiology, food science and related areas;
- use a range of laboratory instruments and equipment relevant to the subject area;
- understand the importance of health and safety in the laboratory.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

After completing this Course, the learner will be able to:

- analyse, interpret and present experimental data;
- organise and manage time in the execution of practical tasks;
- demonstrate confidence in laboratory work;
- participate effectively with others.

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Continuous assessment		100%	None

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination	2 hours

12. Date and Version

Date of Proposal	September 2007	**Date of Approval by School Committee**	2 October 2007	**Date of Implementation**	September 2008	**Version Number**	1

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Environmental Biology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Alastair R Lyndon	**SCQF Level**	7	**Course Code**	A17EB	**Semester**	2	**Credits**	15

1. Pre-requisites	None			
2. Linked Courses (specify if synoptic)				
3. Excluded Courses				
4. Replacement Course	**Code:** A2.1EB3, A1.1EP3 **Date Of Replacement:** September 2008	**5. Availability as an Elective**	**Yes** ✓ **No**	
6. Degrees for which this is a core Course				

7. Aims

The overall aim is to provide an understanding of environmental processes controlling life on earth and an appreciation of how man's activities can perturb such processes The practical component aims to provide experience of observation and practical investigation in the field of environmental biology and to teach basic skills in undertaking biology experiments and statistical analyses.

8. Syllabus

Introduction to ecology, the science of the effect of the environment on organisms and the nature of organismal interaction: control of the size of natural populations, including the influence of abiotic and biotic factors, such as competition and predation; the importance and control of biodiversity; energy flow through ecosystems; ecosystem stability, community ecology and succession; carbon dioxide and plant life; assessment of environmental impact; nature conservation; changing land use; climate change; acid rain and air pollution.

Visits to biological facilities (such as Botanic Gardens, Edinburgh) and field studies to examine the ecology of plant communities; experimental investigation into the environmental factors affecting plant growth

Course Title	Environmental Biology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Alastair R Lyndon	**SCQF Level**	7	**Course Code**	A17EB	**Semester**	2	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** After completing the Course the learner should have the ability to understand and critically assess important environmental issues such as biodiversity loss and climate change using sound scientific criteria.
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Skills in biological experimentation and statistical analysis and ability to interpret experimental results; report writing; group working

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Examination	2 hours	60%	None
Continuous assessment		40%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination (100%)	2 hours

12. Date and Version

Date of Proposal	21 October 2007	**Date of Approval by School Committee**	29 October 2007	**Date of Implementation**	01 September 2008	**Version Number**	1.0

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Introductory Biology 1	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Dr Philip G Meaden	**SCQF Level**	7	**Course Code**	A17IB	**Semester**	1	**Credits**	15

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)	A17IO		
3. Excluded Courses	None		
4. Replacement Course	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ✓ **No** ☐
6. Degrees for which this is a core Course	A111-BRD, A191-BIS, A1A1-FST, A1MB-AMB, A1C1-BSM, A1D1-BSF, A1E1-BSH, A1F1-BSC, A312-SES, A371-SES, A414-PFS, A415-PHH, B161, B16M, B181, B18M (or the equivalent Programmes following RAY)		

7. Aims

The aims of this Course are to:

- consider key topics in molecular and cellular aspects of biology at an introductory level;
- demonstrate the relationship between molecular and cellular biology, and the field of biology and the life sciences as a whole;
- provide the learner with core knowledge and understanding to undertake more advanced Courses in the life sciences;
- give an insight into the importance of molecular and cellular biology in health, medicine, technology and society.

8. Syllabus

The following topics are included in the syllabus:

- the molecules of life (proteins, nucleic acids, lipids and carbohydrates);
- cell structure and function;
- biological membranes;
- energy and metabolism;
- cell growth and division;
- cell signalling and communication;
- genetics and inheritance;
- gene structure and function.

Course Title	Introductory Biology 1	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Dr Philip G Meaden	**SCQF Level**	7	**Course Code**	A17IB	**Semester**	1	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

After completing this Course, the learner will be able to:

- demonstrate a working knowledge and understanding of the key topics in the subject area;
- apply knowledge and understanding of the key topics in the subject area to the wider field of the life sciences;
- understand the relevance of the subject area to appropriate issues in health, medicine, technology and society;
- demonstrate the ability to acquire information on the subject area from printed and computer-based resources;
- compile, structure and communicate information that is relevant to the subject area.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

After completing this Course, the learner will be able to:

- demonstrate the ability to acquire information from printed and computer-based resources;
- compile, structure and communicate relevant and coherent information;
- demonstrate the ability to work independently;
- manage time effectively and work to deadlines.

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Examination	2 hours	70%	None
Continuous assessment		30%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination	2 hours

12. Date and Version

Date of Proposal	September 2007	**Date of Approval by School Committee**	2 October 2007	**Date of Implementation**	September 2008	**Version Number**	1

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Introductory Biology 2	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Dr Philip G Meaden	**SCQF Level**	7	**Course Code**	A17IO	**Semester**	2	**Credits**	15

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)	A17IB		
3. Excluded Courses	None		
4. Replacement Course	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ✓ **No** ☐
6. Degrees for which this is a core Course	A111-BRD, A191-BIS, A1A1-FST, A1MB-AMB, A1C1-BSM, A1D1-BSF, A1E1-BSH, A1F1-BSC, A312-SES, A371-SES, A414-PFS, A415-PHH, B161, B16M, B181, B18M (or the equivalent programmes following RAY)		

7. Aims

The aims of this Course are to:

- consider key topics in human biology at an introductory level which are relevant to human physiology, health, disease and medicine;
- demonstrate the link between a knowledge and understanding of human biology, and health, disease and medicine;
- provide the learner with core knowledge and understanding to undertake more advanced Courses in human biology and related topics;
- give an insight into the importance of a knowledge of human biology to understanding key issues in health, medicine, technology and society.

8. Syllabus

The following topics are included in the syllabus:

- human genetics;
- cell biology and medicine;
- biotechnology;
- microbiology and infectious disease;
- the nervous system;
- digestion and nutrition;
- the immune system;
- the circulatory and respiratory systems.

Course Title	Introductory Biology 2	**School**	Life Sciences					**On or Off-Campus**	On campus
Course Co-ordinator	Dr Philip G Meaden	**SCQF Level**	7	**Course Code**	A17IO	**Semester**	2	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

After completing this Course, the learner will be able to:

- demonstrate a working knowledge and understanding of the key topics in the subject area;
- apply knowledge and understanding of the key topics in the subject area to the wider field of the life sciences;
- understand the relevance of the subject area to appropriate issues in health, medicine, technology and society;
- demonstrate the ability to acquire information on the subject area from printed and computer-based resources;
- compile, structure and communicate information that is relevant to the subject area.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

After completing this Course, the learner will be able to:

- demonstrate the ability to acquire information from printed and computer-based resources;
- compile, structure and communicate relevant and coherent information;
- demonstrate the ability to work independently;
- manage time effectively and work to deadlines.

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Examination	2 hours	70%	None
Continuous assessment		30%	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination	2 hours

12. Date and Version

Date of Proposal	September 2007	**Date of Approval by School Committee**	2 October 2007	**Date of Implementation**	September 2008	**Version Number**	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A18BC**	**2. Course Title**	**The Biosphere**			**3. SCQF Level**	**8**	**4. Credits**	**15**
5. School	**School of Life Sciences**					**6. Course Co-ordinator**	**Dr Alastair Lyndon**		
7. Delivery: Location & Semester	Edin ☒ Sem 2..	SBC ☐ Sem….	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem…...	Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	A17EB1 Environmental Biology								
9. Linked Courses (specify if synoptic)	None								
10. Excluded Courses	None								
11. Replacement Courses	**Code:** A18ET2 **Date Of Replacement:** 01.09.2012					**12. Degrees for which this is a core course**	A1MB; A112		
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

To provide understanding of climate processes and their role in biological processes at various levels of organisation from the cell to the ecosystem. To initiate an appreciation of the importance of the interactions of climate with biology in applied fields such as agriculture and fisheries, and to gain insight into the possible impacts of future climate change.

16. Syllabus

Introduction to earth's climate systems – atmospheric circulations; ocean circulations; ocean-atmosphere interactions. Large-scale climatic factors (e.g.El Nino). Models of climate and predictions of climate change.
Introduction to climatic effects on organisms – temperature; seasonality; phenology; evidence from different climatic provinces.
Evidence for climatic change – historical; recent; contentious issues; future scenarios
Impacts of climate – crops; livestock; diseases; fisheries
Possibilities for mitigation of effects – e.g. crop breeding/genetic modification

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of the course, the student should have the ability to understand the interactions between climate and biology, and to critically assess the possible outcomes of climatic change in the future.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Critical evaluation of conflicting viewpoints
Synthesis and analysis of scientific information
Working in groups

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Course Work	n/a	40%	No
Examination	2 hours	60%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination (100 %)	2 hours	3

20. Date and Version

Date of Proposal	11 Feb 2013	Date of Approval by School Committee	April 2013	Date of Implementation	September 2013	Version Number	2

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A18HA	**2. Course Title**	Human Systemic Physiology and Anatomy			**3. SCQF Level**	8	**4. Credits**	15
5. School	School of Life Sciences					**6. Course Co-ordinator**	Dr Dean Sewell		
7. Delivery: Location & Semester	Edin ☒ Sem 1	SBC ☐ Sem…….	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	None								
9. Linked Courses (specify if synoptic)	None								
10. Excluded Courses	None								
11. Replacement Courses	**Code:** A38HA and A38HN **Date Of Replacement:** 1/9/2013			**12. Degrees for which this is a core course**	BSc Biological Sciences (Human Health)				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

Develop an understanding of the regional and systemic structure and function of the human body with a focus on Transportation and Defence, Respiration, Nutrition and Excretion, Reproduction and Development.
Relate knowledge and understanding to aspects of human health and wellbeing.

16. Syllabus

Physiological functioning and anatomy of the following systems in the Human Body:
Endocrine, Blood, Cardiovascular, Lymphatic, Immune, Respiratory, Digestive, Urinary, and Reproductive systems.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** Be able to describe the location, structure and function of the various organ systems within the body in relation to Transportation and Defence, Respiration, Nutrition and Excretion, Reproduction and Development. Be able to describe in detail the regulatory function of the various organ systems within the body in relation to Transportation and Defence, Respiration, Nutrition and Excretion, Reproduction and Development. Be able to describe routine measurements of physiological function in human subjects. Be able to describe the physiological responses that facilitate physical exertion in humans.
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Be able to arrange information from a range of sources in a coherent manner. Be able to debate issues relating to health and wellbeing in an informed manner. Be able to handle human subjects and perform physiological measurements in a safe and courteous manner.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Continuous Assessment	N/A	100	N/A

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	2 hours	3

20. Date and Version

Date of Proposal	13/02/2013	**Date of Approval by School Committee**	April 2013	**Date of Implementation**	September 2013	**Version Number**	1.0

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A18HM	**2. Course Title**	Metabolism in Human Nutrition		**3. SCQF Level**	8	**4. Credits** 15
5. School	School of Life Sciences				**6. Course Co-ordinator**	Professor M Schweizer	
7. Delivery: Location & Semester	Edin ☒ Sem…1 ..	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..
8. Pre-requisites	First Year courses in the Biology programme, A level or Advanced Higher Biology or equivalent						
9. Linked Courses (specify if synoptic)	None						
10. Excluded Courses	None						
11. Replacement Courses	**Code:** A18HM, A38NH **Date Of Replacement:** September 2013			**12. Degrees for which this is a core course**	A111, A112, A191, A1A1, A1B1, A1C1, A1D1, A1E1, A1F1, A1MB		
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐		**14. Available as an Elective?**	**Yes** ☐	**No** ☒

15. Aims

The course will provide an overview of the relationship between human metabolism and nutrition. Specific aims are to provide::

- Information on human body composition, energy balance and energy expenditure,
- a review of enzyme reactions related to the metabolism of macronutrients,
- a knowledge of regulatory nutrients,
- an appreciation of the scientific basis of a healthy diet.

16. Syllabus

The course will cover the metabolic pathways linked to nutrition with an emphasis on the principles of nutrition and the integration and control of metabolism. Guidelines for a healthy diet, energy balance and body composition, weight management and causes of obesity, alcohol and nutrition. Definition of dietary fibre and functional foods. Nutritional requirements at specific life stages and an introduction to personalized nutrition.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

a) Knowledge and understanding of the metabolic processes providing energy and fuel for the human body
b) Creation of a diet plan

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

a) Self-study, familiarisation with web-based assessments, improved powers of observation and analysis
b) Critical appreciation of nutritional requirements for a healthy lifestyle
c) Teamwork and time/task management

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Three web-based assessments		30	
Assignment/Diet plan		10	
End of semester written examination	2 hours	60	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hours	

20. Date and Version

Date of Proposal	February 2013	Date of Approval by School Committee	April 2013	Date of Implementation	September 2013	Version Number	2.0

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Introduction to Microbiology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Susan Dewar	**SCQF Level**	8	**Course Code**	A18IM	**Semester**	2	**Credits**	15

1. Pre-requisites			
2. Linked Courses (specify if synoptic)			
3. Excluded Courses			
4. Replacement Course	**Code:** A1.2BM1, A1.2MP1 (part) **Date Of Replacement:** September 2008	**5. Availability as an Elective**	**Yes** ☐ **No** x
6. Degrees for which this is a core Course	BSc Biological Sciences (Microbiology), BSc Microbiology		

7. Aims

The Course will provide an introduction to the principal groups of microorganisms, the diversity of microbial metabolism, and some aspects of microbial biotechnology, emphasising the important role that microbes play in our lives.

8. Syllabus

Introduction to microorganisms and microbiological methods
Evolution and classification of microorganisms
Major groups of bacteria
Eukaryotic microorganisms
Viruses
Aspects of microbial metabolism
Aspects of industrial, environmental and medical microbiology

Course Title	Introduction to Microbiology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Susan Dewar	**SCQF Level**	8	**Course Code**	A18IM	**Semester**	2	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** Understanding of basic microbiological concepts and methods Knowledge of cell structure in the microbial world Appreciation of the relationships between different types of microorganisms Understanding of the diversity of metabolic processes Appreciation of the significance of microorganisms in industrial, environmental and medical contexts Knowledge of the principles and practice of handling microorganisms and associated safety issues
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Manipulative skills involving working with microorganisms Observational, analytical and interpretation skills in the microbiological laboratory Teamwork and time management

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Coursework		40	
Examination	2 hours	60	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination	2 hours

12. Date and Version

Date of Proposal	April 2009	**Date of Approval by School Committee**	27 April 2009	**Date of Implementation**	September 2009	**Version Number**	2

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A18MC**	**2. Course Title**	**Cell and Molecular Biology**			**3. SCQF Level**	**8**	**4. Credits**	**15**
5. School	**School of Life Sciences**					**6. Course Co-ordinator**	**Dr Ruth Fowler**		
7. Delivery: Location & Semester	Edin ☒ Sem…2..	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..		

8. Pre-requisites	Introductory Biology 1 & 2			
9. Linked Courses (specify if synoptic)	None			
10. Excluded Courses	None			
11. Replacement Courses	**Code:** **Date Of Replacement:**	**12. Degrees for which this is a core course**	All BSc Biological Sciences degrees, BSc Marine Biology, BSc Brewing and Distilling	
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐	**14. Available as an Elective?** **Yes** ☐ **No** ☒

15. Aims

- To build on topics in cell and molecular biology covered in previous courses
- To give a good grounding in the basics of Prokaryotic Molecular Biology, Genetics, Eukaryotic Cell Biology and Immunology and their relevance to other sciences.
- To provide the learner with the skills and knowledge required to undertake more advanced courses in cell and molecular biology

16. Syllabus

The following topics are covered:

Gene structure and function
Transcription and translation
Eukaryotic cell structure and function
Cell culture and immunology

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of this Course the learner will be able to:

- Demonstrate a thorough knowledge and understanding of cell and molecular biology
- Analyse and interpret information on cell and molecular biology
- Show an awareness of the relevance of cell and molecular biology to other areas of the life sciences

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- Access and interpret relevant information from published and online resources
- Present relevant and coherent information in a written form
- Manage time effectively and work to deadlines

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Examination	2 hr	70%	
Coursework		30%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hr	

20. Date and Version

Date of Proposal	14/2/13	Date of Approval by School Committee	April 2013	Date of Implementation	September 2013	Version Number	1.0

Form 20 **Heriot-Watt University - Course Descriptor Template** Version 2.0 (2003/2004)

Course Title	**Animal Biology**	School	**Life Sciences**					On or Off-Campus	**On**
Course Co-ordinator	**Dr Dan Harries**	SCQF Level	**8**	Course Code	**A18NB**	Term	**2**	Credits	**15**

1. Pre-requisites	None			
2. Linked Courses (specify if synoptic)	None			
3. Excluded Courses	None			
4. Replacement Course	**Code:** A18AB (part) **Date Of Replacement:** September 2009	**5.** Availability as an Elective	**Yes** ☐ **No** x	
6. Degrees for which this is a core Course	BSc Applied Marine Biology			

7. Aims

To introduce the biology of animals within an evolutionary framework
To provide a grounding in practical laboratory techniques, application of statistical analyses, use of the primary literature and preparation of structured reports.

8. Syllabus

Introduction to the animal Kingdom; origins of the animals; approaches to taxonomy/classification.

Systematic review of selected major animal Phyla
Modes of life (aquatic; terrestrial/aerial; parasitic)
Energetics
Food acquisition
Osmoregulation
Circulatory and respiratory physiology
Muscle physiology
Reproductive biology
Nervous system
Endocrine physiology

Course Title	**Animal Biology**	School	**Life Sciences**					On or Off-Campus	**On**
Course Co-ordinator	**Dr Dan Harries**	SCQF Level	**8**	Course Code	**A18NB**	Term	**2**	Credits	**15**

9. Learning Outcomes

Subject Mastery	***Understanding, Knowledge and Subject-Specific Skills*** On completion of the Course a student should be able to:- -outline the classification of animals -describe the main morphological structures of animals - describe the main physiological functions of animals - compare the functioning of different animals according to their morphology and environment - write structured scientific reports (including adequate referencing) - summarise a piece of primary literature relevant to the Course
Personal Abilities	***Cognitive skills, Core skills and Professional Awareness*** - report writing - IT skills for presentation of practical results - acquisition of laboratory skills - synthesis of information - analysis and interpretation of practical data

10. Assessment Methods

Method (e.g. exam)	Length of Examination	Weighting (%)	Synoptic Courses?
Coursework		40%	
Examination	2h	60%	no

11. Re-assessment Methods

Method (e.g. exam)	Length of Examination
Examination (100%)	2h

12. Date and Version

Date of Proposal	April 2009	**Date of Implementation**	September 2009	**Version Number**	1.0

Form 20 **Heriot-Watt University - Course Descriptor Template (RAY)** Version 3.0 (2007/2008)

Course Title	Research Methods in Biology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Alastair Lyndon	**SCQF Level**	8	**Course Code**	A18RB	**Semester**	1	**Credits**	15

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)	None		
3. Excluded Courses	None		
4. Replacement Course	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☐ **No** ☒ X
6. Degrees for which this is a core Course	All BSc degrees in Biology Programme		

7. Aims

To establish knowledge and skills in experiment/survey design, data collection, data handling, data analysis and presentation of results obtained from scientific experiments in relevant fields of the life sciences.

8. Syllabus

Lecture and computer laboratory practical topics will include:-

- Types of data
- Appropriate techniques for data recording and handling, and their analysis using appropriate software packages (e.g. Excel; SPSS)
- Using spreadsheets (e.g.Excel) for data management, processing and presentation
- Using appropriate software packages (e.g. SPSS) for descriptive and inferential statistics
- Theory on appropriate inferential statistics for scientific experiments/surveys
- Constructing Results sections suitable for inclusion in reports/papers for dissemination of scientific findings
- Experimental and survey design and analysis, applied to specific degree disciplines, led by staff from those disciplines
- Personal Development Planning (level 2 component, to be finalised)

Course Title	Research Methods in Biology	**School**	Life Sciences					**On or Off-Campus**	On
Course Co-ordinator	Dr Alastair Lyndon	**SCQF Level**	8	**Course Code**	A18RB	**Semester**	1	**Credits**	15

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

On completion of the Course a student should be able to:-

- identify different types of data
- record and handle raw experimental data in an appropriate manner
- use appropriate software to analyse and present data
- construct Results sections in a form similar to that of primary literature publications

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- writing of Results sections contributing to an ability to disseminate scientific findings
- IT skills for presentation of experimental results
- summarising scientific data
-- synthesis of information
- analysis and interpretation of experimental data
- Personal Development Planning level 2 component

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic Courses?
Coursework		40%	
Examination (computer-based)	2 h	60%	no

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination (100%)	2h
(Computer-based)	

12. Date and Version

Date of Proposal	17.10.2007	**Date of Approval by School Committee**	29.10.2007	**Date of Implementation**	September 2008	**Version Number**	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A18XP**	**2. Course Title**	**Science and Exploitation of Plants**				**3. SCQF Level**	**8**	**4. Credits**	**15**
5. School	**School of Life Sciences**					**6. Course Co-ordinator**	**Dr Peter Morris**			
7. Delivery: Location & Semester	Edin ☒ Sem 1	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..			
8. Pre-requisites										
9. Linked Courses (specify if synoptic)										
10. Excluded Courses										
11. Replacement Courses	**Code:** A18TB **Date Of Replacement:** Sept. 2013					**12. Degrees for which this is a core course**	A112 and A1MB			
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐	**No** ☒		

15. Aims

The aims of the course are to provide a basic understanding of plant structure, function and ecosystems, and to deliver an appreciation of human dependence on plants as primary producers of food and raw materials, and an understanding of both European and global systems for the exploitation and management of crop plants.

16. Syllabus

Initial lectures will cover basics of plant physiology, biochemistry and genetics. This will lead into systematics and ecology, interdependence of plants and microbes in the soil. Following this, lectures will expand upon man's relationship with plants starting from a historical perspective and covering the major global crops and systems for plant production in order to provide for animal and human food, and raw materials for industry (wood, textiles, fuels).

The lectures will be underpinned by relevant field excursions and exercises (for example visits to the Royal Botanic Gardens, Edinburgh, the SASA (Science Advice for Scottish Agriculture, formerly the Scottish Agricultural Science Agency, the James Hutton Institute) assessments based upon these visits will be carried out over Vision.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** Understanding of basic plant biochemistry, physiology, genetics, systematics and ecosystems. Knowledge of the major systems for plant production in agriculture, and an understanding of the most important problems facing agriculture today. Enquiry and scholarship into agricultural and ecological systems and methods as exemplified by visits to agricultural research stations and self-assessed over web-based tests.
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** This course will introduce students to the basics of industrial, commercial and professional practice in modern plant science, silviculture and agriculture, which underpins the food industry and much of the commercial sector in for example textiles, building, medicine.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Exam	2 hrs	50%	
Assignments based on visits		50%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam (100%)	2 hrs	

20. Date and Version

Date of Proposal	April 2013	**Date of Approval by School Committee**	April 2013	**Date of Implementation**	September 2013	**Version Number**	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19AS	**2. Course Title**	Applied Systems Human Physiology			**3. SCQF Level**	9	**4. Credits**	15
5. School	Life Sciences					**6. Course Co-ordinator**	Dr Derek Ball		
7. Delivery: Location & Semester	Edin ☒ Sem…1 ..	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	A18HA Human Systemic Physiology and Anatomy								
9. Linked Courses (specify if synoptic)									
10. Excluded Courses									
11. Replacement Courses	**Code:** A39HE **Date Of Replacement:** September 2014					**12. Degrees for which this is a core course**	A1E1		
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

The aims of this course are:

To understand the function and control of the human respiratory, neuromuscular and endocrine systems

To demonstrate the biological variability between individuals at a baseline assessment and in response to various stimuli.

To enable students to become familiar with data handling and interpretation of biological data.

To develop students skills and understanding regarding current research in this area

16. Syllabus

The course is developed around three main areas of respiratory physiology, musculoskeletal biology and the central nervous system in relation to autonomic and voluntary control. Each phase of the course is supported by laboratory practical classes that will further illustrate the biological variability between individuals. The students will collect human derived data and use these data to develop their analytical and data handling skills.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** Following completion of this course students will be able to: Demonstrate an understanding of the principles of function of the human respiratory system and how this system is controlled Explain the basis of force development within skeletal muscle from a molecular to whole muscle level Discuss the role of the central nervous system in the maintenance of homeostasis Competently assess and interpret the data from measures of the neuromuscular and respiratory systems Critically evaluate the literature and research on human systems physiology
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** To be able and confident to: Describe and discuss the underlying principles governing control of each of the physiological systems Communicate with peers and tutors Conduct tests examining function of the respiratory and neuromuscular system from a human *in vivo* experiments and collate the results Carry out data analysis using IT skills and SPSS Work and communicate within a team

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Continuous assessment		40	No
Examination	2 hours	60	No

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hours	

20. Date and Version

Date of Proposal	03/04/14	**Date of Approval by School Committee**	April 2014	**Date of Implementation**	September 2014	**Version Number**	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A19BT**	**2. Course Title**	**Biotechnology**				**3. SCQF Level**	**9**	**4. Credits**	**15**
5. School	**Life Sciences**					**6. Course Co-ordinator**	**Dr Derek Jamieson**			
7. Delivery: Location & Semester	Edin ☒ Sem 2	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..			
8. Pre-requisites	A18MC Cell & Molecular Biology and A18IM Introductory Microbiology									
9. Linked Courses (specify if synoptic)										
10. Excluded Courses										
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**	Biological Sciences (Cell & Molecular Biology); Biological Sciences (Microbiology); Biological Sciences (Food & Beverage Science)					
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒			

15. Aims

This course aims to provide students with:

- A working knowledge and understanding of biotechnology;
- The skills to apply that knowledge and understanding to a variety of different courses where biotechnology may be used;
- The skills to evaluate and interpret published outputs in biotechnology.

16. Syllabus

The course will include descriptions and discussion on microbial resources and culture banks. Fermentation methods, the production of small molecules (amino acids and antibiotics etc). Biofuels. Protein engineering and protein/ enzyme production. Environmental biotechnology; including biotechnological sources, products & sustainability. Sewage treatment, bioremediation, natural resource recovery (incl. bio-mining) and agricultural biotechnology.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

- Demonstrate a detailed knowledge and understanding of biotechnology.
- Apply knowledge and understanding of biotechnology specific to the students' specialist area.
- Analyse and interpret experimental data in biotechnology.
- Identify, access and use the appropriate literature.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Through the coursework tasks students will be exposed to the scientific literature in the form of research papers and the ability to read, understand and critically assess the contents of the scientific literature will be developed. The laboratory work in addition to highlighting key techniques, will emphasis problem solving, numerical work and group work.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework		40%	
Exam	2 hr	60%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	2 hr	

20. Date and Version

Date of Proposal	20 November 2013	**Date of Approval by School Committee**		**Date of Implementation**	September 2014	**Version Number**	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19CN	**2. Course Title**	Concepts in Beverage and Food Science			**3. SCQF Level**	9	**4. Credits**	15
5. School	Life Sciences					**6. Course Co-ordinator**	Dr Lydia Campbell and Professor Alex Speers		
7. Delivery: Location & Semester	Edin ☒ Sem 1	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites									
9. Linked Courses (specify if synoptic)									
10. Excluded Courses									
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**	A111-BRD, A1B1-FBS				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

The aims of this course are to:

- Provide an understanding of selected unit operations and advances in food processing.
- Introduce students to production of selected food commodities.
- Provide students with the ability to understand and modify quality sampling plans and understand how food product development occurs.
- Introduce students to sensory evaluation theory and practise.

16. Syllabus

- Concepts in Beverage and Food Science: Beverage and Food processing: Food quality control and Product development.
- Emerging technologies in the food and beverage industry.
- Physicochemical properties of plant and dairy based ingredients, with emphasis on parameters influencing finished product specifications.
- Enhancing functional properties of ingredients with emphasis on texture and rheology.
- Statistical Quality Assurance: sampling plans, control charts.
- Food and Beverage New Product Development.
- Sensory Evaluation.
- Food and Beverage Thermal Processing.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

At the end of this course students will be able to:

- Appreciate a number of sub-disciplines in Food Science including processing of various food commodities, advances in food processing, food quality assurance, food product development, and sensory evaluation. Examples from industry will be used to illustrate these topics.
- Recognise new emerging technologies in the food industry
- Know the range of food commodity ingredients available based on plant and dairy raw materials
- Know the effect of processing and storage on chemical properties of food ingredients
- Understand approaches to improve functional properties of food ingredients
- Apply a structured approach to food product development
- Understand basic concepts of food quality assurance
- Understand how and why statistical tools are used to assure quality control
- Understand the principles for measurement of texture and rheology and their significance in food quality control
- Understand basic sensory evaluation methods

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- Enhance professional practice by acquiring knowledge of food commodity production, the use of food ingredients.
- Enhance professional practice of emerging technologies.
- Enhance professional practice by understanding principles of food quality assurance.
- Attain the ability to design selected statistical methods for food quality monitoring.
- Enhance professional practice by application of structured approach to product development.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Examination	2 hours	60%	
Coursework		40%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hours	

20. Date and Version

Date of Proposal	March 2014	Date of Approval by School Committee	April 2014	Date of Implementation	September 2014	Version Number	1.0

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A19CV**	**2. Course Title**	**Cardiovascular Regulation in Humans**		**3. SCQF Level**	**9**	**4. Credits**	**15**
5. School	**School of Life Sciences**			**6. Course Co-ordinator**	**Dr Derek Ball**			
7. Delivery: Location & Semester	Edin ☒ Sem 2	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..	
8. Pre-requisites	Human Systemic Physiology and Anatomy							
9. Linked Courses (specify if synoptic)								
10. Excluded Courses								
11. Replacement Courses	**Code:** A39CV **Date Of Replacement:** September 2014			**12. Degrees for which this is a core course**	A1E1			
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐		**14. Available as an Elective?**	**Yes** ☐	**No** ☒	

15. Aims

The aims of this course are:

To understand the control of pressure, vascular volume and blood flow

To demonstrate that exercise has main role in affecting the variables of pressure, volume and flow

To provide the student with the skills and knowledge to understand current research in this area

16. Syllabus

The following topics will be covered:

Hydrostatics and vascular pressures; reflex control to maintain pressure and volume, central circulatory adjustments to dynamic exercise; control of regional blood flow during dynamic exercise.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

Following completion of this course students will be able to:
Demonstrate an understanding of the principles of control of the human cardiovascular system
Explain how exercise modulates the control of the human cardiovascular system
Competently assess and interpret the data from measures of the cardiovascular system
Critically evaluate the literature and research on the human cardiovascular system

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

To be able and confident to:
Describe and discuss understanding and knowledge gained
Communicate with peers and tutors
Carry out data analysis using IT skills and SPSS
Conduct exercise tests and collate results
Work and communicate within a team

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Exam	2 hrs	60	
Coursework		40	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam (100%)	2 hrs	

20. Date and Version

Date of Proposal	April 2014	Date of Approval by School Committee	April 2014	Date of Implementation	September 2014	Version Number	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19HU	**2. Course Title**	Pathobiology of Human Disease			**3. SCQF Level**	9	**4. Credits**	15
5. School	Life Sciences					**6. Course Co-ordinator**	Professor Mihalis Panagiotidis		
7. Delivery: Location & Semester	Edin ☒ Sem…1	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..		Approved Learning Partner ☐ Name ……Sem……..	
8. Pre-requisites	A18MC Cell & Molecular Biology and A18HM Metabolism in Human Nutrition								
9. Linked Courses (specify if synoptic)									
10. Excluded Courses									
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**	Biological Sciences (Cell & Molecular Biology) Biological Sciences (Human Health)				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

To cover advanced topics in human disease mechanisms; to explain the pathobiology of major human diseases; to provide the learner with the knowledge to understand current research in human disease biology with a focus on therapeutic approaches for disease treatment and management.

16. Syllabus

The following topics are covered:

(1) Respiratory diseases
(2) Cardiovascular diseases
(3) Neurological diseases
(4) Metabolic Diseases
(5) Nutritional diseases
(6) Cancer

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

After completing this course, students should be able to:

(1) demonstrate an advanced knowledge of cell and molecular biology underlying major disease mechanisms
(2) explain how such knowledge is essential in biotechnology and medicine for the development of therapeutics
(3) understand current research in disease pathophysiology

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

After completing this course, students should be able to:

(1) access and interpret relevant information from published resources
(2) present relevant and coherent information in a written form
(3) manage time effectively and work to deadlines

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework		40%	
Exam	2 hr	60%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	2 hr	

20. Date and Version

Date of Proposal	November 2013	Date of Approval by School Committee	16 December 2013	Date of Implementation	September 2014	Version Number	1

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**A19ML**	**2. Course Title**	**Medical Microbiology**				**3. SCQF Level**	**9**	**4. Credits**	**15**
5. School	**Life Sciences**						**6. Course Co-ordinator**		**Dr Elisabeth Dyrynda**	
7. Delivery: Location & Semester	Edin ☒ Sem…2	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..		Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites										
9. Linked Courses (specify if synoptic)										
10. Excluded Courses										
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**		BSc Biological Sciences (Microbiology)				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐				**14. Available as an Elective?**	**Yes** ☐	**No** ☒	

15. Aims

This course centres on human bacterial, viral and fungal pathogens, as well as parasites. The aims of the theory part of the course are:

- To discuss relevant diseases of humans
- To discuss methods for the diagnosis of disease
- To discuss methods of disease control, including chemotherapy and vaccination

The aims of the practical component are:

- To learn safe microbiological techniques for the manipulation of pathogenic micro-organisms
- To learn methods for the isolation and identification of bacterial pathogens
- To learn and compare different detection methods for human pathogens

16. Syllabus

The lecture based component will comprise:
Bacterial diseases: including gastrointestinal diseases and the problem of food and water contamination; respiratory pathogens; septicaemias; occupational hazards; problems of travel; emerging problems
Parasitic diseases: includes protozoan diseases such as sleeping sickness, Leishmaniasis, malaria and considers epidemiology, vector transmission, and control strategies.
Viral diseases: Describes important viral diseases, including polio, influenza, common cold, viral hepatitis and AIDS.
BSE and nvCJD
Interactions between the host and the immune system: Consideration of methods used to control disease, emphasising vaccines and chemotherapy.
The practical based component will comprise:
Safe microbiological techniques
Pathological techniques including the isolation and identification of bacterial pathogens
Recovery of antibiotic-producing bacteria
Comparison of detection methods including microscopy, ELISA, serotyping

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

Skills to be developed:
During the lecture component of the course, the student will become familiar with the principles of microbial pathology from the viewpoint of human medicine and develop an awareness of the impact of disease on human society. The practical element will focus on safe techniques used in medical microbiology.
Learning outcomes:
An intermediate knowledge and understanding of the following:

- Methods used for the diagnosis of infectious disease.
- Important infectious diseases of humans
- Biology of important bacterial, viral and fungal pathogens
- Role of emerging diseases in human society
- Methods useful for the control of infectious disease.
- Microbiological safety
- Methods used for the isolation and identification of bacterial pathogens.
- Comparison of detection methods for pathogenic bacteria

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

The ability to work with human pathogens, safely.
Report writing
Group work

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Examination	2 h	60%	
Coursework		40%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 h	

20. Date and Version

Date of Proposal	April 2014	Date of Approval by School Committee	April 2014	Date of Implementation	September 2014	Version Number	1.0

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19M0	**2. Course Title**	Molecular Biology				**3. SCQF Level**	9	**4. Credits**	15
5. School	School of Life Sciences						**6. Course Co-ordinator**	Dr Peter Morris		
7. Delivery: Location & Semester	Edin ☒ Sem..1..	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..		Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	A18MC Cell & Molecular Biology									
9. Linked Courses (specify if synoptic)	None									
10. Excluded Courses	None									
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**	A1B1, A1C1, A1E1, A1F1					
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐				**14. Available as an Elective?**	**Yes**	**No** ☒	

15. Aims

The aims of this course are:

- To describe the methods involved in the manipulation and analysis of DNA
- To provide training in core practical techniques in recombinant DNA technology
- To demonstrate why recombinant DNA is important in the life sciences
- To foster an understanding of the importance of health and safety in the laboratory

16. Syllabus

The following topics are covered: principles of genetic engineering; isolation of plasmid and genomic DNA; restriction enzyme digestion of DNA; agarose gel electrophoresis of DNA; ligation of DNA; transformation of bacteria with recombinant DNA; Southern hybridisation of DNA, DNA sequencing and analysis of gene expression. Practical work will include the use of a wide range of instruments and equipment.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

After completing this course, the learner should be able to:

- Demonstrate an advanced knowledge of molecular biological technology
- Perform core practical techniques in recombinant DNA technology
- Use a wide range of appropriate instruments and equipment
- Understand the importance of health and safety in the laboratory

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

After completing this course, the learner should be able to:

- Analyse and interpret experimental data
- Demonstrate competence and confidence in experimental work
- Work effectively with others

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework		40%	
Examination	2 hours	60%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hours	3

20. Date and Version

Date of Proposal	April 2014	Date of Approval by School Committee	April 2014	Date of Implementation	September 2014	Version Number	2

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19MY	**2. Course Title**	Microbial Physiology				**3. SCQF Level**	9	**4. Credits**	15
5. School	School of Life Sciences						**6. Course Co-ordinator**	Dr Wilf Mitchell		
7. Delivery: Location & Semester	Edin ☒ Sem..1	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..		Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	A18IM Introduction to Microbiology									
9. Linked Courses (specify if synoptic)										
10. Excluded Courses										
11. Replacement Courses	**Code:** **Date Of Replacement:**					**12. Degrees for which this is a core course**		BSc Biological Sciences (Cell and Molecular Biology), BSc Biological Sciences (Microbiology)		
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**		**Yes** ☐	**No** ☒	

15. Aims

To familiarise students with some important aspects of the physiology of microbial cells which relate to their growth, metabolism and survival in a variety of habitats.

16. Syllabus

Principles of gene expression; membrane structure and function; nutrient assimilation and its control; aerobic and anaerobic respiration and its control; homeostasis; chemotaxis; sporulation; quorum sensing. Extremophiles - survival and growth in extreme environments.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

Appreciation of the interactions between microbial cells and their environment, and the molecular mechanisms used to support adaptation and survival in different conditions.
Understanding of mechanisms of adaptation and survival in extreme environments.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Searching literature databases and accessing scientific literature.
Critical analysis and summarising of scientific literature.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework		40	
Examination	2 hours	60	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	2 hours	Resit

20. Date and Version

Date of Proposal	2 April 2014	Date of Approval by School Committee	April 2014	Date of Implementation	September 2014	Version Number	2.0

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	A19VB	**2. Course Title**	Marine Biodiversity			**3. SCQF Level**	9	**4. Credits**	15
5. School	School of Life Sciences					**6. Course Co-ordinator**	Dr Dan Harries		
7. Delivery: Location & Semester	Edin ☒ Sem..1..	SBC ☐ Sem……	Orkney ☐ Sem……..	Dubai ☐ Sem……..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem……..	Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	A18NB Animal Biology								
9. Linked Courses (specify if synoptic)	None								
10. Excluded Courses	None								
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**	A1MB Applied Marine Biology A112 Marine Biology				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

To provide an understanding of the phylogeny, classification, importance, diversity and biology of the major groups of marine organisms, including (but not confined to) bacteria, sponges, cnidarians, nematodes, annelids, molluscs, crustaceans, lophophorates, echinoderms and chordates (including marine vertebrate groups – fish, reptiles, birds, mammals).

16. Syllabus

Phylogeny and classification of marine organisms; biology of marine organisms, including (but not confined to) sponges, cnidarians, nematodes, annelids, molluscs, crustaceans, echinoderms, lophophorates and chordates (including vertebrate groups – fish, reptiles, birds, mammals).

Practical classes will involve examination of selected examples of the above groups, including study of their characteristics and diversity, as well as use of appropriate identification literature.

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

An understanding of the biology of the major groups of organisms found in marine and estuarine waters of the world, as well as their classification and interrelationships.

Ability to understand the external and internal structure of marine organisms and to use appropriate descriptive nomenclature for the groups studied.
Ability to distinguish between different groups and to identify them using characteristic features and identification keys.

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

Enhanced awareness of the importance and diversity of marine organisms.
Development of the ability to observe and accurately depict the structure of biological specimens.
Development of dissection skills and preparation skills for sample observation.

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework	n/a	50 %	No
Examination	2 hours	50%	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Coursework 20%	n/a	
Examination 80%	2 hours	3

20. Date and Version

Date of Proposal	10 February 2012	Date of Approval by School Committee	16 February 2012	Date of Implementation	1 September 2012	Version Number	1.0

Aims

This module provides a course on differential calculus with applications of differentiation and an introduction to integral calculus. It is designed for students who will specialize in mathematics, actuarial mathematics or statistics. The module builds on what the students learned at school but provides a greater depth of study and introduces new material and concepts.

Syllabus

Functions: Functions, domains and ranges, *(2 lectures)* .

Limits of functions: Limit of a function at a point, evaluation of limits, continuous functions. *(3 lectures)* .

Introduction to Differentiation: Differentiable functions, laws of differentiation, differentiation of standard functions, rules of differentiation. *(4 lectures)* .

Inverse Functions: one-to-one and onto functions, inverse functions, inverse trig functions, exponetial functions, logarithms. *(2 lectures)* .

Advanced Differentiation: Parametric differentiation, implicit differentiation. Derivatives of inverse functions, Inverse Trig functions. Hyperbolic functions and hyperbolic equations, Derivatives for hyperbolic functions and inverse hyperbolic functions. *(6 lectures)*

Introduction to Integration: The fundamental theorem of calculus, area under a graph of a continuous function on a bounded interval, indefinite and definite integration of standard functions, integration of rational and surd functions. *(6 lectures)* .

Sequences and Series: Limits of a sequence, Convergence of sequences, partial sums of sequences, partial fractions. Convergence of infinite series, tests for convergence of infinite series, power series, radius of convergence, Maclaurin series, Leibnitz theorem, sums of Maclaurin series. *(8 lectures)* .

Teaching and Assessment

Contact Hours:	3 lectures and 1 tutorial per week
Assessment:	up to 30% by class tests or other continuous assessment at least 70% by end of module 2-hour exam
Resit Type:	exam

By the end of the course, students should be able to:

- recognise domains and ranges for functions.
- understand the concept of limit of a function.
- calculate the limit of a function
- understand the idea of a continuous function.
- define the derivative of a function as a limit.
- determine the derivative of functions from first principles.
- apply the basic rules of differentiation, namely the sum rule, the rule for multiplication by a scalar, the product rule, the quotient rule and the chain rule.
- state the standard derivatives for powers, trig functions and exp and log.
- calculate second and higher derivatives.
- determine if functions are one-to-one or onto.
- understand the concept of the inverse of a function.
- understand the concept of the exponential function and logarithms.
- find first and second derivatives for curves given in parametric form.
- understand and apply implicit differentiation techniques.
- calculate the derivatives of the inverse trig functions.
- define the hyperbolic functions and compute their derivatives.
- define the inverse hyperbolic functions and compute their derivatives.
- understand antiderivatives and be able to use the table of standard integrals.
- understand the fundamental theorem of calculus.
- be able to use antiderivatives to work out areas of regions under the graphs of continuous functions.
- evaluate $\int f(ax+b)dx$ where a and b are constants.
- evaluate integrals of rational functions and functions of the form linear over square root of quadratic.
- understand the concept and compute the limit of a sequence.
- compute formulas for the sum to n terms of a sequence.
- compute the limits, if they exist, of some simple infinite series.
- use the comparison test, ratio test and absolute convergence test, to check convergence of series
- find and use the Maclaurin series of functions

Aims

This module builds on the differential and integral calculus introduced in Calculus A, before moving on to introduce the basics of mathematical modelling techniques using first and second order ordinary differential equations.
The module develops integration methods such as integration by parts and reduction formulae and describes applications of integration including general areas under a curve.
Solution methods for first and second order differential equations are introduced and used to investigate various physical problems.

Syllabus

Applications of differentiation: Tangents and normals, maxima and minima, curve sketching, Rates of change, L'Hopital's rule, approximations. *(5 lectures)*

Advanced Integration: Integration of rational and surd functions, integration by substitution, standard substitutions, integrals involving trig and hyperbolic functions, integration by parts, reduction formulae. More general areas under a curve, convergence of integrals. *(9 lectures)* .

Differential Equations: First order differential equations: Variables separable, Linear, homogeneous. Second order differential equations: Solution of linear equations with constant coefficients, Solution of the homogeneous equation, Particular integrals and solution of the nonhomogeneous equation, Initial value problems. *(8 lectures)*

Modelling through first order equations: Linear growth and decay: Carbon dating, Continuously Compounded Interest, Bacterial growth, Newton's Law of cooling. Nonlinear Models: Logistic equation of self-regulated growth. Building the differential equation through approximations. *(6 lectures)*

Modelling through second order equations: Newton's laws of motion: Projectiles in 1D, Falling bodies with air resistance, Motion under constant acceleration. Amplitude and Period of Simple Harmonic Motion, Damped oscillations. *(3 lectures)*

Teaching and Assessment

Contact Hours: 3 lectures and 1 tutorial per week
Assessment: up to 20% by class tests or other continuous assessment
80% by end of module 2-hour exam
Resit Type: exam

By the end of the course, students should be able to:

- compute the equation of tangents and normals to curves.
- determine the nature of stationary points using the first and second derivative tests.
- calculate limits as $x \to \pm\infty$.
- determine the asymptotes for a curve.
- sketch a curve which may have turning points and asymptotes.
- sketch an ellipse, hyperbola or parabola.
- apply the chain rule to solve problems involving related rates of change.
- understand how to do integration by substitution
- evaluate the integrals of trig and hyperbolic functions
- use integration by parts
- obtain reduction formulae using integration by parts
- solve first order differential equations which are separable, linear or homogeneous.
- find the general solution of homogeneous second order differential equations with constant coefficients.
- find particular integrals for nonhomogeneous second order differential equations with constant coefficients
- find the general solution of nonhomogeneous second order differential equations with constant coefficients.
- solve initial value problems involving second order differential equations with constant coefficients.
- develop the first order differential equation to model physical situations involving linear growth or decay.
- determine the solution of first order differential equation models for various applications with given conditions and to use the solution to find values of any parameters involved.
- solve the logistic equation for modelling applications involving nonlinear growth and decay.
- interpret the solutions of differential equation models.
- know the connection between the position, velocity and acceleration of a particle.
- solve problems on projectiles in 1D which involve numerical data, symbols and air resistance.
- find the time to greatest height, the greatest height, the time of flight, for a projectile in 1D.
- derive and solve the equation for simple harmonic motion (SHM).
- determine the period and amplitude for a simple harmonic motion.
- apply solutions for harmonic motion to problems with given initial conditions and to use the particular solutions to answer various questions on the motion.
- derive solutions for damped oscillators.

Aims

The course aims to provide an introduction to the calculus for functions of several variables, which will provide sufficient expertise for use in various later courses. The students will also develop their general skills in differentiation, integration and algebraic manipulation.

Syllabus

Partial differentiation: Functions of several variables, partial derivatives and higher order partial derivatives. Matrix 'total' derivatives. The chain rule, implicit differentiation. *(9 lectures)*

Applications of partial differentiation: Taylor expansions, tangent planes, maxima and minima, Lagrange multipliers. The inverse function theorem (in 1 and 2-dimensions). *(7 lectures)*

Integration: Double integrals, interchange of order of integration. Change of variables. Polar coordinates. Triple integrals. *(8 lectures)*

Applications of integration: Areas, volumes. *(3 lectures)*

Integrals over infinite regions: The definition of the convergence of integrals of functions on unbounded intervals. Comparison tests and absolute convergence tests of integrals. *(3 lectures)*

Sequences: Define a sequence of real numbers. Define bounded and convergent sequences, and the limit of a convergent sequence. *(3 lectures)* .

Teaching and Assessment

Contact Hours: 3 lectures and 1 tutorial per week
Assessment: up to 30% by class tests or other continuous assessment
at least 70% by end of module 2-hour exam
Resit Type: exam only

By the end of the course, students should be able to:

- work out partial derivatives of any order.
- apply the chain rule to functions of functions.
- work out derivatives of implicitly defined functions.
- calculate Taylor expansions of functions of two variables.
- calculate tangent planes to surfaces defined by functions of two variables.
- find extremal points of functions of two variables and determine whether they are maxima or minima.
- find extremal points of constrained max/min problems using Lagrange multipliers.
- evaluate double integrals over various planar regions and triple imtegrals over simple volumes.
- interchange the order of integration of repeated integrals.
- change variables in multiple integrals. In particular, use polar coordinates to evaluate multiple integrals.
- use multiple integration to work out areas and volumes of simple geometrical objects.
- recall the definition of and investigate the convergence of integrals of functions on unbounded intervals (and in particular know the values of p for which the standard integral $\int_1^\infty 1/x^p\,dx$ converges)
- state and use the comparison and absolute convergence tests for integrals of functions on unbounded intervals
- recall the definition of and investigate the convergence of integrals of unbounded functions on bounded regions (and in particular know the values of p for which the standard integral $\int_0^1 1/x^p\,dx$ converges)
- state and use the comparison and absolute convergence tests for integrals of unbounded functions on bounded regions

Aims

The course aims to introduce students to the idea of rigorous mathematical arguments and, in particular, to discuss the rigorous foundations of calculus. An important feature of the course is the use of careful, rigorous proofs of the theorems used and one of the aims of the course is to improve student's ability to understand such arguments and to develop such proofs for themselves. A central concept in analysis is the idea of convergence, either of sequences, series or of functions, and this course aims to introduce this concept and provide the basic results which will be used in later courses. In addition, it will give methods of obtaining inequalities and approximations (with precise estimates of how good the approximations are), tests for convergence of series and power series and ways of identifying functions defined by power series and characterisations of functions (over bounded and unbounded intervals) for which the concept of area under the graph of a function makes sense.

Syllabus

Sequences: Briefly recall the idea of a sequence of real numbers, and of bounded and convergent sequences. *(1 lecture)* .

Suprema and infima: Sup and inf of sets of real numbers. The completeness axiom for real numbers. *(1 lecture)*

Monotone sequences: Monotone sequences and the monotone convergence theorem. Use of the monotone convergence theorem to prove convergence of sequences without knowing the limit. *(2 lectures)*

Subsequences: Subsequences and the Bolzano-Weierstrass theorem. *(2 lectures)*

Continuous functions: Limits of functions, manipulation of limits. Continuity, combinations of continuous functions. Boundedness of continuous functions on closed intervals. The intermediate value theorem. *(6 lectures)*

Differentiability: Differentiability. Continuity of differentiable functions. Rolle's theorem. Local maxima and minima. *(5 lectures)*

First mean value theorem: Statement and proof of the first mean value theorem, applications to inequalities *(2 lectures)* .

n^{th} **mean value theorem:** Statement and proof of the n^{th} mean value theorem, applications to approximations *(2 lectures)* .

Series and power series: Convergence of series, the comparison, ratio, zero, absolute convergence and alternating series tests for series, radius of convergence of a power series properties of functions defined by power series, convergence of standard power series *(7 lectures)* .

Riemann integration and convergence of integrals: Partitions, upper and lower sums, Riemann integrable functions. *(5 lectures)* .

Teaching and Assessment

Contact Hours:	3 lectures and 1 tutorial per week
Assessment:	up to 15% by class tests or other continuous assessment up to 85% by end of module 2-hour exam
Resit Type:	exam

By the end of the course, students should be able to:

- know what a sequence of numbers is.
- be able to prove from the definition that a sequence of numbers is bounded.
- understand the definition of convergence of a sequences of numbers, and be able to prove from the definition that simple sequences of numbers are convergent.
- prove results on combinations of sequences.
- prove the a convergent sequence is bounded.
- prove results on inequalities satisfied by limits, i.e. $a_n < a \Rightarrow \lim_{n\to\infty} a_n \leq a$.
- understand the definition of the sup and inf of a set of numbers.
- understand the completeness axiom for the set of real numbers.
- be able to prove from the definition that a set of numbers is bounded above or below.
- understand the idea of monotone sequences and the monotone convergence theorem.
- use the monotone convergence theorem to show that sequences are convergent, without knowing the limit. Use this to retrospectively find the limit. In particular, to do this for iteratively defined sequences.
- understand the idea of subsequences and construct examples illustrating the behaviour of subsequences.
- state the Bolzano-Weierstrass theorem, and use it to show that sequences have convergent subsequences.
- understand the sequential and the ϵ-δ definition of continuity of functions.
- prove simple results involving continuous functions and their combinations.
- determine if given functions are continuous or discontinuous.
- prove that a continuous function on a closed interval is bounded and attains its bounds.
- prove the intermediate value theorem.
- use the intermediate value theorem to prove that c7ertain equations have solutions in appropriate intervals.
- define differentiability of a function.
- determine from the definition if given functions are differentiable.
- show that the derivative is zero at a local maximum or minimum.
- prove Rolle's theorem.
- use Rolle's theorem to prove that certain equations have unique solutions in appropriate intervals.
- state and prove the first mean value theorem and use it to obtain inequalities
- state the n^{th} mean value theorem
- find Taylor polynomials of degree n for suitable functions and estimate the remainder term
- use the n^{th} mean value theorem to find polynomial or other approximations, with estimates of accuracy
- use results on convergence of sequences given in $F1.2MK2$ to determine whether series are convergent (and in particular know the values of p for which the standard series $\sum 1/n^p$ converges)
- state the comparison test, the ratio test, the zero test, the absolute convergence test and the alternating series test, be aware of their proofs (and be able to prove the zero test) and use them to determine whether series are convergent
- understand what is meant by the radius of convergence of a power series
- be able to find the radius of convergence of a power series
- differentiate a function defined by a power series (inside its radius of convergence)
- show how the Maclaurin series of some functions (for example $e^x, \cos(x)$ and $\log(1+x)$) converge to these functions inside the radius of convergence
- define and compute the upper and lower sums of a bounded function f with respect to a partition
- understand the effect of refining a partition
- determine whether a function is Riemann integrable either directly from the definition or from the sequential characterisation of integrability and be aware that continuous and monotone functions are integrable
- be aware of the basic properties of Riemann integrals
- state and prove the fundamental theorem of calculus
- use the n^{th} mean value theorem to approximate integrals of continuous functions which do not have an antiderivative expressible in elementary functions
- integral test for series.

Content: February 2008

Aims

The course aims to give an understanding of linear and nonlinear ordinary differential equations and systems of equations and to show how ordinary differential equations are important in mathematical modelling.

Syllabus

Introduction to differential equations: Revision of first-order equations, exact equations, existence and uniqueness of solutions, direction fields, exactly solvable second order equations. *(4 lectures)*

Linear systems of ODEs: Fundamental sets of solutions, equations with constant coefficients, Wronskians, inhomogeneous equations, variations of parameters, solution of linear systems by matrix methods. *(9 lectures)*

Laplace transforms: Calculation of transforms, solution of linear equations and systems, inverse transforms, equations with discontinuous or impulsive forcing terms, convolutions. *(4 lectures)*

Boundary value problems: Existence and uniqueness of solutions, Green's functions *(4 lectures)*

Sturm Liouville problems: Eigenvalues and eigenfunctions, orthogonality of eigenfunctions, eigenfunction expansions. *(4 lectures)*

Phase Planes: Equilibrium points, phase planes for nonlinear second-order equations, the pendulum equation, phase planes for linear systems, classification of equilibrium points, stability. *(7 lectures)*

Teaching and Assessment

Contact Hours: 3 lectures and 1 tutorial per week
Assessment: up to 15% by class tests or other continuous assessment
at least 85% by end of module 2-hour exam
Resit Type: exam

By the end of the course, students should be able to:

- recognize and solve first-order ODE's which are separable, linear, can be solved by changing variable (e.g. homogeneous, Bernouilli type), exact.
- understand how Picard's theorem can be applied to prove the the existence and uniqueness of solutions of initial value problems.
- sketch the graphs of solutions of first-order equations by first drawng appropriate direction fields.
- use MAPLE to find direction fields and to plot solutions of equations.
- be able to solve second order ODE's of the form $y'' = f(x, y')$ and $y'' = f(y, y')$.
- find fundamental sets of solutions of homogeneous second-order equations with constant coefficients, of Euler type, and where one solution can be found by inspection.
- understand Wronskians; be able to state and prove Abel's theorem and verify that the theorem holds for given equations.
- understand the connection between the solutions of homogeneous and inhomogeneous equations and solve inhomogeneous equations using the methods of undetermined coefficients and variation of parameters.
- find the general solution of linear systems of two ODE's with constant coefficients in terms of the eigenvalues and eigenfunctions of an appropriate matrix.
- calculate Laplace transforms and know the basic properties of the transforms.
- use Laplace transforms to solve initial value problems for second-order ODE's.
- use Laplace transforms to solve problems involving discontinuous functions and Dirac delta functions, including problems arising in oscillating springs.
- understand convolutions and be able to solve integral equations involving convolutions by using Laplace transforms.
- invert Laplace transforms by using the convolution theorem.
- use Laplace transforms to solve linear systems of ODE's.
- understand the difference between initial value problems and boundary value problems.
- show that sometimes boundary value problems have no solution.
- be able to construct Green's functions and use them to solve boundary value problems.
- be able to solve boundary value problems under appropriate conditions when no Green's function exists.
- find the eigenvalues and eigenfunctions of boundary value problems.
- understand the completeness and orthogonality of families of eigenfunctions.
- find general eigenfunction expansions.
- know what is meant by a phase plane.
- sketch the phase plane of an autonomous second-order nonlinear ODE by first finding the equations of the trajectories.
- draw the phase plane corresponding to the nonlinear pendulum equation.
- classify equilibrium points for systems of two linear ODE's with constant coefficients and sketch the corresponding phase planes.
- understand the concept of stability.

Aims

The course aims to provide an introduction to abstract algebra, covering the basics of groups, rings and fields

Syllabus

Introduction and examples: Motivational examples: permutations and modular arithmetic. Matrix and cycle notation for permutations, the order, even and odd permutations. Addition and multiplication modulo n: differences in structure. *(5 lectures)*

Axiomatic approach to groups: Binary operations; axioms for a group, Cayley tables. *(4 lectures)*

Subgroups: The subgroup test. Lagrange's Theorem. *(4 lectures)*

Homomorphisms: Homomorphisms. Kernels and images. Isomorphisms. Quotient groups. The first isomorphism theorem. Cayley's theorem. *(5 lectures)*

Axiomatic approach to rings: Axioms for a ring. Examples. Units and zero-divisors. *(3 lectures)*

Subrings and ideals: Definitions. The subring test. The ideal test. *(3 lectures)*

Homomorphisms: Homomorphisms. Kernels and images. Isomorphisms. Quotient rings. The first isomorphism theorem. *(4 lectures)*

Special ideals and quotient rings: Prime ideals and maximal ideals. Principal ideals and principal ideal domains. Integral domains and fields. *(5 lectures)*

Teaching and Assessment

Contact Hours: 3 lectures and 1 tutorial per week
Assessment: up to 15% by class tests or other continuous assessment
at least 85% by end of module 2-hour exam
Resit Type: exam

By the end of the course, students should be able to:

- compute with permutations
- compute using modular addition and multiplication
- understand the notion of binary operation
- carry out simple deductions using axioms for binary operations
- give standard examples of groups, rings and fields
- construct Cayley tables for small groups
- understand the notion of subgroup
- apply the subgroup test
- understand and apply Lagrange's theorem
- understand the notion of normal subgroup
- be able to determine whether a given subgroup is normal
- understand the notions of homomorphism and isomorphism
- understand the notions of kernel and image of a homomorphism
- prove that the image is a subgroup and the kernel is a normal subgroup
- understand the construction of a quotient group
- apply the first isomorphism theorem
- understand the signficance of Cayley's theorem
- understand the notion of subring and ideal
- apply the subgroup test and the ideal test
- understand the notions of homomorphism and isomorphism of rings
- understand the notions of kernel and image of a homomorphism
- prove that the image is a subring and the kernel is an ideal
- understand the construction of a quotient ring
- apply the first isomorphism theorem
- understand the relevance of prime ideals, maximal ideals and principal ideals
- understand polynomial rings and their use to construct field extensions

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

Course Code	**F27CS**	**Course Title**	**Introduction to Computer Systems**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**Peter King**		

Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem…….	Orkney [ ] Sem……..	Dubai [x] Sem……..	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem….....	Approved Learning Partner [x] Name ……Sem...……..

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)			
3. Excluded Courses			
4. Replacement Courses	**Code:** **Date Of Replacement:**	**5. Degrees for which this is a core course**	Mandatory module for BSc Information Systems, BSc Computer Science , MEng Software Engineering, BSc Computer Systems

6. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐	**7. Available as an Elective?**	**Yes** ☐ **No** ☒

8. Aims

To introduce students to modern computer systems architecture
To give students an appreciation of logical design and data representation

9. Syllabus

- Overview.
- Hardware components - peripherals, memory & CPU.
- Boolean algebra.
- Low-level information representation.
- CPU organisation.
- Introductory assembly language programming.
- Operating system: I/O; interrupts; scheduler; virtual memory; file system.
- Concurrency: processes; threads; synchronisation; shared & distributed memory; distributed & parallel architectures.
- Language processors: compiler; interpreter; assembler; loader.
- Linux shell scripting

Course Code	**F27CS**	**Course Title**	**Introduction to Computer Systems**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**Peter King**		

Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem……	Orkney [ ] Sem……..	Dubai [x] Sem……..	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem….....	Approved Learning Partner [x] Name ……Sem...……..

10. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

- Overview of hardware/software hierarchy in contemporary computer systems;
- Understanding of purpose and function of major system hardware and software components;
- Understanding of information representation in computer systems;
- Ability to write Linux shell scripting

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- To be able to express arguments/problems in propositional and predicate calculus.
- To be able to communicate in using formal notations

11. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Continuous Assessment (Computer Tests)		**100%**	

12. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Electronic Exam	**2 hours**	**3**

13. Date and Version

Date of Proposal	11/3/2011	**Date of Approval by School Committee**	March 2011	**Date of Implementation**	September 2011	**Version Number**	V2

Form C4 Heriot-Watt University - Course Descriptor Template

Course Code	**F27SB**	**Course Title**	**Software Development 2**			**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**					**Course Co-ordinator**		**G Michaelson/V Rieser**	
Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem……..	Orkney [ ] Sem……..	Dubai [x] Sem 2.	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem……..		Approved Learning Partner [x] Name …CTI Sem…Block 2 (Sem 1)……..	

1. Pre-requisites	None			
2. Linked Courses (specify if synoptic)	F27SA Software Development 1			
3. Excluded Courses				
4. Replacement Courses	**Code:** **Date Of Replacement:**	**5. Degrees for which this is a core course**	Mandatory module for BSc Information Systems, BSc Computer Science, MEng Software Engineering, BSc Computer Systems	
6. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐	**7. Available as an Elective?** **Yes** ☐ **No** ☒

8. Aims

To impart further techniques of object orientation
To introduce simple data structures and algorithms

9. Syllabus

- Inheritance and Generics: hierarchies, subclasses, polymorphism, static and dynamic type, overriding, dynamic method lookup.
- Designing classes: coupling, cohesion, abstraction, modularisation, types
- Abstract classes, abstract methods, interfaces
- State machines & state diagrams GUIs: components, layout, event handling
- Error-handling: defensive programming, exceptions, assertions, JUnit tests (?)
- Collection classes

Form C4 Heriot-Watt University - Course Descriptor Template

Course Code	**F27SB**	**Course Title**	**Software Development 2**			**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**					**Course Co-ordinator**	**G Michaelson/V Rieser**		
Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem……..	Orkney [ ] Sem……..	Dubai [x] Sem 2.	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem……..		Approved Learning Partner [x] Name …CTI Sem…Block 2 (Sem 1)……..	

10. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

- Understanding and application/ mastery of the object-oriented paradigm
- Understanding of inheritance and generics.
- Understand how to produce well designed, i.e. extendable and maintainable, code.
- Ability to critically evaluate and improve the quality of code.
- Ability to develop simple state diagrams
- Ability to design and implement simple graphic user interfaces

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- Possession of fundamental skills in computer science, applicable throughout the remainder of the degree
- Understand challenges in developing , designing and maintaining code.
- Understanding of the importance of regular working habits (pdp)
- Understanding of the use of chatboards and other devices to learn from and instruct others in the class (pdp)
- Ability to compare and evaluate the applicability of simple data structures and code design choices to relevant problems (pdp)

11. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Laboratories		**50%**	
Examination (electronic)	**2 hours**	**50%**	

12. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Examination	**2 hours**	**3**

13. Date and Version

Date of Proposal	October 2012	**Date of Approval by School Committee**	October 2012	**Date of Implementation**	September 2012	**Version Number**	V2

Form C4 **Heriot-Watt University - Course Descriptor Template**

Course Code	**F27SG**	**Course Title**	**Software Development 3**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**P Vargas/G Grov**		
Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem……..	Orkney [ ] Sem……..	Dubai [x] Sem 2…….	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem……..	Approved Learning Partner [x] Name …CTI…Sem1/Block2…(Jan start)……..

1. Pre-requisites				
2. Linked Courses (specify if synoptic)				
3. Excluded Courses				
4. Replacement Courses	**Code:** **Date Of Replacement:**	**5. Degrees for which this is a core course**	Mandatory course for BSc Computer Science & MEng Software Engineering. Mandatory course for BSc Computer Systems	
6. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐	**7. Available as an Elective?** **Yes** ☐ **No** ☒

8. Aims

To develop further skills and techniques in programming in a high-level language.

9. Syllabus

- static structures – tables
- linear techniques e.g. search, delete, update
- string & text processing
- dynamic structures - stacks & queues
- recursive techniques – linear recursion, accumulation recursion
- sorting & searching e.g. binary search, quicksort, merge sort, hash tables
- linked structures – lists – construction, traversal, delete, update
- linked structures – trees – construction, traversal, delete, update, balance
- file processing
- introductory complexity & “big O” notation

Form C4 **Heriot-Watt University - Course Descriptor Template**

Course Code	**F27SG**	**Course Title**	**Software Development 3**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**P Vargas/G Grov**		

Delivery: Location & Semester	Edin [x]	SBC [ ]	Orkney [ ]	Dubai [x]	IDL [ ]	Collaborative Partner [ ]	Approved Learning Partner [x]
	Sem 2..	Sem……..	Sem……..	Sem 2……..	Sem….	Name……..Sem……..	Name …CTI…Sem1/Block2…(Jan start)……..

10. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** ♦ To understand properties of and algorithms for fundamental static, dynamic and linked data structures ♦ To know when to deploy fundamental data structures and algorithms in practical problem solving ♦ To gain mastery of fundamental linear and recursive programming techniques ♦ To know when to deploy linear and recursive programming techniques in practical problem solving ♦ To understand fundamental techniques for processing very large data sets from files ♦ To gain skill in elementary analyses of fundamental algorithms and data structures to give insight into their time and space complexity bounds ♦ To understand correspondences between different programming techniques ♦ To understand correspondences between different data structures and algorithms
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** ♦ To understand how the choice of algorithms and data structures determines the efficacy of proposed solutions to problems ♦ To be able to explain the implications of choosing particular algorithms and data structures for the time and space behaviour of solutions

11. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Coursework		**50%**	
Exam (electronic)	**2 hours**	**50%**	

12. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	**2 hours**	**3**

13. Date and Version

Date of Proposal	October 2012	**Date of Approval by School Committee**	October 2012	**Date of Implementation**	September 2012	**Version Number**	V2

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

1. Course Code	**F28DA**	**2. Course Title**	**Data Structures & Algorithms**				**3. SCQF Level**	**8**	**4. Credits**	**15**
5. School	**Mathematical & Computer Sciences**						**6. Course Co-ordinator**	**L Georgieva**		
7. Delivery: Location & Semester	Edin ☒ Sem.1.	SBC ☐ Sem…….	Orkney ☐ Sem……..	Dubai ☒ Sem…1…..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem….....		Approved Learning Partner ☐ Name ……Sem……..		
8. Pre-requisites	F27SB Software Development 2 & F27SG Software Development 3									
9. Linked Courses (specify if synoptic)										
10. Excluded Courses										
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**		Mandatory course for BSc Computer Science, MEng Software Engineering & BSc Computer Systems				
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐				**14. Available as an Elective?**	**Yes** ☐ **No** ☒		

15. Aims

To introduce core algorithms and data structures used in a wide range of applications in Computer Science
To further develop skills in algorithm and data structure design, and the development of medium sized programs

16. Syllabus

- Algorithm and data structure topics including: advanced trees, string processing, graphs, hash tables
- Algorithm/data structure choice, design and deployment

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

- Ability to analyse and hence choose suitable algorithms and data structures for a given problem
- To design and implement medium sized programs based on a range of standard algorithms and data structures and making appropriate use of libraries
- Understanding the distinction between abstract Algebraic Data Type (ADT) properties and concrete ADT realisations
- Appreciation of need for integration of multiple ADTs in substantial programs
- Appreciation of efficiencies/reassurances from ADT reuse

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- To be able to critically analyse and hence choose suitable algorithms and data structures for a given problem
- To be able to convey the advantages and disadvantages of alternative data structures and algorithms
- To develop practical problem-solving skills in the context of programming
- To be able to plan & execute a substantial software project

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Exam	**2 hours**	**60%**	
Coursework		**40%**	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam		**3**

20. Date and Version

Date of Proposal	April 2013	**Date of Approval by School Committee**	April 2013	**Date of Implementation**	September 2013	**Version Number**	2

Form C4 **Heriot-Watt University - Course Descriptor Template**

1. Course Code	**F28PL**	**2. Course Title**	**Programming Languages**			**3. SCQF Level**	**8**	**4. Credits**	**15**
5. School	**Mathematical & Computer Sciences**					**6. Course Co-ordinator**		**Greg Michaelson**	
7. Delivery: Location & Semester	Edin ☒ Sem 1	SBC ☐ Sem…….	Orkney ☐ Sem……..	Dubai ☒ Sem…1…..	IDL ☐ Sem….	Collaborative Partner ☐ Name……..Sem..…...		Approved Learning Partner ☐ Name ……Sem……..	
8. Pre-requisites	Software Development 3 (F27SG), Introduction to Computer Systems (F27CS), Logic & Proof (F17LP) *or equivalent*								
9. Linked Courses (specify if synoptic)									
10. Excluded Courses									
11. Replacement Courses	**Code:** **Date Of Replacement:**			**12. Degrees for which this is a core course**		**BSc Computer Science, BSc Computer Systems, MEng Software Engineering**			
13. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐			**14. Available as an Elective?**		**Yes** ☐ **No** ☒	

15. Aims

To gain understanding of different language paradigms
To gain understanding of defining concepts of programming languages
To develop skills in programming in languages from key paradigms

16. Syllabus

- Overviews of language history, definition (lexicon, syntax, semantics), implementation (compiler, interpreter, virtual machine)
- Overviews of language paradigms: e.g. imperative (high-level, system, low-level), declarative (functional, logic), concurrency/parallelism
- Overviews of programming language concepts: variable, lvalue & rvalue, assignment (sharing/copying), data abstraction (sequential, structured, recursive, shared/distributed), type mechanisms (weak/strong, static/dynamic, ad-hoc/parametric polymorphism), declaration (scope, extent), control abstraction (sequence, choice, repetition, block, procedure, labels/jumps, exceptions, processes) , expression abstraction (functions), parameter mechanisms (value, reference) , evaluation mechanisms (strict/lazy, ordered/unordered, concurrent)
- An introduction to programming in languages from key paradigms e.g.
    - imperative/system: C
    - imperative/low-level: assembler
    - declarative/functional: SML
    - declarative/logic: Prolog

17. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** • understanding of distinguishing characteristics of language paradigms • understanding of relationships between languages • understanding of generic language concepts • ability to program in languages from key paradigms • ability to use tool sets for these languages
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** • understanding of how to choose an appropriate language for different problem domains

18. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Exam	**2 hours**	**60**	
Coursework		**40**	

19. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	**2hrs**	**Resit**

20. Date and Version

Date of Proposal	3/2/12	**Date of Approval by School Committee**	March 2012	**Date of Implementation**	September 2012	**Version Number**	2.0

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)**

Module Title	**Critical Thinking**	**School**	**Mathematics and Computer Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Judy Robertson/Fairouz Kamareddine**	**SCQF Level**	**9**	**Module Code**	**F29CT**	**Semester**	**1**	**Credits**	**15**

1. Pre-requisites	None		
2. Linked Modules (specify if synoptic)			
3. Excluded Modules	None		
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☐ **No** ☑
6. Degrees for which this is a core module	Mandatory module for BSc Information Systems		

7. Aims

- The module aims to give students the opportunity to develop general thinking skills which will be useful to them throughout their studies and future lives.
-
- They will gain knowledge and experience of:

- *Critical thinking* including assessing credibility of evidence, assessing and developing arguments, resolving dilemmas and critical reasoning.
- *Cognitive strategies and meta-cognitive skills* including the capacity to evaluate and switch thinking strategies when appropriate.

8. Syllabus

Logical fallacies, critical thinking case studies drawn from topical media reports, effective strategies for problem solving, cognitive tools, flaws in human reasoning, experimental design, descriptive and inferential statistics.
Use of solution techniques from other disciplines in problem solving.
Reporting and explaining solutions using a wide range of formats and notations, including textual, graphical and symbolic forms.

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)**

Module Title	**Critical Thinking**	**School**	**Mathematics and Computer Sciences**					**On or Off-Campus**	**On**
Module Co-ordinator	**Judy Robertson/Fairouz Kamareddine**	**SCQF Level**	**9**	**Module Code**	**F29CT**	**Semester**	**1**	**Credits**	**15**

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** Students will develop skills in the following areas: ♦ Critically analysing arguments in written or verbal form. ♦ Monitoring and evaluating the effectiveness of their thought processes and problem solving techniques ♦ Evaluating statistical and experimental methodologies ♦ Communicating ideas and solutions to others, including those from other disciplines.
Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Students will develop skills in the following areas: ♦ Analyse and interpret numerical and graphical as evidence for an argument ♦ Communicate critical thinking effectively to non-expert audiences. ♦ Exercise autonomy and initiative by planning and managing their own work (PDP); ♦ Take responsibility for their own and other's work by contributing effectively and conscientiously to the work of a group (PDP).

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Exam	**2 hours**	**50%**	
Coursework		**50%**	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Exam	**2 hours**

12. Date and Version

Date of Proposal	24/9/12	**Date of Approval by School Committee**		**Date of Implementation**	September 2013	**Version Number**	2

Form C4 **Heriot-Watt University - Course Descriptor Template** Version 4.0 (2010/2011)

Course Code	**F29OC**	**Course Title**	**Operating Systems & Concurrency**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**Sven Bodo Scholz**		

Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem…….	Orkney [ ] Sem……..	Dubai [x] Sem……..	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem….....	Approved Learning Partner [x] Name …CTI……..Sem...1 & 2……..

1. Pre-requisites	None		
2. Linked Courses (specify if synoptic)			
3. Excluded Courses			
4. Replacement Courses	**Code:** **Date Of Replacement:**	**5. Degrees for which this is a core course**	Mandatory module for BSc Computer Science , MEng Software Engineering, BSc Computer Systems

6. The course may be delivered to:	**UG only** ☒	**PG only** ☐	**UG & PG** ☐	**7. Available as an Elective?**	**Yes** ☐ **No** ☒

8. Aims

***For the Operating system part*: To provide an introduction to operating systems, their basic principles and shell programming.**
***For the Concurrency part*: To introduce the theory and practice of concurrent hardware and software systems**

9. Syllabus

For the Operating system part: overview on operating systems concepts and structures, processes, threads, classical inter-process communication problems, memory management

For the Concurrency part: Concurrency, Parallelism, Pthreads. Parallelism Pattern: Pipelining, Data-Parallelism, Nested Data-Parallelism, Flattening, Task-Parallelism, Data-Flow.

Course Code	**F29OC**	**Course Title**	**Operating Systems & Concurrency**	**SCQF Level**	**7**	**Credits**	**15**
School	**Mathematical and Computer Sciences**			**Course Co-ordinator**	**Sven Bodo Scholz**		

Delivery: Location & Semester	Edin [x] Sem 2..	SBC [ ] Sem…….	Orkney [ ] Sem……..	Dubai [x] Sem……..	IDL [ ] Sem….	Collaborative Partner [ ] Name……..Sem….....	Approved Learning Partner [x] Name …CTI……..…Sem...1 & 2……..

10. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery

Understanding, Knowledge and Cognitive Skills ***Scholarship, Enquiry and Research (Research-Informed Learning)***

For the Operating systems part:

- Understanding of the concepts and structures present in modern operating systems.

For the Concurrency part:

- Broad and integrated knowledge and understanding of concurrency concepts, techniques and problems
- Critical understanding of predominant concurrency pattern and their implementation on modern architectures
- Hands-on experience

Personal Abilities

Industrial, Commercial & Professional Practice ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT***

- Critically evaluate the problematic and concepts related to operating systems.
- Analysis of the different possible solutions to leveraging concurrency for parallel execution.

11. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic courses?
Exam	**2hours**	**60%**	
Assessed Coursework		**40%**	

12. Re-assessment Methods

Method	Duration of Exam (if applicable)	Diet(s)
Exam	**2 hours**	**3**

13. Date and Version

Date of Proposal	28/11/2012	**Date of Approval by School Committee**	January 2013	**Date of Implementation**	January 2013	**Version Number**	V1

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	**Photonics and Quantum Mechanics**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**8**	**Module Code**	**B28PQ**	**Semester**	**1**	**Credits**	**15**

1. Pre-requisites	B27MW and B27FF or equivalent		
2. Linked Modules (specify if synoptic)			
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☐ **No** X

6. Degrees for which this is a core module

B211-PHY	BSc Physics
B2C1-COM	BSc Computational Physics
B281-ENV	BSc Physics with Environmental Science
B261-ENG	BSc Engineering Physics
B2B1-PHO	BSc Photonics and Lasers
B2PE-PRO	BSc Physics with Professional Education
B271-EDU	BSc Physics with Education
B2N1-NAN	BSc Nanoscience
B2M1-MAT	BSc Mathematical Physics
B2G1-ENE	BSc Energy Science and Technology
B2PS-SCI	BSc Physical Science
B21M-PHY	MPhys Physics
B23M-COM	MPhys Computational Physics
B26M-ENG	MPhys Engineering Physics
B2BM-PHO	MPhys Photonics and Lasers
B2NM-NAN	MPhys Nanoscience
B2MM-MAT	MPhys Mathematical Physics
B2GM-ENE	MPhys Energy Science and Technology
B2FM-SCI	MPhys Physical Science
B2DM-OPT	MPhys Optoelectronics and Lasers

7. Aims

To give a grounding in quantum mechanics and particle physics
To demonstrate the importance of quantum mechanics in photonics and hence in the everyday world via applications of photonics
To provide an understanding of wave optics, including interference, coherence, diffraction
To provide an understanding of the physics behind the 3 major photonics elements: lasers; semiconductor devices; optical fibres.
To give a grounding in the technology of photonics and its applications

Module Title	**Photonics and Quantum Mechanics**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**8**	**Module Code**	**B28PQ**	**Semester**	**1**	**Credits**	**15**

8. Syllabus

Quantum mechanics
Comparison of classical theory (Rayleigh Jeans) and quantum theory (Planck)
Photoelectric effect
Bohr theory of the atom
De Broglie principle and wave-particle duality
Heisenberg uncertainty principle
Wavepackets and wavefunctions
Production and properties of x-rays
Line spectra of atoms
Compton scattering
Electron diffraction

Photonics
Waves: wave equation; spherical, plane waves; superposition
Interference: double & multiple beam interference; interferometers (Michelson, Mach-Zehnder, Fabry-Perot); coherence
Diffraction: Fraunhofer diffraction; diffraction gratings and resolving power
Lasers: principles of operation (stimulated emission, resonators, population inversion and how to achieve it); properties of laser light
Fibre optics: principles of optical waveguides (including fibre optics) - total internal reflection, modes; applications of fibre optics
Semiconductors: basic semiconductor theory & applications in photonics as light sources (LEDs, lasers) and detectors
Applications of photonics: a number of applications will be explored, such as: optical data storage; laser ranging; laser processing of materials (welding, drilling, cutting, etc; optical telecommunications.

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)*** Understanding of the need for the quantum mechanical model of physics, and in particular to light-matter interaction and its significance with everyday modern technology Understanding of light as a wave and the relevance of this to optical effects such as interference and diffraction, and hence to lasers and optical fibres Understanding of basic semiconductor theory, in particular the concept of bandgaps; conduction; pn junctions Students should be able to use mathematical methods to predict optical and quantum mechanical effects with e.g. light-matter interaction, interference, fibre optics, lasers, semiconductors

Module Title	**Photonics and Quantum Mechanics**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**8**	**Module Code**	**B28PQ**	**Semester**	**1**	**Credits**	**15**

Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Students should develop abilities to: Critically evaluate a problem; Plan and organise their work; Review and evaluate academic materials; Express and interpret physical data graphically; Solve problems mathematically. Take an interest in current developments in, and applications of, physics; Make critical and evaluative comment; Understand that physics is a changing subject; Think independently about the subject. Make effective use of online learning support materials; Make effective use of the support of academic and tutorial support staff; Organise their study time in a way that allows them to meet coursework submission deadlines and prepare effectively for assessments

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Exam	**2 hours**	**70%**	**no**
Coursework		**30%**	**no**

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Exam (100%)	**2 hours**

12. Date and Version

Date of Proposal	11/12/07	**Date of Approval by School Committee**		**Date of Implementation**		**Version Number**	

Form 20 **Heriot-Watt University - Module Descriptor Template (RAY)** Version 3.0 (2007/2008)

Module Title	**Quantum theory and Spectroscopy**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**9**	**Module Code**	**B29QS**	**Semester**	**2**	**Credits**	**10**

1. Pre-requisites	B88AO and B88AP or equivalent		
2. Linked Modules (specify if synoptic)			
3. Excluded Modules			
4. Replacement Module	**Code:** **Date Of Replacement:**	**5. Availability as an Elective**	**Yes** ☐ **No** ☒
6. Degrees for which this is a core module			

7. Aims

This module aims to provide a fundamental course in the basic physics, concepts and techniques of quantum mechanics and spectroscopy.

8. Syllabus

Quantum Theory:

Wave vs. particle properties
Schrödinger equation
Free and confined particles
Expectation values and observables
Double slit experiment and interpretation of quantum mechanics
Tunnelling
The harmonic oscillator
The rigid rotor and angular momentum
The hydrogen atom.
Entanglement
The formalism of quantum mechanics: state vectors, Hilbert space and the density matrix.
Quantum information processing: the two-level system and the qubit.

Module Title	**Quantum theory and Spectroscopy**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**9**	**Module Code**	**B29QS**	**Semester**	**2**	**Credits**	**10**

Spectroscopy:

Common spectroscopic units of energy & notation
Multi-electron atoms
Angular momentum coupling
Selection rules
Atomic spectroscopy
Timescales of atomic and molecular motion
Rotational & vibrational spectroscopy of molecules
Linear combinations of atomic orbitals & chemical bonding
Introduction to molecular electronic spectroscopy
Factors influencing spectral lines shapes & intensities

9. Learning Outcomes (HWU Core Skills: Employability and Professional Career Readiness)

Subject Mastery	***Understanding, Knowledge and Cognitive Skills*** ***Scholarship, Enquiry and Research (Research-Informed Learning)***

- Appreciation of wave properties of particles and particle properties of waves.
- Application of the Schrödinger equation to free and confined particles
- Calculation of expectation values for observables
- Appreciation of the Double slit experiment and interpretation of quantum mechanics.
- Quantitative understanding of tunnelling and barrier penetration.
- Familiarity with the harmonic oscillator
- Basic knowledge of angular momentum in quantum mechanics.
- Ability to reproduce elementary treatment of the Hydrogen atom.
- To understand the concept of state vectors and to be able to relate this to qubits.
- Ability to extract structural information from atomic and molecular spectra
- Understanding why different types of spectra appear as they do
- Simple understanding of atomic bonding
- Appreciation of spectroscopy as a diagnostic tool
- Appreciation of the timescales of molecular motion
- Understanding of spectroscopic notation

Module Title	**Quantum theory and Spectroscopy**	**School**	**EPS**					**On or Off-Campus**	**on**
Module Co-ordinator	**Physics Teaching Group Convener**	**SCQF Level**	**9**	**Module Code**	**B29QS**	**Semester**	**2**	**Credits**	**10**

Personal Abilities	***Industrial, Commercial & Professional Practice*** ***Autonomy, Accountability & Working with Others*** ***Communication, Numeracy & ICT*** Personal abilities are embedded in the module. The module provides the opportunity to : • Apply the advanced core knowledge expected of a professional physicist to gain professional level insights, • Communicate effectively with professional level colleagues • Interpret, use and evaluate critically a wide range of data to solve problems of both a familiar and unfamiliar nature • Manage time effectively, work to deadlines and prioritise workloads • Use a range of ICT skills with on-line materials and web links to support the learning process • Apply strategies for appropriate selection of relevant information from a wide source and large body of knowledge • Exercise significant initiative and independence in carrying out learning activities and researching information

10. Assessment Methods

Method	Duration of Exam (if applicable)	Weighting (%)	Synoptic modules?
Examination	**3 hours**	**70**	
Course work		**30**	

11. Re-assessment Methods

Method	Duration of Exam (if applicable)
Examination	**3 hours**

12. Date and Version

Date of Proposal	19/04/08	**Date of Approval by School Committee**		**Date of Implementation**		**Version Number**	2

Form P6 Heriot-Watt University – Undergraduate Programme Structure Template

Version 4.0 (2010/2011)

1. Programme Code(s) (*recruitment & exit awards)*	2. Programme Titles for all awards *(unabbreviated)*	3. Main Award(s) *(to be recruited to)*	4. Exit Awards *(for graduation only)*
A191-BIS	Biological Sciences	BSc (Hons)	BSc Ordinary

5. Type	6. Programme Accredited by	7. UCAS Code	8. School	9. QAA Subject Benchmarking Group(s)	10. Date of Production/ Revision
Specialist School Degree		C120	Life Sciences	Biosciences	April 2014

11. Stage Composition	12. Arrangement of Courses: (Themes and Subject Streams)						13. Awards, Credits & Levels
	Mandatory Courses		Optional Courses		Elective Courses		
	Semester 1	Semester 2	Semester 1	Semester 2	Semester 1	Semester 2	
Stage 1	**8 courses: 8 mandatory** A17IB Introductory Biology 1 A57IU Information and Communication Skills in Life Sciences F17SG Mathematics for Scientists 1 A47NY Introduction to Psychology 1	A17IO Introductory Biology 2 A17BP Biology Practical A17EB Environmental Biology B17LS Chemistry for Life Sciences					**Certificate of Higher Education** Requires 120 SCQF credits
Stage 2	**8 courses: 4 mandatory 4 optional** A18HM Metabolism in Human Nutrition A18RB Research Methods in Biology	A18MC Cell and Molecular Biology A18IM Introduction to Microbiology	A18HA Human Systemic Physiology and Anatomy A18XP Science and Exploitation of Plants C17EB Management in a Global Context	A18NB Animal Biology A18BC The Biosphere A48SY Social Psychology C17EC Enterprise and its Business Environment B17LS Chemistry for Life Sciences			**Diploma of Higher Education** Requires 240 SCQF credits

Form P6 Heriot-Watt University – Undergraduate Programme Structure Template

Version 4.0 (2010/2011)

1. Programme Code(s) (*recruitment & exit awards)*	2. Programme Titles for all awards *(unabbreviated)*	3. Main Award(s) *(to be recruited to)*	4. Exit Awards *(for graduation only)*
A191-BIS	Biological Sciences	BSc (Hons)	BSc Ordinary

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Specialist School Degree		C120	Life Sciences	Biosciences	April 2014

11. Stage Composition	12. Arrangement of Courses: (Themes and Subject Streams)						13. Awards, Credits & Levels
	Mandatory Courses		Optional Courses		Elective Courses		
Stage 3	**8 courses:** **1 mandatory** **7 optional**		A19RS Research Studies in Biology	A19HU Pathobiology of Human Disease A19MO Molecular Biology A19MY Microbial Physiology A19TG Introduction to Process Technology A19AS Applied Systems Human Physiology A19VB Marine Biodiversity A19SM Practical Marine Biology C18FM Fundamentals of Marketing	A19ML Medical Microbiology A19BT Biotechnology A19ME Marine Environmental Biology A19CV Cardiovascular Regulation in Humans C18OP Operations Management			**Ordinary or General Degree** Requires 360 SCQF credits

Form P6 Heriot-Watt University – Undergraduate Programme Structure Template

Version 4.0 (2010/2011)

1. Programme Code(s) (*recruitment & exit awards)*	2. Programme Titles for all awards *(unabbreviated)*	3. Main Award(s) *(to be recruited to)*	4. Exit Awards *(for graduation only)*
A191-BIS	Biological Sciences	BSc (Hons)	BSc Ordinary

5. Type	6. Programme Accredited by	7. UCAS Code	8. School	9. QAA Subject Benchmarking Group(s)	10. Date of Production/ Revision
Specialist School Degree		C120	Life Sciences	Biosciences	April 2014

11. Stage Composition	12. Arrangement of Courses: (Themes and Subject Streams)						13. Awards, Credits & Levels
	Mandatory Courses		Optional Courses		Elective Courses		
Stage 4	**8 courses:** **8 mandatory**	A10LA Advanced Biological Sciences 1 A10LB Advanced Biological Sciences 2 A10QA Qualitative and Quantitative Analytical Skills 1 A10PE Honours Research Project - Execution	A10LC Advanced Biological Sciences 3 A10LD Advanced Biological Sciences 4 A10QB Qualitative and Quantitative Analytical Skills 2 A10PI Honours Research Project -Dissemination				**Honours Degree** Requires 480 SCQF credits

The accompanying Programme Notes provide details of stage notes, progression requirements and award requirements for the programme.
The accompanying Programme Description provides details of aims, outcomes, teaching & learning and assessment policies for the programme.

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- ALP Students
- MACS Undergraduate Handbook
- MACS Postgraduate Handbook
- MACS Postgraduate Research
- Forms

Staff Information

Timetables & Programme Structures

Support Services

School of Mathematical and Computer Sciences

F78PA Probability and Statistics A

Lecturer: Dr. Jennie Hansen

Aims
The aims of this course are

- To develop the tools of probability theory with a view to applications in statistical inference and actuarial science
- To provide an introduction to computer simulation in R and its applictions to probability and statistics.

Summary
In this course we develop probability models for random phenomena. In particular, we develop the methodology needed for the study of random variables and their distributions. Random variables are essential to the modelling of most random phenomena, and have applications in statistical science, financial mathematics, and actuarial science. Common discrete and continuous random variables (Bernoulli, binomial, geometric, hypergeometric, Poisson, uniform, normal, exponential, gamma) which are frequently used for modelling are introduced and their properties investigated. We also introduce multivariate distributions, conditional distributions, and criteria for independence of random variables. We study sums of independent random variables, and introduce the weak law of large numbers and the central limit theorem.

We will use computer simulation as an aid to understanding the behaviour of probabilistic and statistical models, and to doing calculations for these models.

Reading
Some recommended textbooks are:

- D. Stirzaker (1999), *Probability and Random Variables: a beginner's guide*, Cambridge University Press.
- G. Grimmett & D. Welsh (1990), *Probability: an Introduction*, Oxford University Press.
- S. M. Ross (2006), *A First Course in Probability*, 7th edition, Pearson.

Assessment

2 hour end-of-course examination	(85% weight)
continuous assessment	(15% weight)

Help
If you have any problems or questions regarding the course, you are encouraged to contact the lecturer.
Course web page
Further information and course materials will be available on Vision
Detailed syllabus

- *Probability models*: sample spaces, events, probability measures, axioms and properties
- *Random variables and their distributions*: distribution, probability and density functions, transformations of random variables
- *Expectation, variance, and standard deviation of random variables*
- *Important special distributions and their main properties*: Bernoulli, Binomial, Geometric, Hypergeometric, Poisson, Uniform, Normal, Exponential, Gamma
- *Conditional probability and independence*: including chain rule, partition rule, Bayes' Theorem
- *Joint probability, density and distribution functions*
- *Marginal and conditional distributions*
- *Independent random variables* and sums of independent random variables
- *Generating functions* and their applications
- *Markov and Chebychev inequalities, the weak law of large numbers, and the Central Limit Theorem*, with applications to statistics
- *Expectation of a function of random variables, covariance, correlation*
- *Conditional expectation* and its uses
- *Computer simulation* and its applications in probability and statistics

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Support Services

School of Mathematical and Computer Sciences

F78PB Probability and Statistics B

Lecturer: John Phillips

Aims
To reinforce basic ideas related to the description and analysis of data, and provide the basis for the application of statistical modelling, estimation, hypothesis testing and regression.

Summary
This course follows on from Probability and Statistics A. It develops the basic ideas used in statistical analysis and inference, with an emphasis on how we learn from data using both graphical techniques and statistical methodology based on probability theory. Topics presented include: analysis of simple data; construction of statistical models; sampling distributions and properties of estimators; method of moments and introduction to maximum likelihood estimation; inference for data from one population; comparisons of data from two populations; confidence intervals with samples from one or two populations; hypothesis testing; issues related to association between two variables; linear regression; statistical computing.

Learning outcomes
After studying this course, students should be able to:

- Understand, interpret and describe data using appropriate numerical and graphical summaries
- Understand issues related to data collection, model construction and model choice
- Calculate point estimates using the method of moments
- Understand the concept of maximum likelihood estimation and derive maximum likelihood estimates in various applications
- Compare data from two populations
- Construct, calculate and interpret confidence intervals for parameters of interest in one or two populations
- Understand and interpret the concepts of null hypothesis, alternative hypothesis, critical region, level of significance and P-values
- Perform hypothesis tests for population parameters
- Investigate associations between two variables
- Perform linear regression analysis and interpret findings meaningfully
- Demonstrate results related to sampling distributions, the central limit theorem and confidence intervals using simulation

Reading
J.E. Freund's mathematical statistics, by I. Miller and M. Miller, 6th ed., Prentice-Hall, 1999.

Assessment
Two-hour written examination (80%); continuous assessment (20%)

Feedback
Feedback on submitted and assessed work will be provided at tutorial classes. Students can also obtain feedback from the lecturer during office hours.

Help
If you have any problems or questions regarding the course, you are encouraged to contact the lecturer.

Course web page
Further information and course materials will be available on Vision

Detailed syllabus

- Analysis of simple data (single variable distributions)
- Construction of statistical models
- Sampling distributions, some properties of estimators
- Introduction to the method of moments and maximum likelihood
- Statistical inference for data from one population
- Comparisons of data from two populations
- Confidence intervals with samples from one or two populations
- Hypothesis Testing: introduction, terminology and test statistics for typical situations
- Issues related to association between two variables: graphical techniques, correlation and contingency tables
- Linear regression
- Statistical computing

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School of Mathematical and Computer Sciences

F79MA Statistical Models A

Lecturers: Fraser Daly and Gavin Gibson

Aims
To describe and compare the main approaches to statistical inference: including classical and Bayesian, and to develop students' skills in practical, computer- based estimation and inference. This module also aims to develop students' independent research skills, and their report writing skills.

Summary
This module will consist of a mixture of lectures, tutorials, computer practicals and project work. First and second year courses have discussed how to draw conclusions from data, and introduced some basic methods in an informal way. In this course we take a more fundamental approach to estimation and quantifying the accuracy of estimates.

In lectures we introduce the principles of classical and Bayesian inference discussing their different philosophical bases, and comparing the different solutions that each method gives to various problems of inference. The properties and fundamental importance of the likelihood are described, along with some important results on the sampling properties of estimators. The course will emphasise worked examples and there will be a project based on the computer implementation of the theory taught in lectures and tutorials. This project will require students to apply statistical methods covered in the lectures, to implement these methods using the **R**programming language and to present their results.

Learning outcomes
After studying this module, students should be able to:

- understand the main approaches to statistical inference and the relations between them, and to apply appropriate statistical methods in a practical application.

Reading

- Garthwaite, PH, Jolliffe, IT, and Jones, B (2002) *Statistical Inference (2nd ed.)*, Oxford UP.
  [A good reference for the course, though - like all the following books - it goes well beyond what we will cover.]
- Pawitan, Y (2001) *In all likelihood*, Oxford UP.
  [A possible alternative to Garthwaite et al.]
- Barnett, V (1982) *Comparative Statistical Inference* (2nd Edn), Wiley.
  [A good general reference.]
- Berger, JO (1985) *Statistical Decision Theory and Bayesian Analysis*, Springer.
  [Difficult reading, but comprehensive.]
- Casella, G & Berger RL (1990) *Statistical Inference*, Duxbury Press.
  [Very comprehensive particularly on classical methods.]

Assessment
There is a 2-hour exam on the lecture material in December (60%) and one project (40%).

The module is synoptically linked with F79MB Statistical Models B.

Help
If you have any problems or questions regarding the module, you are encouraged to contact Fraser Daly or Gavin Gibson .

Module web page
Further information and course materials are available on Vision.

Detailed syllabus

- Introduction
  - Inference and decision-making
  - Background material: distributions and random variables
- Parameter estimation
  - Notation and definitions
  - The method of moments
  - Interval estimation
  - The method of pivots
- Likelihood
  - Definition and example
  - The likelihood principle and sufficiency
  - Point and interval estimation
  - Invariance under transformations

- Classical meets Likelihood: the Cramér-Rao Theorem and after
  - A lower bound for the variance of an unbiased estimator
  - Attaining the Cramér-Rao lower bound
  - Minimum variance unbiased estimators (MVUEs)
  - Classic properties of MLEs
  - Extension to multi-parameter models
- Classical inference in practice
  - Practical sampling problems
  - Case studies
  - Computing exercises
  - Project work and report writing
- Introduction to Bayesian inference
  - Introduction and prior information
  - Prior and posterior distributions
  - Conjugate priors
  - Bayesian estimation
  - Choice of prior distribution
  - Link to decision theory
  - Utility and the loss function
- Hypothesis testing
  - Revision of classical approach - N-P lemma up to GLRT's
  - Bayesian approach to testing

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F79MB Statistical Models B

Lecturer: George Streftaris and Damian Clancy

Aims

This course aims to develop students' abilities in understanding and solving practical statistical problems, and to teach them how to use appropriate models and techniques for analysing data especially in applications related to linear and generalised linear models.

Summary

The course will consist of a mixture of lectures and practical work.

Lectures will focus on statistical modelling, including the selection of appropriate models and the analysis and interpretation of results. Exploratory and graphical techniques will be considered, as well as more formal statistical procedures. Both parametric procedures (e.g. linear and generalised linear models) and nonparametric methods will be discussed, as will modern robust techniques.

There will be considerable emphasis on examples, applications, and case studies, especially for continuous response variables. Computing facilities, especially R, will be used extensively.

Learning outcomes

At the end of the course, students should:

- be able to construct statistical models appropriate to practical problems;
- be able to understand, select and use appropriate graphical and summary techniques for exploratory data analysis;
- understand in detail the issues involved in the modelling of a continuous response variable with one or more explanatory variables, with particular regard to model selection and fitting and diagnostic procedures;
- understand the theory and techniques for the analysis of categorical data;
- choose appropriate techniques, e.g. generalised linear models, to analyse categorical data and present results;
- be able to write clear, concise and well-structured reports involving the application of the above skills to practical data-analytic problems.

Reading

It is highly desirable that students should have good access to the following books:

- Garthwaite, P.H., Jolliffe, I.T. and Jones, B. (2002) *Statistical Inference*, 2nd edn. Prentice Hall.
- Faraway, J. (2005) *Linear models with R*, Chapman & Hall.
- Faraway, J. (2006) *Extending the Linear Model with R :Generalized Linear, Mixed Effects and Nonparametric Regression Models*, Chapman & Hall/CRC.
- Weisberg, S. (2005) *Applied linear regression*, 3rd edn, Wiley/Interscience.

The following texts will be useful for occasional reference:

- Dobson, A.J. (2002) *An Introduction to Generalized Linear Models*, 2nd edn, Chapman & Hall.
- Verzani, J. (2005) *Using R for Introductory Statistics*, Chapman & Hall/CRC.

Assessment

The course is assessed by 2 projects which will be handed in by stated dates.

Help

If you have any problems or questions regarding the course, you are encouraged tocontact the lecturer.

Course web page

Further information and course materials will be available on Vision

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COURSE DETAILS
Course Code: A19CN
Full Course Title: Concepts in Beverage and Food Science
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

- Provide an understanding of selected unit operations and advances in food processing.
- Introduce students to production of selected food commodities.
- Provide students with the ability to understand and modify quality sampling plans and understand how food product development occurs.
- Introduce students to sensory evaluation theory and practise.

LEARNING OUTCOMES – SUBJECT MASTERY

At the end of this course students will be able to:

- Appreciate a number of sub-disciplines in Food Science including processing of various food commodities, advances in food processing, food quality assurance, food product development, and sensory evaluation. Examples from industry will be used to illustrate these topics.
- Recognise new emerging technologies in the food industry
- Know the range of food commodity ingredients available based on plant and dairy raw materials
- Know the effect of processing and storage on chemical properties of food ingredients
- Understand approaches to improve functional properties of food ingredients
- Apply a structured approach to food product development
- Understand basic concepts of food quality assurance
- Understand how and why statistical tools are used to assure quality control
- Understand the principles for measurement of texture and rheology and their significance in food quality control
- Understand basic sensory evaluation methods

LEARNING OUTCOMES – PERSONAL ABILITIES

- Enhance professional practice by acquiring knowledge of food commodity production, the use of food ingredients.
- Enhance professional practice of emerging technologies.
- Enhance professional practice by understanding principles of food quality assurance.
- Attain the ability to design selected statistical methods for food quality monitoring.
- Enhance professional practice by application of structured approach to product development.

SYLLABUS

- Concepts in Beverage and Food Science: Beverage and Food processing: Food quality control and Product development.
- Emerging technologies in the food and beverage industry.
- Physicochemical properties of plant and dairy based ingredients, with emphasis on parameters influencing finished product specifications.
- Enhancing functional properties of ingredients with emphasis on texture and rheology.
- Statistical Quality Assurance: sampling plans, control charts.
- Food and Beverage New Product Development.
- Sensory Evaluation.
- Food and Beverage Thermal Processing

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y									Examination	60	120	Assessment	Semester 1	
Y									Coursework	40		Assessment	Semester 2	
Y									Examination	100	120	Reassessment	Semester 3	

COURSE DETAILS
Course Code: C17EB
Full Course Title: Management in a Global Context
SCQF Level: 7
SCAF Credits: 15
Available as Elective: Yes

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

- To enable students to acquire and develop understanding, knowledge and skills related to business management
- To develop student knowledge and understanding of organisations and to enable students to contextualise this knowledge within the external environment in which the organisations operate (The external environment is defined as 'wide range of factors, including economic, environmental, ethical, legal, political, sociological and technological, together with their effects at local, national and international levels upon the strategy, behaviour and management of organisations'.)
- To address a range of relevant `contemporary and pervasive issues' that inform the interface between the organisation and its external environment.
- To enhance business skills via an understanding of the practical application of theoretical knowledge through assessment and guest speakers (As available).
- To assist the development of skills (particularly critical evaluation of academic research, diagnostic, problem solving, team/group working, communication, written, presentation and IT skills) through the both formative classroom based work and summative assessment

LEARNING OUTCOMES – SUBJECT MASTERY

- The ability to analyse, evaluate, and report on contemporary challenges to organisations and contextualise knowledge according to sector; organisational structure, culture and country.
- The development and application of problem-solving skills to a range of theoretical and practical challenges.

- The ability to apply management frameworks and theoretical concepts to a case study organisation (linking theory to practice).
- The ability to research and select secondary research into management trends both independently and in groups (specifically through the coursework component of the course).
- The ability to critically evaluate and assess empirical and theoretical evidence from management research.

LEARNING OUTCOMES – PERSONAL ABILITIES

- Developing insight into a range of business practice through case study and practitioner talks.

- Transferring theoretical and practical problem-solving skills to a variety of contexts.
- Working independently and as part of a group. Tasks might include tutorial discussion and debate.

- Communicating and presenting ideas effectively by verbal and written means.
- Developing an interest in current developments in business management.
- Knowing how to use a range of online sources of knowledge through both library databases and WWW.

SYLLABUS

This course will look at a range of issues that will shape the enterprise and its interface with the contemporary business environment. The syllabus will be flexible and responsive to changing events, themes and processes. The syllabus will include but is not limited to the following topics:

- What is management?
- The organisation and its political environment (e.g. the role of political stability, etc.)
- The organisation and its economic environment (e.g. economic systems etc)
- The organisation and its social environment and context (e.g. demographics, etc)
- The organisation and its technological environment (e.g. the rise of internet based commerce, innovation, etc)
- The organisation and the natural environment (e.g. issues of sustainability, etc)
- The organisation and its legal environment (e.g. regulations, etc)

COURSE RELATIONSHIPS

Course Code	Level	Title	School	Type
C17EC	7	Enterprise and its Business Environment	School of Mgmt & Languages	Taught Synoptic

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y		Y				Coursework	50		Assessment	Semester 1	
Y			Y		Y				Examination	50	120	Assessment	Semester 1	
							Y		Examination	100	120	Assessment	Semester 1	
Y			Y		Y		Y		Examination	100	120	Reassessment	Semester 3	

COURSE DETAILS
Course Code: C48LE
Full Course Title: Spanish Advanced 1
SCQF Level: 8
SCAF Credits: 15
Available as Elective: Yes

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

Text

- To enable students to achieve a competent standard in the production and presentation of translations and forms of derived text in English, working from source texts in the FL.
- To improve FL reading comprehension in specified topic areas to a level suitable for embarking on translation tasks.
- To introduce the specialist skills of translating by ensuring that (a) students are able to identify and attempt to resolve translating difficulties; (b) students are able to use the appropriate terminology in discussion of translating problems encountered.

Written Composition

- To achieve understanding of basic principles of translation from English into the FL and ability to produce particular text forms in the FL for specific purposes.
- To consolidate students' ability to produce grammatically correct and idiomatic written texts in the FL.
- To improve students' knowledge of procedures for researching source texts and target texts.
- To enable students to produce short FL translations appropriate to specific purposes.
- To foster the acquisition of the skills of summarising and/or report-writing for specific purposes.
- To reinforce students' knowledge and understanding of the contemporary institutions and affairs of the countries where their languages of study are spoken.

Spoken

- To improve students' command of the formal spoken FL to a level adequate for embarking upon a course of university study abroad.
- To foster the ability to perform a number of task-related activities in an appropriate, coherent and communicative fashion including the ability to present information to an audience; the ability to participate actively in discussions, negotiations; decision-making processes.

Skills for Interpreting

Conference

- To improve understanding of a variety of speech forms in FL and to foster the specialist skills of consecutive interpreting.
- To comprehend meaning of the source text.
- To divide attention between tasks.
- To take notes from comprehensible input.
- To use notes effectively to produce accurate speeches in English at an appropriate register.
- To express meaning in formal spoken English
- To develop realistic approaches to preparation (including glossary building).
- To develop confidence in delivery, voice projection, appropriate booth behaviour.

Liaison

- To equip students with the generic skills needed to act as a liaison interpreter between English and the FL
- To familiarise students with the activity of liaison interpreting between English and the FL.
- To consolidate students' comprehension of spoken FL.
- To achieve command of strategies for realisation in FL of the speech acts most common in the liaison interpreting situation.
- To enable students to achieve competence in acting as a liaison interpreter between English and the FL in a restricted range of fields.
- To consolidate the generic skills of the liaison interpreter between English and FL.
- To achieve understanding in FL of ideas relating to the society and institutions of the relevant country/ies.
- Critical awareness of performance as a liaison interpreter in that field.

LEARNING OUTCOMES – SUBJECT MASTERY

- Undertake critical analysis, evaluation and synthesis of ideas, concepts, information, and issues relating to Spanish culture.
- Use a range of routine skills, techniques, practices and materials associated with translating

and interpreting, some of which are advanced or complex.

LEARNING OUTCOMES – PERSONAL ABILITIES

- Deal with professional issues in translating and interpreting in accordance with current practices under guidance.
- Exercise autonomy and initiative.
- Take continuing account of own and others' roles, responsibilities and contributions in carrying out and evaluating translating and interpreting tasks.
- Convey complex information in English and the FL (written and spoken) to a range of audiences and for a range of purposes.

SYLLABUS

Translation

Workshops on techniques of summarising/translation; group and individual presentation of texts prepared for oral summary/translation, including class discussion. Students are given preparation work which they are expected to complete outside class hours.

Written Composition

Workshops involving a variety of activities (translating, correspondence, précis-writing, text analysis) relating to the production of target texts in the FL working from English and/or FL source texts. Students are given preparation work which they are expected to complete outside class hours.

Spoken

Workshops involving a variety of oral activities (argumentation, presentation, discussion) based on business and economy related topics. Students are expected to carry out necessary preparatory research for classes using a variety of written, audio and video sources.

Skills for Interpreting

Conference

Keyword exercises, memory exercises; preparation through video and/or written texts; consecutive interpreting exercises and analysis of performance. Recorded material is provided for class preparation and follow-up which students are expected to work on outside class.

Liaison

Introductory exercises on standard speech acts (statements and enquiries of fact; statements and enquiries of opinion; introductions and leave-taking; politeness; cultural mediation). Recorded material is provided for class preparation and follow-up which students are expected to work on outside class.

Work devoted to investigation and development of lexis in the relevant topic fields (media; education; social welfare and services; industrial relations; government and legal system; political parties; regionalism and the European dimension) will help prepare students for workshops based on simulated dialogues making use of the lexis acquired. Additional recorded material is provided which students are expected to work on outside class hours.

COURSE RELATIONSHIPS

Course Code	Level	Title	School	Type
C47ME	7	Spanish Intermediate 2	School of Mgmt & Languages	Linked
C48LF	8	French Advanced 1	School of Mgmt & Languages	Pre-Requisite

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y									Coursework	100		Assessment	Semester 1	C48ME
Y									Examination	100		Reassessment	Semester 3	

COURSE DETAILS
Course Code: C98CO
Full Course Title: Cognitive Psychology 1
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

To provide students with an understanding of the key empirical findings and theoretical developments in cognitive psychology.

LEARNING OUTCOMES – SUBJECT MASTERY

This course will provide students with the opportunity to gain an in depth knowledge of the empirical findings in cognitive psychology and an understanding of the major theoretical developments together with and appreciation of the relation between theory and empirical evidence within scientific enquiry in general and cognitive psychology in particular. Students have the opportunity to complete formative coursework.

LEARNING OUTCOMES – PERSONAL ABILITIES

The use of exam and a lab report for assessment self-evidently helps to develop autonomy, accountability, working with others, together with communication skills, numeracy, and IT skills. As with others on the curriculum, this course forms part of the BPS core curriculum.

SYLLABUS

- Attention. Visual and spatial imagery
- Knowledge Representation and Conceptual Knowledge
- Learning. Skill acquisition and expertise.

- Memory: encoding and retrieval processes, working, autobiographical, episodic and semantic memory, implicit and explicit memory, memory improvement.
- Thinking and reasoning, problem solving, decision-making.
- Connectionist models

COURSE RELATIONSHIPS
N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y	Y			Y		Examination	70	120	Assessment	Semester 1	
Y			Y	Y			Y		Coursework	30		Assessment	Semester 1	
Y			Y	Y			Y		Examination	100	120	Reassessment	Semester 3	

COURSE DETAILS
Course Code: C98CY
Full Course Title: Cognitive Psychology 2
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

To introduce cognitive ergonomics and to develop understanding of human sensory capabilities in support of user-sympathetic design and analysis.

LEARNING OUTCOMES – SUBJECT MASTERY

To demonstrate understanding of empirical findings and theoretical models in human behavioural modelling, attention, perception, system design, usability, human error and accidents, workload and multiple task performance.

To understand the role of the human in socio-technical systems with particular reference to:

- the design of appropriate controls and displays with respect to
- human capabilities and limitations

To develop skills of analysis, judgement, design, measurement and evaluation.

Students have the opportunity to submit formative coursework.

LEARNING OUTCOMES – PERSONAL ABILITIES

The course provides an introduction to theoretical concepts and research evidence in cognitive ergonomics. It provides a foundation for further professional training in this area.

Students are encouraged through lectures, notes, interactive exercises and on-line materials to supplement their learning through reading from books and journal papers, in order to promote

autonomy and accountability in study.

Efficient spoken and written communication is developed through lectures and supplementary reading; numeracy through interpretation of examples of published quantitative data; ICT through use of Vision, and assessed presentations.

SYLLABUS

General introduction to Ergonomics

- Anthropometry
- User-centred design, sensory processes, controls & displays
- Human error, risk taking and accident theories
- The human as an information processor, vision and lighting, hearing and speech, plus other sensory modalities
- Challenges in allocation of attention, multiple task performance and operator workload measurement
- Introduction to user-sympathetic controls & displays
- Introduction to human-computer interaction
- Participative user trials & Task Analysis

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y	Y			Y		Examination	50	120	Assessment	Semester 2	
Y			Y	Y			Y		Coursework	50		Assessment	Semester 2	
Y			Y	Y			Y		Examination	50	120	Reassessment	Semester 3	
Y			Y	Y			Y		Coursework	50		Reassessment	Semester 3	

D18AB Acoustics and Architectural Design

COURSE DETAILS
Course Code: D18AB
Full Course Title: Acoustics and Architectural Design
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

This Course follows from 'Lighting and Architectural Design'. In this Course students are introduced to architectural acoustics and design. The aims of the Course are:

- To introduce basic concepts of acoustics to students
- To give an overview of environmental noise issues (sound propagation outdoors)
- To introduce students to room acoustics, sound insulation design and noise control in building services
- To use case studies as examples of how to deal with acoustic design issues
- To develop laboratory skills of students (measurement of noise and room acoustics parameters)

LEARNING OUTCOMES – SUBJECT MASTERY

At the end of this Course, students should:

- Be able to understand the basic concepts of acoustics
- Have a comprehensive understanding of the design methodologies related to architectural acoustics and should be able to apply them in unfamiliar situations
- Be able to undertake a series of laboratory based projects and write a technical report

LEARNING OUTCOMES – PERSONAL ABILITIES

At the end of this Course, students should:

- Have developed their engineering practice through laboratory work
- Have developed their intellectual abilities through the writing of coursework
- Have gained an understanding of professional practice in acoustics (case studies)

SYLLABUS

- Introduction
- Basic concepts of acoustics – Fundamental parameters and sound pressure level measurements
- Environmental noise and building design – Propagation of sound outdoors and design of external walls in buildings
- Sound insulation of buildings – Sound transmission inside buildings and design for good sound insulation
- Room acoustics – Introduction to basic concepts such as absorption, reverberation time and sound pressure level in a room
- Noise control in building services – Plant room noise, flow generated noise, breakout noise and cross talk between rooms
- Design targets and criteria - Review of design guidelines for background noise and reverberation time within rooms, as well as soun insulation values for building elements
- Concert hall and theatre acoustics - Basic parameters used in design

A review of noise in Scottish Building Standards is discussed in a presentation given by an external speaker of the Industrial Advisory Panel. The material presented is integrated into the lectures and reviewed each year.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y	Y		Y						Coursework	30		Assessment	Semester 1	
Y	Y		Y						Examination	70	120	Assessment	Semester 1	
Y	Y		Y						Coursework	30		Reassessment	Semester 3	
Y	Y		Y						Examination	70	120	Reassessment	Semester 3	

COURSE DETAILS
Course Code: D49UD
Full Course Title: Urban Design Theory and Practice
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

The course aims to enable learners to:

- gain an in-depth understanding of urban design principles and processes and develop in-depth skills of critical design analysis
- gain a critical understanding of urban design theories and the literature
- develop a penetrating and creative eye when studying the physical environment
- further develop the ability to critically evaluate proposals on design grounds
- develop an awareness of how design issues and attitudes may differ among various stakeholders in the urban design process (including members of the community) and what factors are likely to influence this.

LEARNING OUTCOMES – SUBJECT MASTERY

- in-depth understanding of urban design theories in the relevant literature
- in-depth understanding of urban design principles
- ability to critically analyse the character of a place and the complex components that make this up
- understanding of how the physical environment is shaped and how changes occur.

- ability to relate urban design policy and practice to existing theoretical approaches
- understanding of, and practice in, the collection of data from a variety of sources as inputs to urban design analysis and proposals.

LEARNING OUTCOMES – PERSONAL ABILITIES

- ability to give an in-depth analysis of the urban design character of any place
- ability to critically evaluate proposals on design grounds
- skills in generate collaborative strategies and ideas for good design solutions for particular areas, sites and buildings
- understanding of how the professions and communities can work together to achieve good

design.

- capacity to actively contribute to the generation of collaborative strategies
- skills in working effectively and in a structured way with others in the context of a team.

- develop skills in oral, graphic and written communication and presentation to a professional standard for a variety of audiences.

SYLLABUS

The following topics will be covered in this course:

- urban design theory
- in-depth analysis of the meaning of quality
- strategic importance of good design
- good practice design policy
- examples of urban design practice and process
- design guides and briefs
- relationship between design and the image of places
- using design to improve the quality of places
- involving the public in urban design
- equal opportunities and design
- sustainability aspects of design

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y									Coursework	100		Assessment	Semester 1	
Y									Coursework	100		Reassessment	Semester 3	

COURSE DETAILS
Course Code: F17CC
Full Course Title: Introduction to University Mathematics
SCQF Level: 7
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

The course aims to provide a bridge between school and university (mainly, non-calculus) mathematics.

It will provide an introduction to the culture of mathematics including discussions of history, modern applications and the nature of reasoning, problem-solving and proofs.

In addition, basic skills will be developed in elementary combinatorics, complex numbers and polynomials, the algebra of matrices and their applications and geometry and vectors.

LEARNING OUTCOMES – SUBJECT MASTERY

• Understand the differences between school and university mathematics.
• Understand what a mathematical proof is and why proofs are needed.
• Construct simple proofs.
• Solve simple problems in combinatorics, polynomials, matrices, and vectors.

- An understanding of the importance of rigour, logic and generality in formulating mathematical ideas.
- An understanding of the development of mathematical ideas in historical and conceptual contexts

LEARNING OUTCOMES – PERSONAL ABILITIES

- Use logical reasoning.
- Solve problems individually and cooperatively.
- Formulate problem-solving strategies and implement them.
- Organize complex arguments in a clear and consistent manner.

F17CC Introduction to University Mathematics

SYLLABUS

The nature of mathematics: history, modern applications, reasoning, problem-solving and proofs.

Elementary combinatorics: the language of sets, permutations and combinations et al.

Complex numbers and polynomials: the algebra of complex numbers, nth roots, the algebra of polynomials and the fundamental theorem of algebra.

Matrices: the arithmetic and algebra of matrices, determinants, inverse matrices.

Geometry and vectors: vector algebra, the equations of lines and planes.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y									Examination	70	120	Assessment	Semester 1	
Y									Coursework	30		Assessment	Semester 1	
Y									Examination	100	120	Reassessment	Semester 3	

F29AI Artificial Intelligence and Intelligent Agents

COURSE DETAILS
Course Code: F29AI
Full Course Title: Artificial Intelligence and Intelligent Agents
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	Yes	**Postgraduate Research**:	No

COURSE AIMS

To introduce the fundamental concepts and techniques of AI, including planning, search and knowledge representation

- To introduce the scope, subfields and applications of AI, topics to be taken from a list including natural language processing, expert systems, robots and autonomous agents, machine learning and neural networks, and vision.
- To develop skills in AI programming in an appropriate language

LEARNING OUTCOMES – SUBJECT MASTERY

- Critical understanding of traditional AI problem solving and knowledge representation methods
- Use of knowledge representation techniques (such as predicate logic and frames).
- Critical understanding of different systematic and heuristic search techniques
- Practice in expressing problems in terms of state-space search
- Broad knowledge and understanding of the subfields and applications of AI, such as computer vision, machine learning and expert systems.
- Detailed knowledge of one subfield of AI (e.g. natural language processing, planning) and ability to apply its formalisms and representations to small problems
- Detailed understanding of different approaches to autonomous agent and robot architectures, and the ability to critically evaluate their advantages and disadvantages in different contexts.
- Practice in the implementation of simple AI systems using a suitable language

LEARNING OUTCOMES – PERSONAL ABILITIES

- Identification, representation and solution of problems
- Research skills and report writing
- Practice in the use of ICT, numeracy and presentation skills

F29AI Artificial Intelligence and Intelligent Agents

SYLLABUS

- Search algorithms (depth first search, breadth first search, uniform cost search, A* search)
- constraint satisfaction problems;
- games (min-max, alpha-beta pruning);
- logic, resolution, introductory logic programming
- knowledge representation – logic, rules, frames
- goal and data-driven reasoning
- practical rule-based programming
- Overview of main fields of AI (Vision, Learning, Knowledge Engineering)
- In depth view of one field of AI (e.g. Planning, Natural language)
- Autonomous agents
- Applications of AI
- AI programming

NOTE:- Elementary knowledge of logic at the level of undergraduate Computer Science. Knowledge of high-level programming language concepts.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y				Y		Practical	70	120	Assessment	Semester 1	
Y			Y				Y		Coursework	30		Assessment	Semester 1	
Y			Y				Y		Examination	100	120	Reassessment	Semester 3	
							Y		Examination	70	120	Assessment	Semester 2	
							Y		Coursework	30		Assessment	Semester 2	

COURSE DETAILS
Course Code: C98HD
Full Course Title: Human Development and Intelligence
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

The course aims to:

Introduce the concept of intelligence, and its origins; its measurement and application

Provide an understanding of the processes and landmarks in early human development, including physical, social and cognitive change.

LEARNING OUTCOMES – SUBJECT MASTERY

Understand the role of genetic, educational, cultural and contextual factors on intellectual development.

Recognise the significance of development and intelligence testing for psychology as a science.

Grasp the impact of social and cultural factors on our understanding of development and intelligence.

The impact that development and measures of intelligence have in school and the workplace.

LEARNING OUTCOMES – PERSONAL ABILITIES

Develop critical thinking and evaluative skills.

Show understanding of primary source texts.

C98HD Human Development and Intelligence

Display working knowledge of the application of theories of intellectual development in the wider world.

Demonstrate the ability to interpret, present and defend an argument in a group setting.

SYLLABUS

Definitions of intelligence; the history of intelligence testing.

Dominant contemporary theories of intelligence.

Cultural, gender and individual differences in intelligence.

The heritability of intelligence, and the role of education in shaping intelligence.

Theories of child development.

The development of vision, language, numeracy, theory of mind and personal identity during infancy and early childhood.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y	Y			Y		Examination	70	120	Assessment	Semester 1	
Y			Y	Y			Y		Coursework	30		Assessment	Semester 1	
Y			Y	Y			Y		Examination	70	120	Reassessment	Semester 3	
Y			Y	Y			Y		Coursework	30		Reassessment	Semester 3	

COURSE DETAILS
Course Code: C97RM
Full Course Title: Research Methods and Analysis 1
SCQF Level: 7
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS
Provide the students with basic learning and research skills; provide time for student and mentor interaction; provide students with basic skills for critically evaluating research; provide initial skills for students to become independent learners.

LEARNING OUTCOMES – SUBJECT MASTERY
Appreciate learning expectations in higher education Appreciate how to search for literature and reference academic material Appreciate the benefits of group discussion Appreciate the benefits of self directed learning Understand the basics of ethical consideration Understand the basics of conducting scientific research Students have the opportunity to submit optional formative coursework.

LEARNING OUTCOMES – PERSONAL ABILITIES
Be able to work in a team and independently

To contribute to group discussion

To appreciate expectations of students and teachers in higher education

Make group presentations

Begin to be able to critically appraise literature

Develop writing and communication skills

SYLLABUS

Topics covered will include: acedemic writing and researching skills; ethics, validity and realiability, principles of research hypothesis and testing, critical appraisal, group discussion, oral presentation.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y						Coursework	100		Assessment	Semester 1	
Y			Y						Coursework	100		Reassessment	Semester 3	

COURSE DETAILS
Course Code: C97RE
Full Course Title: Research Methods and Analysis 2
SCQF Level: 7
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL					
Undergraduate:	Yes	**Postgraduate Taught**:	No	**Postgraduate Research**:	No

COURSE AIMS

Introduce principles of scientific research, basic experimental techniques, and basic statistical concepts and analyses

Introduce report writing skills, including incorporating theory and literature with research findings

Provide students with basic research skills

Provide students with basic skills for critically evaluating research

LEARNING OUTCOMES – SUBJECT MASTERY

Understand the basics of conducting scientific research

Understand basic statistical concepts and methods of analyses

Appreciate the principles of report writing

Appreciate how to search for literature and reference academic material

Students will have the opportunity to submit formative coursework.

LEARNING OUTCOMES – PERSONAL ABILITIES

Be able to work in a group and independently

C97RE Research Methods and Analysis 2

Begin to be able to critically appraise literature

Develop data handling and numeracy skills

Develop organisational skills

Develop writing and communication skills

SYLLABUS

Topics covered will include: principles of research hypothesis and testing and basic experimental design, introductory statistical concepts and analyses, and report writing.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

Edi	SBC	Ork	Dub	Malay	IDL	COLL	ALP	OTH	Method	Weight	Exam Mins	Type	Diet	Synoptic Course
Y			Y						Coursework	100		Assessment	Semester 2	
Y			Y						Coursework	100		Reassessment	Semester 3	