FACULTY OF SCIENCE

Index of Subjects – Alphabetical List

Faculty of Science

Academic Integrity

ACADINT A01 **0 Points**
Academic Integrity Course
An online course designed to increase student knowledge of academic integrity, university rules relating to academic conduct, and the identification and consequences of academic misconduct. Students work through a series of modules, outlining scenarios that they may encounter while studying at university. Each scenario provides information on relevant rules, resources and expected behaviour.

Astrosciences

Stage I

ASTRO 100 **15 Points**
ASTRO 100G **15 Points**
Planets, Stars and Galaxies
The story of our place in the Universe. Key topics are the exploration of the solar system, searches for planets around other stars, the structure and evolution of stars and galaxies, high-energy astrophysics, and the origin and overall properties of the Universe. No background in physics or mathematics is assumed.
Restriction: PHYSICS 107, 107G

ASTRO 110 **15 Points**
Introduction to Rocket Science
An introduction to spaceflight and space technology. Topics include rocketry, orbits, spacecraft design and systems, space-based technologies, space exploration, ethical and legal issues and the present and future scientific, technological and social impacts of spaceflight. No background in physics or mathematics is assumed.

Stage II

ASTRO 200 **15 Points**
ASTRO 200G **15 Points**
Astrobiology
Astrobiology examines the potential of the universe to harbour life and is interdisciplinary, combining Geology, Biology, Astronomy, Chemistry, Physics, Philosophy, Ethics. Course focus is on how these disciplines combine with technology, addressing questions of life in the universe. Key topics include origin and evolution of life, definitions and environmental limits of life, and how to search for life beyond Earth.
Prerequisite: 60 points passed

Postgraduate 700 Level Courses

ASTRO 720 **15 Points**
Planetary Science
Explores celestial bodies and planetary systems and the processes of their formation. Emphasis is on planetary geology and geophysics over the 4.6-billion-year-history of our solar system, evaluating the origination, evolution, and habitability of diverse worlds, using varied tools and techniques. Also addressed are modes of scientific enquiry, knowledge perspectives and the ethics of space exploration.

Bioinformatics

Postgraduate 700 Level Courses

BIOINF 789A **22.5 Points**
BIOINF 789B **22.5 Points**
Dissertation - Level 9
Prerequisite: COMPSCI 220 and approval of Programme Director
Restriction: COMPSCI 789, STATS 789
To complete this course students must enrol in BIOINF 789 A and B

BIOINF 796A **60 Points**
BIOINF 796B **60 Points**
MSc Thesis in Bioinformatics - Level 9
To complete this course students must enrol in BIOINF 796 A and B

Biological Sciences

Stage I

BIOSCI 100 **15 Points**
BIOSCI 100G **15 Points**
Antarctica: The Frozen Continent
A general introduction to Antarctica and its environs including the Southern Ocean and the sub-Antarctic islands. Emphasis will be placed on the evolution of Antarctica and how resident plants, animals and micro-organisms have adapted to cope with the extreme environment. Specific topics to be addressed include: the history of Antarctic exploration and its impact on the development of Antarctic science, Antarctic ecosystems, Antarctica as a wilderness region, and the impact of humans including the exploitation of resources and the effects of pollution. This course is suitable for students with both science and non-science backgrounds.

BIOSCI 101 **15 Points**
Life! Origins and Mechanisms
Questions what life is and explores its machinery. Speculates on how life arose from the flow and capture of solar energy, to power growth, movement, replication and storage of genetic information. Describes how genes interact with environments, and how mutations can be catastrophic or transformational. These processes underpin life as we know it.

BIOSCI 106 **15 Points**
Foundations of Biochemistry
An introduction to the core elements of biochemistry, investigating biological processes at the chemical and molecular level. Key themes include the molecular structure of proteins, enzyme kinetics, biochemical energetics, carbohydrate and lipid metabolism, nutrition, cell signalling, vision and aspects of plant biochemistry including world food production. These themes provide a framework for discussion of mechanisms underpinning human disease including diabetes and obesity, antibiotic resistance, drug development and plant medicinals.

BIOSCI 107 **15 Points**
Biology for Biomedical Science: Cellular Processes
The cellular basis of mammalian form and function. Particular emphasis will be placed on cellular components and processes of blood, neural, muscular, reproductive, immune and supporting systems and how they contribute to the structure and function of the body as a whole.

BIOSCI 108 **15 Points**
Biodiversity: Patterns of Life
Knowledge of biodiversity is fundamental to understanding our world. Students will become familiar with biological diversity and whakapapa beginning with viruses and leading through to microbes, plants, fungi and animals. Defining characteristics of major organismal groupings will be highlighted to provide students with an overview of the diversity of life on Earth, and the critical role that kaitiakitanga and maintaining biodiversity has for the future.

BIOSCI 109 **15 Points**
Ecology and Evolution: The Continuum of Life
Explores the ecological mechanisms that determine the distribution and abundance of organisms, and the evolutionary mechanisms which drive change over time. Also explores the role of society and mātauranga Māori in recognising and seeking solutions for human-induced environmental change. Course components emphasise critical thinking and scientific communication skills.
Restriction: BIOSCI 104

Stage II

BIOSCI 201 **15 Points**
Cellular and Molecular Biology
The fundamental processes of the cell are examined to understand how cells reproduce and use information stored within the genome, express proteins for specific functions, and function within larger tissues. Specific modules examine stem cells, tissues and cellular development, cancer progression and the biology of tumours and the basis of immunity.
Prerequisite: BIOSCI 101, and 15 points from BIOSCI 106-109, MEDSCI 142, and 15 points from CHEM 110, 120, 150

BIOSCI 202 **15 Points**
Genetics
The basic principles of mutation, recombination and genetic mapping are established in this course. These principles are developed in a variety of prokaryotic and eukaryotic organisms. Laboratory work uses molecular, microbial and eukaryotic material to explore the key features of heredity.
Prerequisite: BIOSCI 101 and 15 points from BIOSCI 106-109

BIOSCI 203 **15 Points**
Biochemistry
Presents core areas of modern biochemistry. Emphasis is on macromolecular structure and function. Areas covered include protein structure, oxygen and carbon dioxide transport in humans and other species, metabolism in mammals, proteases and human disease, cholesterol metabolism and transport and signal transduction.
Prerequisite: BIOSCI 101, 106 and 15 points from CHEM 110, 120

BIOSCI 204 **15 Points**
Principles of Microbiology
An introduction to the diversity, physiology and functions of microorganisms (prokaryotes, eukaryotes, viruses) as individuals and as communities. The fundamental roles of microorganisms in ecosystems, health and disease are considered alongside methods for their isolation and study. Microbial applications in biotechnology, food production, agriculture and industry are also discussed.
Prerequisite: BIOSCI 101 and 15 points from BIOSCI 106-109

BIOSCI 205 **15 Points**
Plant, Cell and Environment
Unlike animals, plants cannot move to respond to changes in their environment. Plants have evolved diverse signaling systems and the ability to grow towards their essential resources. Explores the intricate ways plants function, how they are able to respond to developmental and environmental signals at the whole plant and cellular level.
Prerequisite: BIOSCI 101, 108

BIOSCI 206 **15 Points**
Principles of Ecology
An examination of ecosystem processes, factors that affect distribution and interactions of organisms, population ecology, and applications of ecology such as restoration and conservation. The key principles of ecology are taught in a New Zealand context emphasising an experimental approach.
Prerequisite: BIOSCI 108, 109 and STATS 101 or 108

BIOSCI 207 **15 Points**
Adaptive Form and Function
Investigates the diverse biological adaptations of animals, with a focus on generating adaptive hypotheses and ways to test them. Topics covered include comparative physiology, behavioural ecology, hormones and predator/prey interactions.
Prerequisite: BIOSCI 108, and BIOSCI 101 or 109

BIOSCI 208 **15 Points**
Invertebrate Diversity
Invertebrates make up over 95 percent of animal species. This course explores the biology of invertebrates with an emphasis on structure, function, life histories, behaviour and ecology. Invertebrate diversity is examined in a variety of environments, using New Zealand examples where possible, and provides the basis for advanced courses in conservation and marine ecology.
Prerequisite: BIOSCI 108, and BIOSCI 101 or 109

BIOSCI 210 **15 Points**
Evolution and the Origin of Life
Covers basic concepts in evolutionary biology including Darwin and the theory of evolution by natural selection, phylogenetics, population genetics, molecular evolution, speciation and extinction. The extent to which Darwin's theory of evolution by natural selection can explain the origins of biological complexity is explored.
Prerequisite: BIOSCI 109, and 15 points from BIOSCI 101-108

BIOSCI 220 **15 Points**
Quantitative Biology
An introduction to mathematical, statistical and computational literacy as required for contemporary biologists. Topics include fundamentals of experimental design, data exploration and visualisation, model-based inference to process biological data into biological information, comparing statistical models, prediction using mathematical models of biological processes, critical thinking about models and effective communication of findings. Data analysis and generation is taught using the R programming language. Recommended preparation: STATS 101
Prerequisite: 30 points from BIOSCI 101-109

Stage III

BIOSCI 300 **15 Points**
Directed Study

BIOSCI 322 **15 Points**
Evolution of Genes, Populations and Species
Advanced concepts in evolutionary biology and their application to current research in molecular evolution,

population genetics, phylogenetics and organismal evolution. Examples from animals, plants and microbes, as well as topical issues, including speciation, adaptation, co-evolution, sexual selection, conservation, biogeography, genomics, biotechnology and human disease. Recommended preparation: Prior or concurrent enrolment in BIOSCI 202.
Prerequisite: BIOSCI 210

BIOSCI 324 **15 Points**
Plant Pathology and Symbiosis
Microorganisms and pests form symbioses with plants that are critically importance for horticulture and agriculture. This course examines the biology of plant pathogens, pests, and symbionts. It focuses on plant-microbe interactions at the cellular and molecular level, the epidemiology and control of plant diseases, and the mechanisms through which these interactions are mediated.
Prerequisite: BIOSCI 204 or 205
Restriction: BIOSCI 321

BIOSCI 325 **15 Points**
Plant Diversity and Function
Plants form the basis of ecosystem food chains and are fundamental to life on Earth. The diversity in land plants from both phylogenetic and functional trait perspectives will be presented, exploring key steps in the evolution of plants and how they interact with their environment. It provides a framework of plant life focussing on the ecologically, economically and culturally important plants of Aotearoa New Zealand.
Prerequisite: BIOSCI 108, and BIOSCI 205 or 206
Restriction: BIOSCI 323

BIOSCI 326 **15 Points**
Plant Biotechnology for Crops and Health
Plants are vital sources of food, health compounds and shelter. Students will learn how biotechnology is used to understand plant biology and discuss strategies for crop improvement. Topics include plant genomics, molecular breeding, genome editing, gene transfer, the regulatory framework and examples of applications in the food, health, environment and crop sectors.
Prerequisite: 15 points from BIOSCI 202, 203, 205
Restriction: BIOSCI 340

BIOSCI 328 **15 Points**
Fisheries and Aquaculture
Harvest and capture of aquatic organisms and inter-relationships with aquaculture. Fisheries and aquaculture are treated not as distinct disciplines but in the context of integrating exploitation and sustainable environmental integrity. Case studies include deep sea and coastal fisheries, and shellfish culture.
Prerequisite: 15 points from BIOSCI 207, 208, MARINE 202

BIOSCI 333 **15 Points**
Marine Ecology and Conservation
Patterns and processes in marine ecology and biodiversity are described; including predator-prey interactions, benthic and pelagic habitats, productivity and physiology. Applied aspects include movement ecology, dispersal related to resource availability, disturbance and impacts of resource use e.g., fisheries. Emerging technologies to understand resilience within ecosystems and dispersal will be included.
Prerequisite: BIOSCI 206 or MARINE 202, and 15 points from BIOSCI 220, STATS 101, 108

BIOSCI 334 **15 Points**
Biology of Marine Organisms
Not only is the earth predominantly oceanic, but higher marine biodiversity occurs on the shallower continental shelf/coastal areas. Students will learn the key groups of marine organisms within New Zealand's waters. Attention will be given to understanding their diversity, distribution and adaptations to thrive within the dynamic marine environment.
Prerequisite: BIOSCI 108, 109 and 15 points from BIOSCI 206, 207, 208

BIOSCI 335 **15 Points**
Ecological Physiology
Focuses on the strategies used by animals to cope with physical and biological challenges in the environment. Accordingly, we work at the level of the individual and the interface between physiological, biochemical or molecular approaches on the one hand, and ecology on the other. The adaptive strategies employed by a range of species, with an emphasis on aquatic organisms, in response to physical factors such as temperature, oxygen and food availability, are considered. Energetics and nutrition are emphasised. The course aims to meet the needs of students with ecological interests wishing to recognise the experimental approach to solving problems in environmental biology. The practical work is project oriented rather than laboratory based.
Prerequisite: 15 points from BIOSCI 207, 208

BIOSCI 337 **15 Points**
Animal Behaviour
Animal Behaviour Proximate and ultimate causes of behaviour are investigated experimentally in the field and the laboratory. Responses by animals to variations in the physical environment and to other organisms are studied. The development and organisation of behaviour and the theoretical background to topics of current interest are covered, using both New Zealand and overseas examples.
Prerequisite: BIOSCI 220, and BIOSCI 207 or 208

BIOSCI 338 **15 Points**
Biology of Terrestrial Animals
The animals of Aotearoa and Tāmaki Makaurau are iconic. We explore the biology, diversity and whakapapa of our native invertebrate and vertebrate animals. Along with a detailed coverage of biology, we focus on practical techniques for sampling and identifying species. This course involves both fieldwork (with the option to conduct this either on campus, or on an overnight fieldtrip) and labwork and training in using biodiversity data for hypothesis testing and scientific communication.
Prerequisite: 15 points from BIOSCI 206-208
Restriction: BIOSCI 320

BIOSCI 347 **15 Points**
Environmental Microbiology and Biotechnology
The ecology and physiology of micro-organisms in natural and engineered environments. Key themes include marine microbiology, the importance of microbial symbioses to life on Earth, and contemporary research methods in microbiology. Processes such as wastewater treatment and the production of bioactives are used to emphasise exploitation of microbial metabolism for environmental biotechnology purposes.
Prerequisite: BIOSCI 204 or MEDSCI 202

BIOSCI 348 **15 Points**
Applied Microbiology
Microorganisms and microbial-derived products have been used by humans for millennia. Explores the interface of microorganisms and engineering, including how microorganisms interact with food products in

beneficial and unfavourable ways, identifying and utilising microorganisms to produce chemicals, therapeutics, and materials and how to use innovative methods to engineer microorganisms to perform novel functions or produce novel products.
Prerequisite: BIOSCI 204 or MEDSCI 202

BIOSCI 349 **15 Points**
Biomedical Microbiology
The molecular biology of micro-organisms affecting human health. The characteristics of microbial pathogens, the origins of virulence, and the development of infectious disease. Routes of infection, evasion of host immune responses, and host-pathogen interactions. The molecular basis for vaccination and anti-microbial therapy, and the development of resistance to treatment.
Prerequisite: BIOSCI 201 and either BIOSCI 204 or MEDSCI 202

BIOSCI 350 **15 Points**
Protein Structure and Function
The relationship of molecular structure to protein function will be emphasised. Techniques for the purification, characterisation, production of native and recombinant proteins and three-dimensional structure determination will be combined with a description of protein structure. Specific groups of proteins will be selected to illustrate structure/function relationships and protein evolution.
Prerequisite: BIOSCI 203

BIOSCI 351 **15 Points**
Molecular Genetics
The analysis of genetic material in prokaryotes, viruses, yeast, plants and humans is addressed. The means by which genetic information is transferred and the mechanisms underlying genome diversity will be examined, together with the study of eukaryote genomes at the level of chromosome structure and organisation. The molecular mechanisms underpinning selected inherited human disorders will be discussed as well as the role of model species in understanding normal and perturbed biological pathways.
Prerequisite: BIOSCI 201, 202

BIOSCI 353 **15 Points**
Molecular and Cellular Regulation
The molecular mechanisms which mediate intracellular sorting and targeting of biologically active molecules and the networks of intracellular and extracellular signals which regulate cell function form the focus of this course. The roles of growth factors, oncogenes, plasma membrane receptors, nuclear receptors, ion channels and membrane transporters are emphasised.
Prerequisite: BIOSCI 201, 203

BIOSCI 355 **15 Points**
Genomics and Genome Biology
Biological information is coded in and expressed from genomes. This course explores methods for detecting structural and functional elements of genomes, plus the wider genome biology of eukaryotic and prokaryotic systems. Students will learn how genomic data is generated and analysed, how genomes evolve, and how genomic information is expressed and regulated.
Prerequisite: BIOSCI 202
Restriction: BIOINF 301, BIOSCI 354

BIOSCI 356 **15 Points**
Developmental Biology and Cancer
Molecular, cellular and genetic aspects of normal and abnormal development focusing on a variety of model systems including drosophila, the zebrafish and the mouse. Molecular events underlying the development of body form, the differentiation of specific tissues such as the blood, and abnormalities of development which contribute to diseases of the body such as cancer. Implications of transgenic techniques on development.
Prerequisite: BIOSCI 201

BIOSCI 358 **15 Points**
Nutritional Science
The scientific basis of nutrition focusing on its biochemistry and physiology in health and disease. Nutritional aspects of carbohydrates, fats, proteins, vitamins and trace nutrients are covered in an integrated manner. The methodologies which underpin nutritional science and its applications are included. Reference will be made to a broad range of examples, and a number of specific nutritional topics of current interest will also be included.
Prerequisite: BIOSCI 203

BIOSCI 394 **15 Points**
Terrestrial Ecology and Conservation
Explores theoretical ecology from populations to ecosystems. Applies ecological theory to conservation management through a cross-disciplinary lens in the context of social and cultural values. Students will test theoretical hypotheses in the field, conduct an ecological site assessment for conservation management and learn to use population viability analysis to assess risks to threatened populations.
Prerequisite: BIOSCI 206, 220

BIOSCI 395 **15 Points**
Pacific Biogeography and Biodiversity
Island biogeography and insular biodiversity across the Pacific. A multi-disciplinary approach involving the study of both plant and animal systematics and biogeography.
Prerequisite: BIOSCI 109 or GEOG 101

BIOSCI 399 **15 Points**
Capstone: Biology: The Science of the 21st Century
Major advances in biology have added immensely to the understanding of our world. These advancements will continue, and biological science will influence our future lives and world. Students will enhance their scientific skills by envisioning the innovative future of biology, and its likely cultural, political and economic impacts, globally, and within the context of Aotearoa and Te Tiriti o Waitangi.
Prerequisite: 30 points at Stage III in Biological Sciences

Postgraduate 700 Level Courses

BIOSCI 700 **15 Points**
Phylogenetics
Students will learn advanced computational methods for inferring phylogenetic trees and studying macroevolutionary processes, including phylogenetic dating, coalescence, epidemic phylogeography, and estimation of ancestral traits and biogeography. Relevant skills in computation (BEAST, command-line programs, R) and statistics (Bayesian methods, model-based inference) will also be taught.
Restriction: BIOINF 702

BIOSCI 701 **15 Points**
Practical Approaches in Genomics - Level 9
Genomics provides insights into the diversity, evolution, adaptation and function of organisms. Students will complete a research project to apply the advanced practical aspects of genomics across taxa and topics such as conservation, health and ecosystem function.

Recommended preparation: BIOSCI 322, 351 or 355 or equivalent.
Restriction: BIOINF 701

BIOSCI 702 **15 Points**
Modelling Biological Processes
Modelling and simulation are increasingly important aspects of the biological sciences. A variety of biological modelling approaches are introduced through a series of practical exercises to build and analyse models of biological processes. Topics include modelling in ecology and systems biology, agent-based modelling of complex biological systems, and molecular dynamics of biological molecules.
Restriction: BIOINF 703

BIOSCI 704 **15 Points**
Practical Applications of Cell Analysis - Level 9
Application of highly specialised technologies for cell analysis relevant to a wide range of biotechnology-based disciplines including immunology, infectious diseases, stem cells, neuroscience and cancer. Advanced skill development in technologies including high dimensional flow cytometry, cell sorting and microscopy/imaging.

BIOSCI 724 **15 Points**
Marine Ecology
The ocean covers 70% of the surface area of Earth, provides 50% of the oxygen and much of the food consumed. This course considers marine ecology at the local, hemispheric and global levels with a focus on habitat and ecosystem connectivity and the impacts of anthropogenic change.

BIOSCI 725 **15 Points**
Ecological Physiology
Physiological and biochemical processes enable animals to occupy diverse habitats. Highly variable and extreme environments provide an opportunity to study the functional attributes of animals, particularly ectotherms, with respect to their metabolic, respiratory, and nutritional adaptations. A sound understanding of BIOSCI 335 or equivalent is assumed.

BIOSCI 727 **15 Points**
Aquaculture
Current assessment of the national and global status of aquaculture and consideration of future prospects. Examples of aquaculture in New Zealand are examined and a review of general environmental and biological problems and the role of scientific knowledge in aquaculture management. A sound knowledge of BIOSCI 328 or equivalent is assumed.

BIOSCI 729 **15 Points**
Evolutionary Biology
A contemporary approach to central issues in evolutionary biology including mechanisms that produce macroevolutionary patterns. Current research using phylogenetic methods for testing evolutionary hypotheses will be discussed, encompassing the role of selection, the origin of mutations, and concepts of heredity. A sound understanding of BIOSCI 322 or equivalent is assumed.

BIOSCI 730 **15 Points**
Entomology
More than half of all described species are insects, but collectively terrestrial arthropods are a hyper-diverse group found in almost every ecosystem, every trophic level above plants, and dominate terrestrial and freshwater food chains. The course explores the evolution of arthropods, their role in terrestrial ecosystems, and problems posed as biosecurity invaders in Aotearoa. A sound understanding of BIOSCI 338, or equivalent is assumed.

BIOSCI 731 **15 Points**
Biogeography
Examines the patterns of animal and plant distribution, and the processes that influence these patterns. Topics covered include equilibrium theory, island succession, vicariance and dispersal, insular speciation, and human migration and colonisation. A sound understanding of BIOSCI 395 or equivalent is assumed.

BIOSCI 733 **15 Points**
Molecular Evolution and Conservation Genomics
Using the molecular archive to address ecological and evolutionary questions. Provides a broad theoretical and practical basis for undertaking studies in fields ranging from conservation genetics/genomics and connectivity, and biosecurity and forensics, to phylogenetics and molecular evolution. Topics may include the neutral theory of molecular evolution, molecular identification of species, gene flow, selection at the molecular level, and inbreeding depression.

BIOSCI 734 **15 Points**
Terrestrial Plant Ecology
Plants form the autotrophic basis of terrestrial food chains and their distribution, diversity and abundance is a critical determinant of ecosystem functioning. Topics covered include both plant population ecology – including population growth and structure, seed and seedling dynamics, and life history strategies – and community ecology – including vegetation structure, dynamics, and species interactions. Methods to survey, analyse, and model plant populations and communities will also be discussed.

BIOSCI 735 **15 Points**
Advanced Behavioural Ecology
Focuses on organisms interacting in natural environments. Both the mechanistic underpinnings of behaviour and the fitness consequences of such behavioural traits will be examined. Behavioural ecology is not limited to questions of behaviour, but draws in issues of energetics and physiology as these factors are often used as proxies for fitness traits such as differences in survival and reproduction. A sound understanding of BIOSCI 337 or equivalent is assumed.

BIOSCI 736 **15 Points**
Microbial Genomics and Metabolism
Cross-disciplinary issues involved in the understanding of microbial genome structure, gene regulation and metabolism. Includes: the genetic basis of microbial interactions and horizontal gene transfer, the effect of stress and mutation on microbial and viral evolution and modern approaches used to link gene sequence to biological function and phenotypes.

BIOSCI 737 **15 Points**
High Resolution Imaging of Biological Molecules
X-ray crystallography and electron microscopy are two of the principal techniques used by biologists to determine molecular structure. The theory and practice of X-ray crystallography and electron microscopy, including a laboratory component where 3D structure are determined from experimental data, are addressed. Accessible to students with a variety of backgrounds, including Biology, Bioengineering, Chemistry and Physics. This course complements CHEM 738 and BIOSCI 757.

BIOSCI 738 **15 Points**
Advanced Biological Data Analysis
Building on a strong foundation in quantitative biology, fundamental statistical methods and basic R programming, students will learn an array of advanced biostatistical methods for data analysis. Topics covered include: data wrangling, methods for the analysis of designed experiments, regression analysis, including mixed effect models, and the analysis of multivariate data, including advanced supervised and unsupervised learning techniques. Requires students to apply their knowledge across a myriad of complex biological datasets.

BIOSCI 739 **15 Points**
Dialogues in Biology
Social, ethical and other philosophical issues in the life sciences will be debated and explored. Topics may include: animal and environmental ethics, conservation and biodiversity, the history and philosophy of science, ethical and commercial issues underpinning science, scientific publishing and advocacy, medical and agricultural biotechnology.

BIOSCI 741 **15 Points**
Applied Microbiology and Biotechnology
Explores recent advances in microbial biotechnology across the environmental, industrial and medical sectors, highlighting the diversity and complexity of applications. Features of experimental design and data analysis will be discussed. A sound understanding of BIOSCI 348 or equivalent is assumed.

BIOSCI 746 **15 Points**
The Molecular Machinery of The Cell
The experimental investigation and modelling of protein behaviour at the molecular level, in order to explain cellular biology and facilitate protein engineering. Topics addressed may include binding, transport, catalysis, chemical modification, and dynamics. A sound understanding of BIOSCI 350 or equivalent is assumed.

BIOSCI 747 **15 Points**
Biosecurity and Invasion Biology
The science of invasion biology, including stages of the invasion process and ecological interactions between species. The impacts of invasive alien species in different ecosystems. Population and community ecology, in relation to biosecurity.

BIOSCI 748 **15 Points**
Weed and Pest Management
Techniques for the management of invasive plants and animals (vertebrates and invertebrates) in different ecosystem types, including terrestrial and aquatic ecosystems. Approaches to the prevention, control and eradication of invasive species in different situations.

BIOSCI 749 **15 Points**
Microbiomes
The roles of microbial communities (microbiomes) and current research methods to study these are considered in different contexts including the environment (natural and biotechnological systems) and the human microbiome. A sound understanding of BIOSCI 347 or equivalent is assumed.

BIOSCI 751 **15 Points**
Plant-microbial Interactions
Addresses selected topics in plant microbial interactions. Modern research on issues relating to plant pathogens and biosecurity, plant disease spread (epidemiology) and plant-microbial interactions (both pathogenic and mutualistic) will be investigated and discussed. A basic understanding of microbiology and molecular biology is assumed.

BIOSCI 752 **15 Points**
Plant Genomics and Biotechnology
How genomics and gene transfer technologies could be used to achieve improved plant growth and to develop food with new traits. Includes: plant genomics methods, engineering fruit colour, control of fruit ripening and texture, biotechnology project design. A sound understanding of BIOSCI 354 or 340 or 326 or equivalent is assumed.

BIOSCI 753 **15 Points**
Synthesis of Plant Products and Foods
Includes the biosynthesis of: selected plant cell-wall components important in dietary fibre or biomass for the production of biofuels, including lignins, cellulose or non-cellulosic polysaccharides; antioxidant pigments in food plants and their possible impacts on human health. The manipulation of nitrogen assimilation in plants to increase the yield and quality of agricultural and horticultural plant products. A sound understanding of BIOSCI 340 or equivalent is assumed.

BIOSCI 754 **15 Points**
Plant Genomes and Gene Expression
The analysis of plant genomes and regulation of gene expression in plant biology. Includes: inferences from whole plant genome sequences, genetic control of nitrogen fixation, uptake and use, flowering time, hormone signalling pathways, sugar metabolism and its regulation. A sound understanding of BIOSCI 354 or 340 or 326 or equivalent is assumed.

BIOSCI 755 **15 Points**
Genomics and Gene Expression
The analysis of genomes and gene expression as a means of understanding biological processes. Aspects of functional and chemical genomics will be presented, as well as gene expression profiling using microarray technology. In terms of the latter, features of experimental design and data analysis will be discussed in the context of disease and developmental processes. A sound understanding of BIOSCI 351 or equivalent is assumed.

BIOSCI 757 **15 Points**
Molecular Form, Function and Design
Biological systems highlight a complex interplay of thousands of molecules. Reviews fundamental studies focusing on molecular structure and function (structural biology), and designer molecules with applications in nanotechnology and biomedicine. Topics may include: enzyme evolution and engineering, protein design and assembly, rational drug and vaccine discovery, and protein structure and dynamics.

BIOSCI 758 **15 Points**
Development, Differentiation and Disease
A critical analysis of normal and perturbed gene expression in selected model organisms as a means of understanding biological pathways and disease processes. Includes the development and use of transgenic organisms as models for human disease. A sound understanding of BIOSCI 356 or equivalent is assumed.

BIOSCI 759 **15 Points**
Cell and Molecular Biomedicine
Explores recent advances in cell biology that have led to a greater understanding of a variety of cellular processes at the molecular level. Emphasis will be placed on biochemical

and genetic approaches to understand disease mechanisms at the cellular level. A sound understanding of either BIOSCI 349 or 353 or MEDSCI 314 or equivalent is assumed.

BIOSCI 760 **15 Points**
Biosystematics
Exploration of key concepts and processes that form the professional discipline of biosystematics. Introduction and familiarisation with advanced concepts in biosystematics, and knowledge of methods to manage biosystematics collections, to develop accessible biodiversity databases, and to study and characterise biodiversity. Previous experience with basic taxonomic principles and the systematics of a taxonomic group is desirable.

BIOSCI 761 **15 Points**
Research Practice - Level 9
Students will complete an advanced literature review to produce a research output that applies their knowledge to a novel context or application. Students will develop skills to synthesise and communicate their research output including the significance, potential limitations and context within the wider discipline to an academic audience using both written and verbal platforms.
Restriction: BIOSCI 762, ENVSCI 701, MEDSCI 701

BIOSCI 762 **15 Points**
BSc(Hons) Dissertation Proposal - Level 9
A review of the literature associated with the dissertation topic and an outline of the proposed research and its significance. Students will also be required to present an overview of the proposal in a seminar.

BIOSCI 763 **15 Points**
Professional Applications of Ecology
Exploration of key concepts that form the professional discipline of ecology. Introduction and familiarisation with relevant policy, advanced ecological community and population survey and monitoring, use of Geographic Information Science (GIS) and remote sensing, accessing biosystematics resources, data management, effective engagement with mana whenua, and effective communication skills. Some previous knowledge of ecology is desirable.

BIOSCI 764 **15 Points**
Human Virology
The COVID-19 pandemic was a global health crisis without parallel in the modern era and has evoked an unprecedented scientific response. Explores aspects of virus biology to illustrate principles of emergence, transmission and disease caused by viruses with pandemic potential and discusses how emerging pandemics can reshape our ability to respond to future viral threats with pandemic potential.

BIOSCI 765 **15 Points**
Translating Biomedical Science into Therapeutic Strategies
Explores the research involved in development of currently available and potential future cell based biomedical therapeutics. The challenges and wider societal issues which need to be considered when conducting this research will be discussed. Emphasis will also be placed on guiding students as they develop their critical evaluation and communication skills.

BIOSCI 766 **15 Points**
Global Change Ecology
Discusses the profound impacts global change processes have on ecological systems, including climate change, land use change, biodiversity loss and changes in biogeochemical cycles. Covers the complex concepts of global change and approaches for planning and mitigation. Some previous knowledge of ecology is desirable.

BIOSCI 788 **45 Points**
BIOSCI 788A **22.5 Points**
BIOSCI 788B **22.5 Points**
BSc(Hons) Dissertation in Biological Sciences - Level 9
Restriction: BIOSCI 789
To complete this course students must enrol in BIOSCI 788 A and B, or BIOSCI 788

BIOSCI 793 **60 Points**
BIOSCI 793A **30 Points**
BIOSCI 793B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in BIOSCI 793 A and B, or BIOSCI 793

BIOSCI 796A **60 Points**
BIOSCI 796B **60 Points**
MSc Thesis in Biological Sciences - Level 9
To complete this course students must enrol in BIOSCI 796 A and B

Biomedical Science

Stage III

BIOMED 399 **15 Points**
Capstone: Biomedical Science
Students will synthesise knowledge and reflect on learning experiences attained during their studies in Biomedical Science. Students will engage in debate on contemporary issues and use their scientific reasoning to counter misunderstandings and misrepresentation. Students will consider wider societal issues involved in research, such as human and animal ethics, Māori and Pacific health advancement, and public health relevance and economic benefits.
Prerequisite: 30 points from BIOSCI 347-358, MEDSCI 300-320, MEDIMAGE 300, 302

Biosecurity and Conservation

Postgraduate 700 Level Courses

BIOSEC 796A **60 Points**
BIOSEC 796B **60 Points**
Thesis in Biosecurity and Conservation - Level 9
To complete this course students must enrol in BIOSEC 796 A and B

Biotechnology

Postgraduate 700 Level Courses

BIOTECH 788 **45 Points**
BIOTECH 788A **15 Points**
BIOTECH 788B **30 Points**
BSc(Hons) Dissertation in Biotechnology - Level 9
An independent research study conducted in conjunction with an industry partner.
To complete this course students must enrol in BIOTECH 788 A and B, or BIOTECH 788

BIOTECH 792 **45 Points**
BIOTECH 792A **15 Points**
BIOTECH 792B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in BIOTECH 792 A and B, or BIOTECH 792

BIOTECH 793 **60 Points**
BIOTECH 793A **30 Points**
BIOTECH 793B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in BIOTECH 793 A and B, or BIOTECH 793

BIOTECH 794A **45 Points**
BIOTECH 794B **45 Points**
MSc Thesis in Biotechnology - Level 9
To complete this course students must enrol in BIOTECH 794 A and B

Chemistry

Preparatory Courses

CHEM 91P **15 Points**
Preparatory Chemistry 1
Preparatory introduction to elements, compounds, the periodic table, atomic structure, covalent bonding, molecular shape and polarity. Quantitative chemistry, including balancing equations, calculating moles and particles present, calculation of concentration in mol L-1. Energy and thermo-chemistry. Laboratories include practical skills and qualitative analysis, and simple modelling.
Restriction: CHEM 91F

Stage I

CHEM 100 **15 Points**
CHEM 100G **15 Points**
Molecules that Changed the World
The impact of chemistry on the modern world will be explored by focusing on the stories of specific molecules, including penicillin, DDT and nylon. Their discovery, the underlying chemical principles that explain their behaviour, their impact on our lives including social and scientific issues that arise from their use, and their likely impact on the future will be investigated. No formal prerequisite, but the course assumes a science background at Year 11 or higher.

CHEM 110 **15 Points**
Chemistry of the Living World
A foundation for understanding the chemistry of life is laid by exploring the diversity and reactivity of organic compounds. A systematic study of reactivity focuses on the site and mechanism of reaction including application of chemical kinetics. A quantitative study of proton transfer reactions features control of pH of fluids in both living systems and the environment. It is recommended that students with a limited background in chemistry take CHEM 150 prior to CHEM 110.

CHEM 120 **15 Points**
Chemistry of the Material World
The chemistry of the elements and their compounds is explored. The relationship between molecular structure and reactivity, the role of energy, concepts of bond formation and chemical equilibrium are discussed. Issues such as sustainability, energy and fuels, and the creation of new materials are also discussed. It is recommended that students with a limited background in chemistry take CHEM 150 prior to CHEM 120.

CHEM 150 **15 Points**
Concepts in Chemistry
The fundamentals of chemistry are explored with a view to enhancing understanding of the chemical nature of the world around us and providing a foundation for further study in chemistry. Special attention is paid to familiarisation with the language of chemistry and the chemist's perspective of the properties of matter and its transformations. It is recommended that students with a limited background in chemistry take this course prior to CHEM 110 or CHEM 120.
Restriction: Cannot be taken at the same time as any other chemistry course, or after any successfully completed chemistry course, other than CHEM 100/CHEM 100G

Stage II

CHEM 200 **15 Points**
Special Topic

CHEM 251 **15 Points**
Structure and Spectroscopy
To study chemicals it is important to understand the stereochemical and electronic properties of molecules. Molecular orbital techniques and the application of approaches based on molecular symmetry and group theory to the understanding of molecular properties, bonding and spectroscopy will be studied. Application of these concepts to spectroscopic characterisation and quantification of materials by various spectroscopic techniques will be discussed.
Prerequisite: CHEM 120 and 15 points from MATHS 108, 110, 120, 130, PHYSICS 120, 160, STATS 101, 108
Restriction: CHEM 220

CHEM 252 **15 Points**
Properties and Analysis of Matter
Understanding the physico-chemical properties of matter is crucial for modern chemistry. Fundamental processes to the analysis and understanding of chemical systems, including thermodynamics, equilibria, acid and bases will be covered. Applications of modern electrochemistry, physical chemistry of modern materials and methods for assessing the reliability of results will be described while the laboratory course emphasises the obtaining and understanding of chemical measurements.
Prerequisite: CHEM 110, 120, and 15 points from MATHS 108, 110, 120, 130, PHYSICS 120, 160, STATS 101, 108
Restriction: CHEM 240

CHEM 253 **15 Points**
Making Molecules: Synthesis and Isolation
Creation of chemicals and compounds is at the heart of synthetic chemistry and is fundamental for the preparation of new materials and medicines. Students will learn organic, organometallic and inorganic synthesis with an emphasis on how and why reactions occur. Students will study separation strategies and characterisation techniques such as NMR spectroscopy to determine reaction outcomes. Provides experience in synthesising, purifying and characterising compounds.
Prerequisite: CHEM 110
Restriction: CHEM 230

CHEM 254 **15 Points**
CHEM 254A **7.5 Points**
CHEM 254B **7.5 Points**
Modelling Chemical Processes
From quantum mechanics to enzyme active sites, statistical analysis to the greenhouse effect, models are essential to our understanding of chemical phenomena. But what makes a good model? How are they developed and tested? After exploring the concept of models and their relationship to the scientific method, students will investigate several currently accepted models used in the chemical sciences.
Prerequisite: CHEM 110, 120 and 15 points from MATHS 108, 110, 130, 150, PHYSICS 120
To complete this course students must enrol in CHEM 254 A and B, or CHEM 254

CHEM 260 **15 Points**
Introduction to Green Chemistry
Introduction to the concepts and principles of Green Chemistry. Selected real world applications of Green Chemistry are presented to illustrate how these important guiding principles can be applied. The integral laboratory course provides valuable practical experience in relevant areas of the chemical sciences.
Prerequisite: Either CHEM 110 and 120, or at least B- in CHEM 110 or 120

Stage III

CHEM 300 **15 Points**
Special Topic

CHEM 310 **15 Points**
Structural Chemistry and Spectroscopy
Molecular structure is fundamental to the understanding of modern chemistry. Molecular spectroscopy provides an important method for probing the structure of molecules, and the following aspects of this subject will be presented: molecular energies and molecular spectra, molecular symmetry and spectroscopy, surface spectroscopy and the structure and chemistry of surfaces.
Prerequisite: 15 points from CHEM 210, 251

CHEM 320 **15 Points**
Design and Reactivity of Inorganic Compounds
A selection of the most recent developments in contemporary inorganic chemistry will be covered. Topics include selected physical properties of coordination compounds such as multinuclear NMR spectroscopy, UV-vis spectroscopy, magnetism, redox chemistry and photochemistry, the organometallic chemistry and catalytic reactions of transition elements, bioinorganic and medicinal inorganic chemistry, the kinetics and thermodynamics of ligand substitution reactions, main-group organometallic chemistry and main-group polymers. The laboratories provide an important complementary experience in the synthesis and measurement of physical properties for selected inorganic compounds.
Prerequisite: CHEM 220 or 251

CHEM 330 **15 Points**
Contemporary Organic Chemistry
Topics in advanced organic chemistry, including the synthesis, reactions and uses of compounds containing phosphorus, selenium, boron and silicon. Organotransition metal chemistry. Asymmetric synthesis. Heterocyclic chemistry and pericyclic reactions. Laboratories emphasise synthetic and structural methods.
Prerequisite: 15 points from CHEM 230, 253

CHEM 340 **15 Points**
Advanced Analytical Chemistry
Principles and applications of modern instrumental analytical chemistry. Statistical methods, quality control and assurance, sampling, instrumentation, chromatographic and other separation methods, spectrophotometric methods, electro-analytical methods.
Prerequisite: 15 points from CHEM 240, 252

CHEM 351 **15 Points**
Chemicals Big and Small: Nano-material to Bio-macromolecules
Chemical materials are found with a broad range of shapes, sizes and physical properties. Students will study the synthesis of chemical materials; including polymeric materials using radical chemistry, inorganic materials and proteins and peptides using synthetic and biological chemical approaches. Methods to characterise materials will be investigated, including a range of physical and computational techniques giving insight into molecular interactions.
Prerequisite: 30 points from CHEM 251, 252, 253
Restriction: CHEM 350

CHEM 360 **15 Points**
Contemporary Green Chemistry
Covers topics central to contemporary Green Chemistry such as sustainable syntheses, energy production, catalysis, pollution control, and basic toxicology. The integral laboratory course provides valuable practical experience in relevant areas of the chemical sciences.
Prerequisite: CHEM 260

CHEM 380 **15 Points**
Materials Chemistry
Synthesis, properties characterisation and applications of advanced materials. Includes a review of current trends in materials research. Important aspects of solid inorganic materials and organic polymers are covered.
Prerequisite: 15 points from CHEM 210, 220, 251, CHEMMAT 121

CHEM 390 **15 Points**
Medicinal Chemistry
Nature of cellular targets for drug action – lipids, proteins, enzymes, DNA. Principles of molecular recognition. Enzymes and receptors as targets for drug action. DNA as a target for drug action. An overview of approaches to drug discovery and development. Structure-activity relationships, stereochemistry and drug action, prodrugs, drug solubilisation and delivery, drug metabolism and antibiotic resistance. Laboratories focus on the synthesis, computer modelling and biological testing of drugs.
Prerequisite: CHEM 110 and a minimum of 165 points passed

CHEM 392 **15 Points**
Issues in Drug Design and Development
Intellectual property and patent law in the pharmaceutical industry. An overview of the legal and regulatory framework for drug design and development. Clinical trials: formulation of a drug; phase I, phase II and phase III protocols. An introduction to the principles involved in the Codes of Good Manufacturing Practice and Good Laboratory Practice (quality control and quality assurance procedures) as applied to the manufacture of drug products and the quantification of drugs and metabolites in biological fluids. Examples of drug development. Case studies of selected drugs from design to release.
Prerequisite: CHEM 110 and a further 150 points passed

CHEM 397 **15 Points**
Capstone: Green Chemical Science
Explores green chemical processes, principles, applications and development. Students will examine the ethical, social and commercial implications of green chemical processes.
Prerequisite: 30 points from CHEM 351, 360, ENVSCI 301

CHEM 398 **15 Points**
Capstone: Medicinal Chemistry
Integrates and applies the foundations of medicinal chemistry to popular science-related themes, working individually and in groups and producing written and oral reports. Comprises an open-ended drug discovery research project that will require students to work in groups and individually.
Prerequisite: CHEM 390 and 15 points from CHEM 310, 320, 330, 340, 351, 360, 380, 392

CHEM 399 **15 Points**
Capstone: Chemistry
Using a combination of skills learnt throughout their major, students will investigate key chemistry-related phenomena, working individually and in groups, producing both written and oral reports. Along with the chemistry behind the phenomena, the social, environmental, economic and ethical considerations will be explored.
Prerequisite: 30 points from CHEM 251, 252, 253, 260 and 255 points passed

Diploma Courses

CHEM 690A **15 Points**
CHEM 690B **15 Points**
Graduate Diploma Research Project
To complete this course students must enrol in CHEM 690 A and B

Postgraduate 700 Level Courses

CHEM 701 **15 Points**
Directed Study
A directed reading and individual study course to prepare students in the methodologies in a selected sub-discipline of chemistry.

CHEM 702 **15 Points**
Directed Study
A directed reading and individual study course to prepare students in the methodologies in a selected sub-discipline of chemistry.

CHEM 710 **15 Points**
Advanced Physical Chemistry
Covers modern areas of research in physical chemistry and may include solid-state nuclear magnetic resonance spectroscopy (NMR), X-ray spectroscopic techniques commonly used in materials science (including synchrotron-based X-ray absorption, emission and scattering techniques), and computational chemistry with applications in heterogeneous catalysis.

CHEM 712 **15 Points**
Nanomaterials and Nanotechnology
Introduces a range of modern methods used in the synthesis and characterisation of nanomaterials (including metal nanoparticles, polymers, ceramics and their nanocomposites), with the application of these nanomaterials in energy conversion, optical devices and biosensing also being explored. Potential risks of nanomaterials in the environment will be discussed.

CHEM 720 **15 Points**
Advanced Inorganic Chemistry
Covers modern areas of research in inorganic chemistry, and may include main-group catalysis, medicinal inorganic chemistry, supramolecular chemistry and/or inorganic cluster compounds.

CHEM 730 **15 Points**
Modern Methods for the Synthesis of Bioactive Molecules
The use of modern methods for the construction of complex molecules with an emphasis on carbon-carbon bond formation and control of stereochemistry. Principles and practice of synthesis design based on retrosynthetic analysis. Each student will present and discuss a recent synthesis of a complex bioactive organic compound. No formal prerequisite, but knowledge of organic chemistry at the level covered in CHEM 330 will be assumed.

CHEM 735 **15 Points**
Advanced Medicinal Chemistry
A selection of topics dealing with aspects of medicinal chemistry, including anticancer agents, metals in medicine, antibacterial and antiviral chemotherapy, contemporary topics in medicinal and/or bio-organic chemistry.

CHEM 738 **15 Points**
Biomolecular Chemistry
Discusses how techniques including NMR spectroscopy, calorimetry, neutron scattering and computational modelling, can characterise the molecular structure, dynamics, and interactions of biological macromolecules. The principles of each technique will be presented and complemented with examples of where these methods have made major advances in understanding important biochemical processes. Accessible to students with a background in chemistry, biology, bioengineering, or physics.

CHEM 740 **15 Points**
Current Topics in Analytical Chemistry
Principles and applications of modern analytical chemistry. Emphasis will be on the solution of problems met by analytical chemists, including a study of the development of instrumentation, and a study of current trends in analytical research. No formal prerequisite, but knowledge of analytical chemistry at the level covered in CHEM 340 will be assumed.

CHEM 741 **15 Points**
Chemometrics and Quality Assurance in Chemistry
Explores a range of different chemometric processes including statistical analysis techniques, and methods and strategies for experimental design. Concepts related to method validation for analysis will be covered, as well as quality management of chemistry experimental data and principles of Good Laboratory Practice (GLP).

CHEM 750 **15 Points**
CHEM 750A **7.5 Points**
CHEM 750B **7.5 Points**
Advanced Topics in Chemistry 1
To complete this course students must enrol in CHEM 750 A and B, or CHEM 750

CHEM 751 **15 Points**
CHEM 751A **7.5 Points**
CHEM 751B **7.5 Points**
Advanced Topics in Chemistry 2
A modular course comprising topics in physical, inorganic, organic and analytical chemistry related to departmental

research interests, which will vary from year to year. Students satisfactorily completing three modules will be awarded CHEM 750. Students satisfactorily completing an additional three modules will be awarded CHEM 751.
To complete this course students must enrol in CHEM 751 A and B, or CHEM 751

CHEM 760 **15 Points**
Advanced Green Chemistry
Examines topics that are of key global significance to sustainability such as human activities that exceed the planetary boundaries, global warming, ocean acidification, endocrine disrupting compounds, global population, imbalance of the phosphorus and nitrogen cycles, and extinction of species. No formal prerequisite, but knowledge of green chemistry at the level covered in CHEM 360 will be assumed.

CHEM 780 **15 Points**
Advanced Materials Chemistry
A selection of topics on the chemistry of advanced materials, including novel polymeric materials and materials characterisation and analysis. No formal prerequisite, but knowledge of materials chemistry at the level covered in CHEM 380 will be assumed.

CHEM 791 **30 Points**
CHEM 791A **15 Points**
CHEM 791B **15 Points**
Research Project - Level 9
Corequisite: CHEM 795
To complete this course students must enrol in CHEM 791 A and B, or CHEM 791

CHEM 793 **60 Points**
CHEM 793A **30 Points**
CHEM 793B **30 Points**
Honours Dissertation in Chemistry - Level 9
To complete this course students must enrol in CHEM 793 A and B, or CHEM 793

CHEM 794 **60 Points**
CHEM 794A **30 Points**
CHEM 794B **30 Points**
Dissertation - Level 9
Corequisite: CHEM 795
To complete this course students must enrol in CHEM 794 A and B, or CHEM 794

CHEM 795 **15 Points**
Research Methods in Chemistry - Level 9
Explores topics to provide students with key skills relevant to performing research in the chemical sciences. Selected topics include investigating and critically analysing the scientific literature, data visualisation and interpretation, good lab practice, including health and safety requirements, constructing a review article and preparing a research proposal.

CHEM 796A **60 Points**
CHEM 796B **60 Points**
MSc Thesis in Chemistry - Level 9
To complete this course students must enrol in CHEM 796 A and B

Computer Science

Stage I

COMPSCI 101 **15 Points**
Principles of Programming
A practical introduction to computers and computer programming in a high-level language. The course is lab-based and focuses on reading and writing computer programs. The course is intended for students who may wish to advance in Computer Science or in Information Systems and Operations Management.
Restriction: Cannot be taken with or after COMPSCI 105, 107, 130, 210-220, 230-289, 313-399

COMPSCI 110 **15 Points**
Introduction to Computer Systems
An introduction to the various layers that make up a modern computer system: encoding of data and instructions, hardware, low-level programming, operating systems, applications and communications.
Restriction: Cannot be taken with or after COMPSCI 210

COMPSCI 111 **15 Points**
An Introduction to Practical Computing
A practical introduction to computing. Topics include: web design, an overview of computer hardware and operating systems, effective use of common applications, using the internet as a communication medium, applying programming concepts, and social implications of technology.

COMPSCI 120 **15 Points**
Mathematics for Computer Science
Basic mathematical tools and methods needed for computer science are introduced. Elementary mathematical skills for defining, analysing and reasoning with abstract objects used in programming are developed. Topics include integers and rational numbers, strings and sets, methods of proof (including induction), algorithms and functions, and elementary introductions to graphs, trees, counting and probability.
Prerequisite: MATHS 102 or at least 13 credits in Mathematics at NCEA Level 3 or D in CIE A2 Mathematics or C in CIE AS Mathematics or 3 out of 7 in IB Mathematics
Restriction: Cannot be taken with, or after, COMPSCI 225, MATHS 254

COMPSCI 130 **15 Points**
Introduction to Software Fundamentals
Fundamental programming techniques and processes, such as conditionals, iteration, recursion, functions, testing and debugging. Efficient ways to organise and manipulate data, including sorting and searching algorithms. Writing software that uses and implements common abstract data types such as lists, stacks, queues, dictionaries and trees.
Prerequisite: COMPSCI 101, or B+ or higher in ENGGEN 131, or Achievement Standard NCEA Level 3 Digital Technologies and Programming: 91906 Use complex programming techniques to develop a computer program, or 91637 Develop a complex computer program for a specified task
Restriction: COMPSCI 105, 107

Stage II

COMPSCI 210 **15 Points**
Computer Organisation
The low level representation of data and algorithms in the computer. An introduction to computer organisation. The instruction execution model. Assembly and disassembly

of instructions. Assembly language programming. How a high-level language is implemented at the machine level. The memory subsystem. Hardware support necessary to implement a secure multi-user operating system.
Prerequisite: COMPSCI 110, 130

COMPSCI 215 **15 Points**
Data Communications and Security
An introduction to data communications: the OSI reference model, particularly how the lower layers combine to implement the application layer. An introduction to secure communication and computer systems.
Prerequisite: COMPSCI 110, 130, PHYSICS 140

COMPSCI 220 **15 Points**
Algorithms and Data Structures
An introduction to the analysis of algorithms and data structures. Common abstract data types and their implementations. Asymptotic complexity analysis. Sorting and searching algorithms. Depth-first and breadth-first search and applications. Graph optimisation problems.
Prerequisite: COMPSCI 120, 130
Restriction: COMPSCI 717, SOFTENG 284

COMPSCI 225 **15 Points**
Discrete Structures in Mathematics and Computer Science
An introduction to the foundations of computer science, mathematics and logic. Topics include logic, principles of counting, mathematical induction, recursion, sets and functions, graphs, codes, and finite automata.
Prerequisite: COMPSCI 120 or MATHS 120
Restriction: MATHS 254, SOFTENG 282

COMPSCI 230 **15 Points**
Object Oriented Software Development
The design and implementation of object-oriented programmes. Analysis and design. Modelling with UML. Design for reuse, for testing, and for ease of change. Programming with classes, objects and polymorphism.
Prerequisite: COMPSCI 130
Restriction: SOFTENG 281

COMPSCI 235 **15 Points**
Software Development Methodologies
An introduction to software development, including processes, best practices, tools and quality assurance techniques such as testing.
Prerequisite: COMPSCI 130
Restriction: COMPSCI 280

COMPSCI 289 **15 Points**
Research Seminar in Computer Science
An introduction to research topics in computer science. Students will be expected to prepare and deliver a review of research in a topic of their choice. Research articles will be provided during the course, and will consist of key scientific publications.
Prerequisite: Minimum GPA of 5.0 and COMPSCI 110, 120, 130

COMPSCI 290 **15 Points**
Special Topic

Stage III

COMPSCI 313 **15 Points**
Computer Architecture
Modern processor architectures. Principles of modern processor design; pipelining; memory hierarchies; I/O and network interfacing; compiler and OS support; embedded processors; performance; multiprocessing.
Prerequisite: COMPSCI 210, PHYSICS 140
Restriction: SOFTENG 363, COMPSYS 304

COMPSCI 315 **15 Points**
Data Communications Technologies
The structure of data communications and networks, including the internet, covering all levels of the communications architecture. The layered protocol model, data transmission and coding, link-level and local area network protocols, wide-area internet working, routing, transport and security protocols. Basic application protocols as the foundation for distributed computing.
Prerequisite: COMPSCI 210, 215
Restriction: COMPSCI 314

COMPSCI 316 **15 Points**
Cyber Security
Introduces various concepts related to software, system and network security. Covers a range of topics including attacks on privacy and attack surface, static and dynamic analysis of malware, hardware security (trusted computing base, secure boot, and attestation), network security and some hot topics in cryptography including elliptic curve, blockchain and bitcoin.
Prerequisite: COMPSCI 210, 215 or COMPSYS 201

COMPSCI 320 **15 Points**
Applied Algorithmics
Fundamental design techniques used for efficient algorithmic problem-solving and software development. Methods that yield algorithms that are both provably correct and efficient. Efficiency of algorithms to provide a basis for deciding which algorithm is best for the job. Limits on the power of computers and the theory of NP-completeness. An introduction to methods whose correctness or performance is not guaranteed.
Prerequisite: COMPSCI 220, and COMPSCI 225 or MATHS 254

COMPSCI 331 **15 Points**
Large-Scale Software Development
Students will understand how to develop large-scale software systems, and learn about the issues associated with large-scale software systems and techniques for addressing them.
Prerequisite: COMPSCI 230, 235
Restriction: SOFTENG 325

COMPSCI 335 **15 Points**
Web Programming and Distributed Services
Covers web programming concepts, with applications to data integration from heterogeneous and asynchronous collections. Building web and cloud clients and services, with emphasis on high-level declarative and functional techniques. Dynamic web applications. Security and performance as overarching factors of web application development.
Prerequisite: COMPSCI 230 and 15 points at Stage II in Computer Science, or SOFTENG 281

COMPSCI 340 **15 Points**
Operating Systems
Operating system principles. Multi-user systems. Virtualisation. Scheduling. Concurrent processes, threads, synchronisation and deadlock. Memory allocation and virtual memory. Managing files, disks and other peripherals. Security, protection and archiving. Distributed systems and algorithms, location, migration and replication

transparency. Real-time requirements. History of operating systems.
Prerequisite: COMPSCI 210, 230
Restriction: SOFTENG 370

COMPSCI 345 **15 Points**
Human-computer Interaction
Human behaviour and humans' expectations of computers. Computer interfaces and the interaction between humans and computers. The significance of the user interface, interface design and user centred design process in software development. Interface usability evaluation methodologies and practice. Includes a group development and evaluation project using current implementation techniques and tools.
Prerequisite: COMPSCI 230 or SOFTENG 206
Restriction: SOFTENG 350

COMPSCI 350 **15 Points**
Mathematical Foundations of Computer Science
The aim of this course is to present mathematical models for programming languages and computation, and derive some theorems regarding what can and cannot be computed. Abstract programming languages (finite automata, context-free grammars, Turing and register machines) are studied. Basic concepts for programming languages, limits on computational power and algorithmic complexity are presented. Church-Turing thesis and quantum computing are briefly and critically discussed.
Prerequisite: COMPSCI 220 or PHIL 222, and COMPSCI 225 or MATHS 254

COMPSCI 351 **15 Points**
Fundamentals of Database Systems
Database principles. Relational model, Relational Algebra, Relational Calculus, SQL, SQL and Programming Languages, Entity Relationship Model, Normalisation, Query Processing and Query Optimisation, ACID Transactions, Transaction Isolation Levels, Database Recovery, Database Security, Databases and XML.
Prerequisite: COMPSCI 220, and COMPSCI 225 or MATHS 254
Restriction: COMPSCI 751, SOFTENG 351

COMPSCI 361 **15 Points**
Machine Learning
Machine learning is a branch of artificial intelligence concerned with making accurate, interpretable, computationally efficient, and robust inferences from data to solve a given problem. Understand the foundations of machine learning, and introduce practical skills to solve different problems.
Prerequisite: COMPSCI 220, and 15 points from DATASCI 100, STATS 101, 108, and 15 points from COMPSCI 225, MATHS 254, 255
Restriction: COMPSCI 762

COMPSCI 367 **15 Points**
Artificial Intelligence
Covers algorithms and representational schemes used in artificial intelligence. AI search techniques (e.g., heuristic search, constraint satisfaction, etc.) for solving both optimal and satisficing tasks. Tasks such as game playing (adversarial search), planning, and natural language processing. Discusses and examines the history and future of AI and the ethics surrounding the use of AI in society.
Prerequisite: COMPSCI 220 and COMPSCI 225 or MATHS 254, or SOFTENG 282 and 284
Restriction: COMPSCI 761

COMPSCI 369 **15 Points**
Computational Methods in Interdisciplinary Science
Many sciences use computational methods that involve the development and application of computer algorithms and software to answer scientific questions. This course looks at how to tackle these interdisciplinary problems through methods like probabilistic computer modelling, computer-based statistical inference, and computer simulations. The material is largely motivated by the life sciences but also uses examples from other sciences. It focuses on modelling and analysing real-world data with an emphasis on analysing DNA sequence data. No background in physical or life sciences is assumed.
Prerequisite: COMPSCI 220, and COMPSCI 225 or MATHS 254

COMPSCI 373 **15 Points**
Computer Graphics and Image Processing
Basic geometric processes including transformations; viewing and projection; back projection and ray tracing. Graphics modelling concepts: primitives, surfaces, and scene graphs, lighting and shading, texture mapping, and curve and surface design. Graphics and image processing fundamentals: image definition and representation, perception and colour models, grey level and colour enhancement, neighbourhood operations and filtering. Use of the OpenGL graphics pipeline.
Prerequisite: COMPSCI 210, 230, or COMPSYS 201 and SOFTENG 281
Restriction: COMPSCI 771

COMPSCI 380 **15 Points**
COMPSCI 380A **7.5 Points**
COMPSCI 380B **7.5 Points**
Project in Computer Science
Each student taking one of these courses will be expected to do an individual practical project under the supervision of a member of staff. Only students with excellent academic records will be allowed to take these courses, and only after a supervisor and topic have been agreed upon by the Head of Department.
Prerequisite: Approval of Academic Head or nominee
Restriction: COMPSCI 690
To complete this course students must enrol in COMPSCI 380 A and B, or COMPSCI 380

COMPSCI 389 **15 Points**
Research Methods in Computer Science
An overview of research methods and techniques used across the discipline of Computer Science, including formal proof techniques and empirical methods that involve quantitative and/or qualitative data. Students will be expected to apply the research methods in a collaborative research project.
Prerequisite: GPA of 5.0 or higher and COMPSCI 289 and 30 points at Stage II in Computer Science

COMPSCI 390 **15 Points**
Special Topic

COMPSCI 391 **15 Points**
Special Topic

COMPSCI 392 **15 Points**
Special Topic

COMPSCI 393 **15 Points**
Special Topic

COMPSCI 399 **15 Points**
Capstone: Computer Science
Students work in small groups to complete a substantial

problem applying the knowledge learnt from the different courses in the Computer Science major. Teams are expected to reason on a problem, devise a solution, produce an artefact and present their work. The capstone provides an opportunity for students to further develop their technical and communication skills.
Prerequisite: 30 points at Stage III in Computer Science and COMPSCI 210, 220, 230

Diploma Courses

COMPSCI 601 **15 Points**
Special Topic
Prerequisite: Approval of the Academic Head or nominee

COMPSCI 690A **15 Points**
COMPSCI 690B **15 Points**
Graduate Diploma Research Project
Restriction: COMPSCI 380
To complete this course students must enrol in COMPSCI 690 A and B

COMPSCI 691A **15 Points**
COMPSCI 691B **15 Points**
Postgraduate Diploma Research Project
Restriction: COMPSCI 780
To complete this course students must enrol in COMPSCI 691 A and B

Postgraduate 700 Level Courses

COMPSCI 700 **15 Points**
Special Topic

COMPSCI 701 **15 Points**
Creating Maintainable Software
Developing maintainable software has been an ongoing challenge in the software industry. This course presents the principles and practices that have been proposed for developing maintainable software systems. It will evaluate and critique these principles and practices through examining their application in practice and through understanding the research on their effectiveness. Recommended preparation: COMPSCI 331 or 718

COMPSCI 702 **15 Points**
Security for Smart-devices
Covers security features supported by the different platforms for smart devices. Provides an overview of the most popular OS platforms in the market and focuses on security for Android and iOS. Recommended preparation: COMPSCI 340

COMPSCI 703 **15 Points**
Generalising Artificial Intelligence
AI deep learning has significantly advanced image understanding, language modelling, speech recognition, game playing, and more. These developments enable near-human capabilities in text and image generation. Explores highly specialised knowledge in planning, reasoning, explanation, natural language understanding, and knowledge acquisition, and assess their contribution to highly competent, general AI systems. Includes a significant individual research project.
Prerequisite: 15 points from COMPSCI 361, 367, 761, 762, or COMPSCI 713 and 714

COMPSCI 704 **15 Points**
Fundamentals in Human-Computer Interaction
Human behaviour and humans' expectations of interaction. Computer interfaces and the interaction between humans and computers. The significance of the user interface, interface design and user centred design process in system development. Interface usability evaluation methodologies and practice. Includes processes of evaluation, design, and implementation using current techniques and tools.
Restriction: COMPSCI 345, SOFTENG 350

COMPSCI 705 **15 Points**
Advanced Topics in Human Computer Interaction
Human aspects of computer systems, relevant to commercial solution development and computer science research. Sample topics: advanced evaluation methods; support of pen and touch-based interaction; trends with domain specific user interface design, such as interfaces for enterprise systems.
Prerequisite: COMPSCI 345 or 704 or SOFTENG 350
Restriction: SOFTENG 702

COMPSCI 706 **15 Points**
Special Topic
Prerequisite: Approval of the Academic Head or nominee

COMPSCI 707 **15 Points**
Special Topic
Prerequisite: Approval of the Academic Head or nominee

COMPSCI 710 **15 Points**
Directed Study
Prerequisite: Approval of the Academic Head or nominee

COMPSCI 711 **15 Points**
Parallel and Distributed Computing
Computer architectures and languages for exploring parallelism, conceptual models of parallelism, principles for programming in a parallel environment, different models to achieve interprocess communication, concurrency control, distributed algorithms and fault tolerance. Recommended preparation: COMPSCI 320 or 335

COMPSCI 712 **15 Points**
AI Agency, Ethics and Society
Introduces students to a range of philosophical and normative topics relating to artificial intelligence. Examines key ideas of intelligence, privacy, consent, and discusses other ethical issues that arise in the development and use of AI. The importance of Māori rights and interests in AI and data are explored. Possible approaches to addressing these various concerns are considered.

COMPSCI 713 **15 Points**
AI Fundamentals
Examines the core concepts and techniques in AI, including breakthroughs in symbolic AI, machine learning, and neural networks. Real-world applications are presented, with a focus on AI research in Aotearoa/NZ and ethical considerations. The course is designed to be accessible to students with limited programming experience.

COMPSCI 714 **15 Points**
AI Architecture and Design
Equips students with the ability to develop AI applications by introducing well-established AI frameworks and using web-based interactive computing platforms. Students will acquire the skills to implement simple AI techniques using these frameworks and evaluate their performance. Introduces basic practical technologies to investigate artificial intelligence techniques.

COMPSCI 715 **15 Points**
Advanced Computer Graphics
An advanced look at current research issues in computer graphics. Typical topics include: ray-tracing acceleration

methods; radiosity; subdivision surfaces; physically-based modelling; animation; image-based lighting and rendering; non-photorealistic rendering; advanced texturing. Recommended preparation: COMPSCI 373
Prerequisite: Approval of the Academic Head or nominee

COMPSCI 717 **30 Points**
Fundamentals of Algorithmics
Fundamental techniques are covered for the design of algorithms such as greedy algorithms, divide-and-conquer, and dynamic programming. Data structures are explored that help implement algorithms. Essential tools are taught for analysing algorithms, for example worst- and average-case analyses of space and time. Recommended preparation: COMPSCI 120, 130
Restriction: COMPSCI 220, 320, SOFTENG 250, 284

COMPSCI 718 **30 Points**
Programming for Industry
An examination of object-oriented programming and design. Key principles of object-oriented programming: typing, encapsulation, inheritance, polymorphism and composition. Fundamental object-oriented modelling and design techniques. Students will develop application software of reasonable complexity that draws on object-oriented language features, and contemporary APIs, frameworks and tools.

COMPSCI 719 **30 Points**
Programming with Web Technologies
An examination of developing web-based applications. Client-side technologies: HTML, CSS and Javascript. Server-side technologies to support dynamic Web pages and data access. Fundamental relational database concepts and design techniques. Principles of Web-application design. HCI considerations and mobile clients. Students will build a Web-based application that dynamically generates content involving relational database access.

COMPSCI 720 **15 Points**
Advanced Design and Analysis of Algorithms
Selected advanced topics in design and analysis of algorithms, such as: combinatorial enumeration algorithms; advanced graph algorithms; analytic and probabilistic methods in the analysis of algorithms; randomised algorithms; methods for attacking NP-hard problems. Recommended preparation: COMPSCI 320

COMPSCI 721 **15 Points**
Randomised Algorithms and Probabilistic Methods
Randomised algorithms are algorithms that "flip coins" to make decisions. In many cases, such algorithms are faster, simpler, or more elegant than the classical, deterministic ones. Covers basic principles and techniques used to design and analyse randomised algorithms, and applications of randomised methods in mathematics and computer science. Recommended preparation: STATS 125, COMPSCI 225 or MATHS 254, COMPSCI 320

COMPSCI 725 **15 Points**
Usable Security and Privacy Engineering
The human aspect of cyber security and privacy engineering is relevant to commercial solution development and cyber security and privacy research. Sample topics: secure systems design; usable security systems evaluation; privacy-preserving software systems; threat modelling; economics of usable security and privacy; OWASP Top 10 vulnerabilities. Recommended preparation: 30 points from COMPSCI 313, 314, 320, 335, 340, 351, 702, 734, 742

COMPSCI 726 **15 Points**
Network Defence and Countermeasures
Focuses on the use and deployment of protective systems used in securing internal and external networks. Examines in detail the widely used protocols including SSL, IPSec, DNSSEC as well as covers infrastructure platform protocols including wireless security (IEEE 802.11). Explores current research and developments in the area of network defence and countermeasures. Recommended preparation: COMPSCI 314, 315

COMPSCI 727 **15 Points**
Cryptographic Management - Level 9
Builds on best practices, and compliance standards to establish an advanced understanding of modern cryptographic systems used in securing communications and data storage. Advanced knowledge in modern cryptography management issues such as algorithm selection, generation, distribution, and revocation of encryption keys are applied through a research-based report and a group project. Recommended preparation: COMPSCI 210 or MATHS 120

COMPSCI 732 **15 Points**
Software Tools and Techniques
An advanced course examining research issues related to tools and techniques for software design and development. Topics include: techniques for data mapping and data integration, software architectures for developing software tools, issues in advanced database systems. Recommended preparation: COMPSCI 331 or SOFTENG 325 or COMPSCI 718 and 719
Restriction: SOFTENG 750

COMPSCI 734 **15 Points**
Web, Mobile and Enterprise Computing
Examines advanced and emerging software architectures at the confluence of XML, web services, distributed systems, and databases. Includes advanced topics in areas such as: mobile computing, remoting, web services for enterprise integration, workflow orchestrations for the enterprise, peer-to-peer computing, grid computing. Recommended preparation: COMPSCI 335 or 718

COMPSCI 742 **15 Points**
Advanced Internet: Global Data Communications
The course covers wide area networks, global routing, network and protocol performance, buffering and queuing, advanced network measurement, network application performance, content networks, and advanced networking concepts. Recommended preparation: COMPSCI 314 or 315

COMPSCI 747 **15 Points**
Computing Education
An overview of topics related to the use of technology in education and how people learn computer science concepts. Topics include research methodologies used in computer science education, how novices learn to program, and how technology can engage students in active learning, facilitate collaboration and enhance traditional educational practice. Recommended preparation: 30 points at Stage III in Computer Science or COMPSCI 718

COMPSCI 750 **15 Points**
Computational Complexity
Definitions of computational models and complexity classes: time complexity (e.g., P and NP), space complexity (e.g., L and PSPACE), circuit and parallel complexity (NC), polynomial-time hierarchy (PH), interactive complexity (IP), probabilistic complexity (BPP), and fixed-parameter

complexity. Recommended preparation: COMPSCI 320 or 350

COMPSCI 751 **15 Points**
Advanced Topics in Database Systems
Database principles. Relational model, relational algebra, relational calculus, SQL, SQL and programming languages, entity-relationship model, normalisation, query processing and query optimisation, ACID transactions, transaction isolation levels, database recovery, database security, databases and XML. Research frontiers in database systems. Recommended preparation: COMPSCI 220, 225 or COMPSCI 718
Restriction: COMPSCI 351, SOFTENG 351

COMPSCI 752 **15 Points**
Big Data Management
The deep diversity of modern-day data from many companies requires data scientists to master many technologies that rely on new principles to represent, describe, access, and analyse data. The course will provide insight into the rich landscape of big data modelling, management, and analysis in distributed and heterogeneous environments. Recommended preparation: COMPSCI 220, 351

COMPSCI 753 **15 Points**
Algorithms for Massive Data
Modern enterprises and applications such as electronic commerce, social networks, location services, and scientific databases are generating data on a massive scale. Analysis of such data must be carried out by scalable algorithms. This course exposes data science practitioners and researchers to various advanced algorithms for processing and mining massive data, and explores best-practices and state-of-the-art developments in big data. Recommended preparation: COMPSCI 320

COMPSCI 760 **15 Points**
Advanced Topics in Machine Learning
An overview of the learning problem and the view of learning by search. Covers advanced techniques for learning such as: decision tree learning, rule learning, exhaustive learning, Bayesian learning, genetic algorithms, reinforcement learning, neural networks, explanation-based learning and inductive logic programming. Advanced experimental methods necessary for understanding machine learning research.
Prerequisite: COMPSCI 361 or 762

COMPSCI 761 **15 Points**
Advanced Topics in Artificial Intelligence
Examines the cornerstones of AI: representation, utilisation, and acquisition of knowledge. Taking a real-world problem and representing it in a computer so that the computer can do inference. Utilising this knowledge and acquiring new knowledge is done by search which is the main technique behind planning and machine learning. Research frontiers in artificial intelligence.
Prerequisite: COMPSCI 220 and 225, or COMPSCI 220 and MATHS 254, or COMPSCI 713 and 714, or COMPSCI 718
Restriction: COMPSCI 367

COMPSCI 762 **15 Points**
Foundations of Machine Learning
Machine learning is a branch of artificial intelligence concerned with making accurate, interpretable, computationally efficient, and robust inferences from data to solve a given problem. Students will be introduced to the foundations of machine learning and will gain practical skills to solve different problems. Students will explore research frontiers in machine learning.
Prerequisite: COMPSCI 713 and 714, or COMPSCI 718, or 15 points from DATASCI 100, STATS 101, 108 and COMPSCI 220 or 717 and COMPSCI 225 or MATHS 254
Restriction: COMPSCI 361

COMPSCI 764 **15 Points**
Deep Learning - Level 9
Critically analyses the fundamentals of deep neural networks alongside current state-of-the-art advancements in this field. Students will acquire specialised knowledge in state-of-the-art deep learning architectures and gain the ability to apply deep learning in various fields, including natural language processing and computer vision. Includes a significant individual research project.
Prerequisite: COMPSCI 361 or 762, or COMPSCI 713 and 714

COMPSCI 765 **15 Points**
Modelling Minds
How can researchers of artificial intelligence effectively model subjective aspects of minds, such as emotional states, desires, perceptual experience and intrinsic goals? This course draws upon interdisciplinary methods and considers classic and emerging approaches to try to answer this question. Recommended preparation: COMPSCI 367

COMPSCI 767 **15 Points**
Intelligent Software Agents
An introduction to the design, implementation and use of intelligent software agents (e.g., knowbots, softbots etc). Reviews standard artificial intelligence problem-solving paradigms (e.g., planning and expert systems) and knowledge representation formalisms (e.g., logic and semantic nets). Surveys agent architectures and multi-agent frameworks.
Prerequisite: COMPSCI 367 or 761, or COMPSCI 713 and 714

COMPSCI 769 **15 Points**
Natural Language Processing - Level 9
Examines the progress in enabling AI systems to use natural language for communication and knowledge storage. Explores knowledge formalisation, storage, multiple knowledge systems, theory formation, and the roles and risks of belief, explanation, and argumentation in AI. Includes a significant individual research project.
Prerequisite: COMPSCI 361 or 762, or COMPSCI 713 and 714

COMPSCI 771 **15 Points**
Advanced Topics in Computer Graphics and Image Processing
Basic geometric processes including transformations; viewing and projection; back projection and ray tracing. Graphics modelling concepts: primitives, surfaces, and scene graphs, lighting and shading, texture mapping, and curve and surface design. Graphics and image processing fundamentals: image definition and representation, perception and colour models, grey level and colour enhancement, neighbourhood operations and filtering. Use of the OpenGL graphics pipeline. Research frontiers in computer graphics and image processing. Recommended preparation: COMPSCI 210, 230
Restriction: COMPSCI 373

COMPSCI 773 **15 Points**
Intelligent Vision Systems
Computational methods and techniques for computer vision are applied to real-world problems such as 2/3D face biometrics, autonomous navigation, and vision-guided robotics based on 3D scene description. A particular feature of the course work is the emphasis on complete

system design. Recommended preparation: COMPSCI 373 and 15 points at Stage II in Mathematics

COMPSCI 778 **60 Points**
Internship - Level 9
Enables the development of practical knowledge and hands-on experience through a supervised internship in the IT industry. Students complete a research-informed project, and present both written and oral reports of their findings.

COMPSCI 779 **30 Points**
COMPSCI 779A **15 Points**
COMPSCI 779B **15 Points**
Internship - Level 9
Enables students to gain workplace experience, the development of practical knowledge, and hands-on experience on research-informed AI projects through a supervised internship with an external organisation. At the end of the internship, students are expected to present both written and oral reports of their findings.
Prerequisite: Academic Head or nominee approval
To complete this course students must enrol in COMPSCI 779 A and B, or COMPSCI 779

COMPSCI 780 **15 Points**
COMPSCI 780A **7.5 Points**
COMPSCI 780B **7.5 Points**
Postgraduate Project in Computer Science 1
Prerequisite: Approval of Academic Head or nominee
Restriction: COMPSCI 691
To complete this course students must enrol in COMPSCI 780 A and B, or COMPSCI 780

COMPSCI 789A **15 Points**
COMPSCI 789B **15 Points**
Honours Research Project - Level 9
Prerequisite: Approval of Academic Head or nominee
To complete this course students must enrol in COMPSCI 789 A and B

COMPSCI 791 **30 Points**
COMPSCI 791A **15 Points**
COMPSCI 791B **15 Points**
Research Project - Level 9
To complete this course students must enrol in COMPSCI 791 A and B, or COMPSCI 791

COMPSCI 792 **30 Points**
COMPSCI 792A **15 Points**
COMPSCI 792B **15 Points**
Research Project - Level 9
Prerequisite: Academic Head or nominee approval
To complete this course students must enrol in COMPSCI 792 A and B, or COMPSCI 792

COMPSCI 796A **60 Points**
COMPSCI 796B **60 Points**
MSc Thesis in Computer Science - Level 9
To complete this course students must enrol in COMPSCI 796 A and B

Data Science

Stage I

DATASCI 100 **15 Points**
Data Science for Everyone
Explores how to use data to make decisions through the use of visualisation, programming/coding, data manipulation, and modelling approaches. Students will develop conceptual understanding of data science through active participation in problems using modern data, hands-on activities, group work and projects. DATASCI 100 will help students to build strong foundations in the science of learning from data and to develop confidence with integrating statistical and computational thinking.

Stage III

DATASCI 399 **15 Points**
Capstone: Creating Value from Data
A group-based project in which students showcase their skills in collaboratively creating value from data. Within a given data science domain, teams will jointly develop a research question, apply their skills to gather, structure, and analyse data to address the question, and communicate their findings effectively. The insights, their implications, limitations, and future work will be discussed by the group. Each team member will write an individual report about the project.
Prerequisite: 30 points at Stage III in Data Science

Postgraduate 700 Level Courses

DATASCI 709 **30 Points**
Data Management
Data management is the practice of collecting, preparing, organising, storing, and processing data so it can be analysed for business decisions. The course will use R and SQL to illustrate the process of data management. This will include principles and best practice in data wrangling, visualisation, modelling, querying, and updating.
Prerequisite: COMPSCI 130, MATHS 108, and 15 points from STATS 101, 108, or equivalent
Restriction: COMPSCI 351, 751, STATS 383, 707, 765

DATASCI 779 **15 Points**
Statistical Computing Skills for Professional Data Scientists - Level 9
Fundamental topics taught in statistical computing and data management including use of data analytic software such as Excel and R for data analysis, programming, graphics, cleaning and manipulating data, use of regular expressions, mark-up languages LaTeX, and R Markdown, use of SQL and DBMSs, reproducible research and symbolic computation. Students will undertake assigned individual research projects to be presented in-class.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 208, 707
Restriction: STATS 779

DATASCI 791 **30 Points**
DATASCI 791A **15 Points**
DATASCI 791B **15 Points**
Research Project - Level 9
To complete this course students must enrol in DATASCI 791 A and B, or DATASCI 791

DATASCI 792 **45 Points**
DATASCI 792A **15 Points**
DATASCI 792B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in DATASCI 792 A and B, or DATASCI 792

Earth Sciences

Stage I

EARTHSCI 105 **15 Points**

EARTHSCI 105G **15 Points**

Earth's Natural Hazards

New Zealand experiences many natural hazards caused by the Earth's natural processes through earthquakes, volcanic eruptions, weather bombs, storm surge, tsunami, flooding and wildfires. Focuses on spatial and temporal occurrences of disasters, hazard preparedness and recovery, and societal responses that affect and, sometimes, compound the magnitude of disasters. Case studies are drawn from contemporary and ancient societies.

Stage II

EARTHSCI 202 **15 Points**

4.5 Billion Years of Earth and its Life

Earth's surface is dynamic, constantly interacting with the oceans and atmosphere while recycling its rocks. Rocks contain Earth's physical and biologic history, recording life-changing events such as mass extinctions and global glaciations. Through the introduction of multidisciplinary techniques, the course explores how rocks are used to reveal Earth's long history, and how they help give a glimpse into its future.

Prerequisite: 60 points passed or 30 points from ENV 100-103

EARTHSCI 203 **15 Points**

Earth's Resources and Future

Humans depend on Earth's mineral and energy resources, but they are finite and their use creates environmental wastes. The course focuses on mineral and rock formation, and how they can be interpreted to understand the natural processes operating in the Earth System. Examines the expanding and changing use of resources and the need for stewardship of Earth for our future.

Prerequisite: 60 points passed or 30 points from ENV 100-103

EARTHSCI 208 **15 Points**

Buckled and Broken: Our Stressed Planet

Introduces techniques used to analyse and understand folds, faults and stresses within the Earth. Focuses on how to interpret and extract useful information from geologic maps, construct geologic cross-sections, and synthesise analytical results into a coherent structural history, while gaining an appreciation of the relevance of such studies to modern society.

Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: EARTHSCI 204

EARTHSCI 209 **15 Points**

Special Topic

EARTHSCI 220 **15 Points**

Practice in Earth Sciences 1

A practical and field based course that introduces and develops theory and work flows to enable students to read, document and interpret landforms and landscapes in 4-D. Students will be required to participate in a residential field experience and undertake independent field work.

Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: EARTHSCI 201, 260

Stage III

EARTHSCI 303 **15 Points**

Sedimentary Systems

An advanced course that critically examines ancient and contemporary sedimentary systems. State of the art techniques and technologies (sedimentology, geomorphology, modelling) are used to examine the physical and biological processes in freshwater and marine environments. The application of sedimentary systems in the context of Earth's resources and the current energy transition are highlighted.

EARTHSCI 307 **15 Points**

Earth's Changing Climate

An exploration of long-term climatic and environmental variability from deep time to the present - all placed in the context of our warming world. Emphasis is on the nature and drivers of climate change, and the tools used for analysis of past climate impacts on Earth landscapes, the hydrosphere and the biosphere.

Prerequisite: 45 points at Stage II, including 15 points from EARTHSCI 201, 202, 220, GEOG 260-263, or equivalent

EARTHSCI 308 **15 Points**

Tectonic and Magmatic Systems

Explores the tectonic and magmatic evolution of Earth and planetary systems, including their formation, composition, and how they deform. Students are exposed to seminal literature covering the various geological, geochemical, geophysical, and modelling tools and methods used for deciphering Earth deformation and magmatism, and the critical feedbacks between these processes. Recommended preparation: EARTHSCI 203, 208

Restriction: EARTHSCI 304, 305

EARTHSCI 309 **15 Points**

Special Topic

EARTHSCI 315 **15 Points**

Analytical Skills in Geology

A laboratory and field-based course expanding a student's ability to collect, synthesise and analyse the range of datasets encountered in Earth Sciences, in disciplines such as geochemistry, sedimentology, structural geology and geophysics. Activities focus around a residential geological field-trip, where students develop advanced quantitative field skills in geologically diverse settings, and provide a report synthesising and interpreting their collected data.

Prerequisite: EARTHSCI 220, 30 points from EARTHSCI 202, 203, 208, 262 and a Grade Point Average of 5.0 or higher

EARTHSCI 320 **15 Points**

Practice in Earth Sciences 2

A practical and field based course that embeds theory and work flows to enable students to read, document and interpret complex and vulnerable landforms and landscapes in 4-D. Students will be required to participate in a residential field experience and undertake independent field work.

Prerequisite: EARTHSCI 220
Restriction: EARTHSCI 301, GEOG 330

EARTHSCI 361 **15 Points**

Imaging the Subsurface

Geophysical imaging of the subsurface utilises contrasting rock and fluid properties. Applications include environmental, engineering, resource, hazard, and tectonic studies. Students will acquire and interpret geophysical

data by attending a one-day field trip and through laboratory sessions.
Prerequisite: 15 points at Stage II in Earth Sciences, Environmental Physics, Geophysics
Restriction: GEOLOGY 361, GEOPHYS 361

EARTHSCI 372 **15 Points**
Engineering Geology
An integration of quantitative and qualitative concepts in geology as applied to engineering projects. Fundamentals of soil and rock mechanics will be introduced. Topics covered in the course include landslides, dewatering schemes, contaminant transport, foundations, mines (open-pit and underground), dams, tunnels, urban geology, and transportation infrastructures. Case studies are used in lectures to demonstrate the importance of geology and water to engineering projects. Fieldwork is required.
Restriction: CIVIL 726, GEOLOGY 372

EARTHSCI 390 **15 Points**
Directed Study
Prerequisite: Permission of Academic Head

EARTHSCI 399 **15 Points**
Capstone: Earth Sciences
Conducting an Earth Science investigation involving a range of skills, as practised in research and industry careers. Students will undertake an independent research project involving field, desktop and/or laboratory work, and communicate the results in written and oral formats. Skills gained include ability to design a research project, collect and analyse qualitative and quantitative Earth Science data, and research communication.
Prerequisite: 30 points at Stage III in Earth Sciences

Postgraduate 700 Level Courses

EARTHSCI 703 **15 Points**
Hydrothermal Systems
Active hydrothermal systems are dynamic and significant to national energy requirements, hazards assessment and understanding planetary evolution. Geologic, hydrologic, and geochemical features of hydrothermal systems are considered with an emphasis on hydrothermal systems, sustainable geothermal energy extraction, mechanisms underpinning hydrothermal eruptions, and the potential role of hydrothermal systems in origin of/early life scenarios and the search for extra-terrestrial life.

EARTHSCI 704 **15 Points**
Directed Study in Earth Sciences
Prerequisite: Head of School approval

EARTHSCI 705 **15 Points**
Geohazards
Contemporary methods used to identify and assess natural hazards, techniques used for the probabilistic forecasting, spatial representation and communication of hazards. How the relationship between hazard information, risk mitigation and emergency management is addressed. There will be a strong focus on the use of case studies.

EARTHSCI 709 **15 Points**
Special Topic

EARTHSCI 714 **15 Points**
Faults and Fluids
Fault-fluid interaction is critical in earthquake dynamics and hydrothermal systems that have implications for geothermal energy, ore mineralisation and, via hydrothermal alteration, land stability. We will explore the fundamentals of these interactions and their relevance to hazard and resource challenges of society today. This course will be anchored by a strong in-person field component.
Restriction: EARTHSCI 706

EARTHSCI 720 **15 Points**
Environmental Geochemistry
Provides a broad overview of applications of geochemistry across multiple disciplines. In addition, this course will help determine the suitability of different analytical techniques to different problems while providing practical experience in collecting and evaluating geochemical data. Subject areas are wide-reaching and include, geology, environmental science, biology, archaeology, and forensic sciences. No formal prerequisite but knowledge of introductory chemistry will be assumed.

EARTHSCI 732 **15 Points**
Exploring Environmental Change
Sedimentary and biological records show that extreme, rapid and short-lived climatic and environmental changes occurred in the past. Case studies are used to introduce the tools used to identify and interpret abrupt environmental changes during the Last Glacial Period and Holocene that may have implications for the present and our future.

EARTHSCI 752 **15 Points**
Volcanoes
Volcanoes were an important part in the formation of Earth's crust and atmosphere and influenced the evolution of life. Today, volcanoes play an important role in society from hazards and resources to recreation. This course covers how and why volcanoes erupt from magma processes in the mantle to eruption at the surface.

EARTHSCI 754 **15 Points**
Integrated Sedimentology and Tectonics
Develops an advanced and practical understanding of how sedimentary and tectonic processes relate to one another. Case studies, field work, guest lectures and discussions will allow critical examination of the latest research into the dynamics of tectonic and sedimentary environments.

EARTHSCI 770 **15 Points**
Engineering Geological Mapping
A field-based course which provides hands-on experience in outcrop mapping, geomorphic mapping, and simple field testing of rocks and soils for geotechnical purposes.

EARTHSCI 771 **15 Points**
Advanced Engineering Geology
Advanced engineering geology focused on engineering practice. Interpretation of in-situ testing and laboratory test data (including groundwater) for the derivation of design parameters for input into numerical modeling software. The topics covered include, but are not limited to, design and analysis of site investigation, advanced core logging, slope stability analysis, rock fall assessment, introduction to numerical modeling, liquefaction and seismic hazard assessment for engineering design.

EARTHSCI 772 **15 Points**
Hydrogeology
Introduces aquifers and aquifer properties; the various processes and techniques utilised in the discovery, development and assessment of groundwater resources; groundwater in construction; groundwater contamination.

EARTHSCI 785 **60 Points**
EARTHSCI 785A **30 Points**
EARTHSCI 785B **30 Points**
BAdvSci(Hons) Dissertation in Geology - Level 9
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead
To complete this course students must enrol in EARTHSCI 785 A and B, or EARTHSCI 785

EARTHSCI 789 **30 Points**
EARTHSCI 789A **15 Points**
EARTHSCI 789B **15 Points**
Honours Research Project - Level 9
To complete this course students must enrol in EARTHSCI 789 A and B, or EARTHSCI 789

EARTHSCI 794A **30 Points**
EARTHSCI 794B **60 Points**
Thesis in Engineering Geology - Level 9
To complete this course students must enrol in EARTHSCI 794 A and B

EARTHSCI 796A **60 Points**
EARTHSCI 796B **60 Points**
MSc Thesis in Earth Sciences - Level 9
To complete this course students must enrol in EARTHSCI 796 A and B

Ecology

Stage III

ECOLOG 301 **15 Points**
Advanced Research Skills in Ecology
Research design and associated methods from the component fields of ecology. A series of field trips to differing habitats are a central component of the course. During these trips students will be supervised in small groups and apply selected research methods and techniques to complete a research project.
Prerequisite: BIOSCI 206

Postgraduate 700 Level Courses

ECOLOG 789 **60 Points**
ECOLOG 789A **30 Points**
ECOLOG 789B **30 Points**
Dissertation - Level 9
Prerequisite: 15 points from BIOSCI 761, 762, ENVSCI 701
To complete this course students must enrol in ECOLOG 789 A and B, or ECOLOG 789

Environment

Stage I

ENV 100 **15 Points**
Shaping Planet Earth
We inhabit a dynamic planet that impacts our everyday lives. Take a journey from Earth's cataclysmic beginnings to the unprecedented scale of present-day changes to our land, rivers, coasts, and oceans. By examining Earth's processes, hazards, and resources we demonstrate how an understanding of past and present environments will enhance our future.

ENV 101 **15 Points**
Environmental Challenges
From the climate crisis to biodiversity loss, you will explore the scientific foundations of the environmental challenges we face. The complexity of environmental problems and the role of humans within environmental systems are considered. Emphasis is placed on acquiring the scientific knowledge and skill sets required to create innovative, feasible, and sustainable solutions to these issues.

ENV 102 **15 Points**
Social and Environmental Change
The uneven effects of globalisation and social transformations are radically reshaping our worlds. How did we get here and what can we do about it? Using diverse local and global case-studies, this course examines how we navigate social and environmental change. Students will explore social processes to gain a foundational understanding of inequality, sustainability, and environmental and social justice.

ENV 103 **15 Points**
Digital Earth
Explore the interdisciplinary realm of Digital Earth, integrating geospatial techniques and data science to understand socio-environmental processes. A diverse range of analytical and visualisation tools are used to examine Earth, environmental, and societal systems. Students will gain a deeper understanding of how digital technologies transform our knowledge about the planet and enable informed decision-making for addressing environmental and societal challenges.

Environmental Change

Stage III

ENVCHG 300 **15 Points**
Environmental Change
An exploration of the nature and causes of change in the physical environment, including: natural processes driving environmental change and variability; humans as agents of change; and biophysical and societal sensitivity to change. Past, present and future interactions between society and environmental change with examples drawn from climatology and ecology. Principles of scientific writing and communication will also be addressed.
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead
Restriction: GEOG 334

Postgraduate 700 Level Courses

ENVCHG 789 **60 Points**
ENVCHG 789A **30 Points**
ENVCHG 789B **30 Points**
BAdvSci(Hons) Dissertation in Environmental Change - Level 9
Prerequisite: Programme Coordinator approval
To complete this course students must enrol in ENVCHG 789 A and B, or ENVCHG 789

Environmental Management

Postgraduate 700 Level Courses

ENVMGT 701 **15 Points**
Environmental Management in Practice - Level 9
Research and practice in Environmental Management. Students will explore alternative perspectives and methodologies applied in environmental management and

develop a research proposal that includes a critical review of a contemporary practice.

ENVMGT 741 **15 Points**
Social Change for Sustainability
Explores the concept of sustainability through different theoretical frameworks and how social and environmental movements have mobilised around this concept over time. Critically interrogates what is sustainable, what is social change, and how can social change be sustainable in a global economy. Draws on case studies of current environmental issues and associated popular social movements.

ENVMGT 742 **15 Points**
Social Dimensions of Global Environmental Change
An examination of the social dimensions of global environmental change. This includes a review of the history of climate science, the interaction of science with other knowledges, and contemporary debates surrounding climate change as well as other forms of environmental change. It also examines the different ways in which people respond to environmental risks and changes, and the challenges associated with mitigation and adaptation policies.

ENVMGT 743 **15 Points**
Environmental Policy
Debates surrounding environmental policy and governance provide insights into the complexities of environmental management issues. Examples of environmental governance will be considered at global and local scales. The roles of international agencies, nation-states, civil society and corporations in shaping environmental policy and governance are examined.

ENVMGT 744 **15 Points**
Resource Management
A review of advanced principles, concepts and approaches to the sustainable management of natural resources. Case studies emphasise the need for conflict resolution, equitable allocation, and decentralised decision-making to address the social and environmental impacts of resource utilisation.

ENVMGT 746 **15 Points**
Collaborative Environmental Management
An exploration of participatory management and its potential for engaging communities, resource users and stakeholders in the pursuit of sustainable development. Students will examine strategies for incorporating local knowledge within conservation practices and for reconciling natural resource management with human welfare, social justice and indigenous rights.

ENVMGT 748 **15 Points**
Coastal Management
Explores the physical, social and policy dimensions of coastal management. The nature of coastal environments is a function of physical coastal dynamics, the history of human occupation and utilisation of the coast, and governmental decision making. Discusses shifts in management approaches in the coastal environment, using national and international examples to highlight key coastal management issues.

ENVMGT 749 **15 Points**
Ethical Environmental Futures
We face urgent environmental challenges that require innovative responses to affect better environmental futures. This course will analyse environmental uncertainty and its implications; examine the interface between environmental technologies and society; consider environmental responsibilities, values and ethics; and situate environmental solutions within their wider sociopolitical and economic context. Students will engage with strategies to achieve sustainable and just outcomes.

ENVMGT 750 **15 Points**
Special Topic

ENVMGT 751 **15 Points**
River Management
Explores biophysical, socio-economic, cultural and institutional dimensions of river management, contextualising the situation in Aotearoa New Zealand in global terms. A proactive and precautionary approach engages generatively with river futures, scoping sustainable solutions to contemporary environmental problems. Policy, planning and on-the-ground applications are outlined.

ENVMGT 760 **15 Points**
Special Topic

ENVMGT 761 **15 Points**
Directed Study
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

ENVMGT 762 **15 Points**
Directed Study
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

ENVMGT 791 **30 Points**
ENVMGT 791A **15 Points**
ENVMGT 791B **15 Points**
Research Project - Level 9
To complete this course students must enrol in ENVMGT 791 A and B, or ENVMGT 791

ENVMGT 796A **60 Points**
ENVMGT 796B **60 Points**
MSc Thesis in Environmental Management - Level 9
To complete this course students must enrol in ENVMGT 796 A and B

Environmental Physics

Stage I

ENVPHYS 100 **15 Points**
ENVPHYS 100G **15 Points**
Sun, Sand, Surf: Science of Aotearoa
The atmosphere, oceans and land make up the dynamic environment of Aotearoa New Zealand. A range of phenomena with natural beauty can be described elegantly with simple scientific laws. This course establishes the physical principles underlying nature, empowering students to explain everyday environmental phenomena. These principles provide the foundation to unravel the science of Earth, climate and environmental change, and energy systems.

Stage II

ENVPHYS 200 **15 Points**
Earth Observations and Models
An experiential study of applications of environmental physics. The analysis and modelling of laboratory, field and remote sensing observations to explain the state and behaviour of the atmosphere, oceans and the solid earth.

Topics include radiation, cloud and aerosol processes, seismic waves and Earth's magnetic and gravity fields. It develops transferable skills in acquiring measurements, data analytical methods and laboratory techniques.
Prerequisite: 15 points from ENVPHYS 100, PHYSICS 100, 102, 120, 121, 160, EARTHSCI 120 and 15 points from MATHS 108, 110, 120, 130, 199, STATS 101-120
Restriction: GEOPHYS 213

Stage III

ENVPHYS 300 **15 Points**
Atmosphere, Ocean and Earth Physics
The physics basis for dynamical behaviours of the atmosphere, ocean, and solid earth. Topics include the general circulation in the atmosphere, development of storms and convection, emergence of climate states, as well as seismic, gravitational and magnetic imaging of the Earth's interior. An emphasis is placed on the fundamental conservation laws and processes that control geophysical systems.
Prerequisite: PHYSICS 201, and ENVPHYS 200 or GEOPHYS 213, and 15 points from ENGSCI 211, MATHS 253, 260
Restriction: GEOPHYS 310, 311

ENVPHYS 301 **15 Points**
Special Topic

ENVPHYS 370 **15 Points**
Directed Study
Prerequisite: Departmental approval

ENVPHYS 399 **15 Points**
Capstone: Environmental Physics
Students will employ core methodologies (experimental, observational, numerical) to investigate some aspect of climate and environmental systems such as key atmospheric, ocean or solid earth geophysical phenomenon. They will relate their findings to contemporary research in the field, considering wider societal aspects and issues. Students will develop their skills in communication, critical thinking, teaching and creative problem solving.
Prerequisite: ENVPHYS 300
Restriction: EARTHSCI 399, GEOG 399, PHYSICS 399

Postgraduate 700 Level Courses

ENVPHYS 700 **15 Points**
Frontiers in Climate Science
An up-to-date assessment of the state of the climate system that highlights changes in climate pertinent to future change. Evaluates climate using the latest scientific discoveries, evaluates information from observations and models of past, present and future climate. Leverages findings from scientific synthesis efforts and emphasises understanding Earth's climate as a basis for evaluating impacts of climate on wider environment and society.
Prerequisite: ENVPHYS 300

ENVPHYS 701 **15 Points**
Atmosphere and Ocean Dynamics
Explores physical processes underlying Earth's climate using observations, modelling and predictions. Spans geophysical fluid dynamics, Earth's energy budget, the meridional and vertical heat imbalances, and processes linked to seasonal and long-term climate variations and changes. Explores quasi-geostrophic and wave theory to describe general circulation, Hadley and midlatitude circulations in the atmosphere, Sverdrup balance and western boundary currents in the ocean.
Prerequisite: ENVPHYS 300 or 30 points from PHYSICS 201-203, 231, 240, 244, 251, 261
Restriction: GEOPHYS 711

ENVPHYS 702 **15 Points**
Subsurface Characterisation with Geophysical Methods
Pertains to subsurface characterisation through the inversion of geophysical observations. The course covers a combination of rock physics, seismic methods, ground-penetrating radar, as well as gravity, magnetic and electrical methods.
Prerequisite: 15 points from EARTHSCI 361, ENVPHYS 300, GEOPHYS 310
Restriction: GEOPHYS 761

ENVPHYS 703 **15 Points**
Special Topic

ENVPHYS 770 **15 Points**
Directed Study
Prerequisite: Departmental approval

ENVPHYS 780 **30 Points**
ENVPHYS 780A **15 Points**
ENVPHYS 780B **15 Points**
Research Project - Level 9
To complete this course students must enrol in ENVPHYS 780 A and B, or ENVPHYS 780

ENVPHYS 796A **60 Points**
ENVPHYS 796B **60 Points**
Thesis - Level 9
To complete this course students must enrol in ENVPHYS 796 A and B

Environmental Science

Stage II

ENVSCI 201 **15 Points**
Natural and Human Environmental Systems
An examination of current environmental issues in coupled natural and human systems such as urban environments. Interactions among biological, physical and social processes are discussed and means of measuring and managing the environmental outcomes of their interactions are addressed.
Prerequisite: 60 points passed or 30 points from ENV 100-103

ENVSCI 203 **15 Points**
Modelling Environmental Systems
An introduction to the philosophy and use of models in the study of a range of environmental systems, including coastal, ecological, fluvial, atmospheric and social. Students will develop skills in designing, communicating and critically assessing models of the environment.
Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: ENVSCI 310

ENVSCI 204 **15 Points**
Special Topic

Stage III

ENVSCI 301 **15 Points**
Environmental Science in Practice
Advances in environmental science, technology, and policy are explored using case studies of global environmental issues and proposed solutions. Students

apply environmental science to assess how science is used to inform environmental intervention and policy, and understand environmental responses.
Prerequisite: ENVSCI 201 or equivalent

ENVSCI 303 **15 Points**
Environmental Science, Risk and Society
An examination of the contemporary topics that shape the ways in which environmental science may be communicated and understood. Topics of discussion include issues of scientific uncertainty, risk communication, public trust and the role of media.

ENVSCI 304 **15 Points**
Special Topic

ENVSCI 390 **15 Points**
Directed Study
Prerequisite: Academic Head approval

ENVSCI 399 **15 Points**
Capstone: Environmental Science
Students will engage with the research process, as practised in environmental science. Independent or small group research will be undertaken under the guidance of an academic mentor. Students will research an environmental problem and possible solutions and communicate their findings. The emphasis is on research skills and assisting students in developing and implementing academic research.
Prerequisite: 30 points at Stage III in Environmental Science or 15 points at Stage III in Environmental Science and 15 points from other Stage III courses included in the major

Postgraduate 700 Level Courses

ENVSCI 701 **15 Points**
Research Practice in Environmental Science
An understanding of research in Environmental Science. Students will be introduced to a range of methodologies and will be challenged to critically analyse information and data. Principles of scientific writing and communication will also be addressed. Students will apply these skills by developing and writing a research proposal or critical review.

ENVSCI 704 **15 Points**
Modelling of Environmental Systems
The design and application of models for the investigation of environmental problems; understanding the role and utility of modelling in environmental science; the analysis and representation of environmental phenomena. Provides an understanding of modelling concepts, approaches and applications. An understanding of the material in ENVSCI 310, GEOG 250, MATHS 108 and STATS 101 will be assumed.

ENVSCI 705 **15 Points**
Handling Environmental Data
Contemporary approaches to understanding and analysing environmental data with an emphasis on developing skills to support the 'transformation, visualisation, modelling' cycle. The importance of adopting reproducible research practices (eg, data and code archiving) will be emphasised. The course focuses on an applied laboratory component and will be taught in open-source software. Assessment will be via projects analysing environmental data. No formal prerequisites but an understanding of basic statistical methods equivalent to STATS 101 will be presumed.

ENVSCI 706 **15 Points**
Special Topic

ENVSCI 707 **15 Points**
Directed Study in Environmental Science
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

ENVSCI 708 **15 Points**
Ecosystem Dynamics
Ecosystems have a critical role in regulating climate, soil, water, and air quality. Basic concepts of ecosystem ecology are introduced and the effects of human-induced changes on ecosystem processes are examined. The dynamics of key ecosystem processes (e.g. carbon and water cycling) and their driving factors are investigated. Students will conduct a research project linking theoretical and practical aspects of ecosystem science.

ENVSCI 711 **15 Points**
Environmental Impact Assessment - Level 9
A focus on the interdisciplinary, scientific assessment of environmental impacts with specific reference to applying this discipline in New Zealand. Methodologies used in the assessment, monitoring and regulation of environmental impacts will be discussed and critically evaluated. The contribution of Environmental Impact Assessment to policy and regulatory decisions in environmental management, including consenting procedures and plan-making processes and the roles and duties of public and professional participants, will be covered. A key component of the assessment is the preparation of an individual Environmental Impact Assessment report.

ENVSCI 713 **15 Points**
Air Quality and Atmospheric Processes
Monitoring, modelling and management will be considered with emphasis on air quality standards and guidelines and applications of science and technology to indoor and outdoor air pollution prevention, mitigation and remediation. Case studies and practical work will link the theoretical and practical aspects of air quality science.

ENVSCI 714 **15 Points**
Environmental Pollution
Contaminants of soil and water emitted by point and non-point sources. Monitoring of legacy and emerging contaminants, and impact assessment. Application of science and technology to pollution prevention, mitigation and remediation.

ENVSCI 734 **15 Points**
Restoration and Landscape Ecology
Restoration ecology is the scientific study of repairing degraded, damaged or destroyed ecosystems. It is a young but rapidly growing field that represents fundamental changes in human relationships to nature. Restoration draws on concepts from landscape ecology, and the two disciplines are inextricably linked. The course covers the issues of habitat fragmentation and edge effects in a restoration framework.

ENVSCI 737 **15 Points**
Applied Terrestrial Ecology
The dynamics of change in terrestrial ecosystems with a focus on forest and wetland environments. Students will be introduced to methods for vegetation assessment and ecosystem ecology, including multivariate statistical methods. Students are required to participate in a residential field course. No formal prerequisite but a knowledge of ecology equivalent to Stage II, including associated quantitative analysis, is assumed.

ENVSCI 738 **15 Points**
Water Sensitive Cities
This course probes experiments with radical urban change to examine the co-constitution of water-society in the pursuit of improved futures. A case study is built around the aspiration to become a Water Sensitive City. Students first employ quantitative methods to design a water sensitive neighbourhood. Students then critique reductionist approaches to becoming sustainable. The aim is to better understand the sustainable city debate and its emerging logics.

ENVSCI 790 **30 Points**
ENVSCI 790A **15 Points**
ENVSCI 790B **15 Points**
Research Project - Level 9
To complete this course students must enrol in ENVSCI 790 A and B, or ENVSCI 790

ENVSCI 794A **30 Points**
ENVSCI 794B **60 Points**
MEnvSci Thesis - Level 9
To complete this course students must enrol in ENVSCI 794 A and B

ENVSCI 796A **60 Points**
ENVSCI 796B **60 Points**
MSc Thesis in Environmental Science - Level 9
To complete this course students must enrol in ENVSCI 796 A and B

Exercise Sciences

Stage I

EXERSCI 100G **15 Points**
Exercise and Fitness: Myths and Reality
An introduction to the principles of physical exercise, with a focus on understanding how the body moves and responds to exercise, how performance can be measured, and how fitness can be developed and maintained to optimise health. Particular emphasis will be placed on the debunking of common myths about exercise, and offering evidence-based advice on the benefits of appropriate physical activity.
Restriction: BIOSCI 107, EXERSCI 101, 105, SPORTSCI 100G, 101, 105, MEDSCI 142

EXERSCI 101 **15 Points**
Foundations of Exercise and Sport Sciences
Introduction to the scientific principles and concepts underpinning the sub-disciplines of Exercise and Sport Sciences: Biomechanics, Exercise Physiology, Movement Neuroscience and Psychology. Content experts will provide a broad overview of the applications and career pathways of each sub-discipline using examples from research or industry. Academic literacy skills required in all sub-disciplines will be developed.
Restriction: SPORTSCI 101

EXERSCI 103 **15 Points**
Human Anatomy
The study of the gross anatomical organisation of the neural, muscular and skeletal systems, with particular reference to the neck, limbs, back and abdominal wall. Practical work includes gross anatomy laboratories and CD-ROM study.
Restriction: SPORTSCI 103

EXERSCI 105 **15 Points**
Exercise Prescription
An introduction to the risks and benefits of exercise, exercise policy and safety, physical fitness testing, guidelines for exercise test administration, principles of exercise prescription, cardiorespiratory and neuromuscular training.
Restriction: SPORTSCI 105, 205

Stage II

EXERSCI 201 **15 Points**
Exercise Physiology 1
Introduction to the physiological and biochemical requirements and provision of energy for acute exercise and recovery. A key focus is on the mechanisms involved in physiological system responses to aerobic and anaerobic exercise. Practical experiences will cover experimental and scientific procedures of measuring and reporting on physiological responses to acute exercise.
Prerequisite: 15 points from BIOSCI 107, EXERSCI 101, MEDSCI 142
Restriction: SPORTSCI 201

EXERSCI 203 **15 Points**
Biomechanics 1
Covers the mechanical basis of human movement, using quantitative and qualitative modelling approaches. Focuses on the analysis of sporting performance, locomotion, and musculoskeletal stress. Practical work explores key techniques in measurement and data analysis of human movement and the forces involved.
Restriction: SPORTSCI 203

EXERSCI 205 **15 Points**
Motor Learning
Introduction to the principles and stages of motor skill acquisition, and their application to sport and exercise. Key concepts include the structure of practice tasks, feedback, individual differences, growth and development, aging, injury, and relationships to the underlying neurobiology. Develops practical skills in the measurement of human motor performance, and in the development and assessment of individualised training programmes to improve skill.

EXERSCI 206 **15 Points**
Exercise Nutrition
A cross-disciplinary focus on nutrition, examining nutritional enhancement of sports performance, diet and physiological function, eating disorders, energy balance, body composition and the role of diet in growth and exercise.
Prerequisite: 30 points from MEDSCI 100-320 or BSc courses
Restriction: SPORTSCI 206

EXERSCI 207 **15 Points**
Sport Psychology
An introduction to the study of psychology as it relates to human behaviour and performance in sport settings. Key concepts include achievement motivation, individual differences, performing under pressure, psychological skills training, team dynamics, and their relationships to human motor behaviour and performance.
Prerequisite: 45 points passed at Stage I or II
Restriction: EXERSCI 304, SPORTSCI 304

EXERSCI 210 **15 Points**
Special Topic

EXERSCI 271 **15 Points**
Advanced Exercise Assessment and Prescription
This theoretical and workplace-based course integrates behavioural competencies in the application of advanced physical fitness assessment and design, and implementation of evidence-based, effective and individualised exercise programmes for the maintenance of health and physical fitness in apparently healthy individuals. Supervised practice of not less than 70 hours is provided.
Prerequisite: 45 points: EXERSCI 101, 103, 105

Stage III

EXERSCI 301 **15 Points**
Exercise Physiology 2
Systemic physiological responses and adaptations to exercise training and physical inactivity relevant to selected athletic and medical populations and across the lifespan. Skills will be developed in the interpretation of experimental methods and findings in human exercise physiology.
Prerequisite: 15 points from EXERSCI 201, MEDSCI 205, SPORTSCI 201
Restriction: SPORTSCI 301

EXERSCI 303 **15 Points**
Biomechanics 2
Advanced quantitative techniques in biomechanics used to study human movement including mathematical modelling and signal processing. An application area such as occupational ergonomics or clinical gait analysis will be used to demonstrate the biomechanical techniques.
Prerequisite: 15 points from ENGGEN 121, PHYSICS 160, EXERSCI 203, SPORTSCI 203
Restriction: SPORTSCI 303

EXERSCI 304 **15 Points**
Sport Psychology
The study of psychology as it relates to human behaviour and performance in sport settings. Key concepts include achievement motivation, individual differences, performing under pressure, psychological skills training, team dynamics, and their relationships to human motor behaviour and performance.
Prerequisite: EXERSCI 204 or SPORTSCI 204, or 45 points passed at Stage II or III
Restriction: EXERSCI 207, SPORTSCI 304

EXERSCI 305 **15 Points**
Movement Neuroscience
Examines brain and spinal cord organisation and function related to movement, and the neurological mechanisms involved in the planning, execution and control of movement in health and disease. Introduces the concept of neural plasticity as it relates to motor skill learning and recovery after injury in both healthy and neurologically impaired populations. An understanding of human anatomy at the level covered in EXERSCI 103 will also be assumed.
Prerequisite: 15 points from EXERSCI 201, 205, MEDSCI 206, 309, 320, PSYCH 202, SPORTSCI 201
Restriction: SPORTSCI 305

EXERSCI 307 **15 Points**
Psychology of Physical Activity
Introduction to the study of psychology as it relates to physical activity, sedentary behaviour and health. Key concepts include exercise motivation, mental health benefits of exercise, models of behaviour change, intervention design, special populations, and the relationship to the underlying neurophysiology and implications for physical activity behaviour.
Prerequisite: 45 points passed at Stage II or III
Restriction: EXERSCI 204, SPORTSCI 204

EXERSCI 309 **15 Points**
EXERSCI 309A **7.5 Points**
EXERSCI 309B **7.5 Points**
Project in Exercise Sciences
A supervised individual practical project in a clinical or other research laboratory setting to explore and assess how science underpins practical skills.
Prerequisite: 15 points at Stage II or III in Exercise Sciences and Departmental approval
Restriction: SPORTSCI 309
To complete this course students must enrol in EXERSCI 309 A and B, or EXERSCI 309

EXERSCI 310 **15 Points**
Special Topic

EXERSCI 371 **15 Points**
Practicum in Exercise and Sport Sciences
A workplace-based course of supervised practice of not less than 100 hours. Competencies will be developed in the application of advanced physical fitness assessment and design of evidence-based, effective and individualised exercise programmes for the maintenance of health and physical fitness in apparently healthy individuals.
Prerequisite: EXERSCI 271

EXERSCI 399 **15 Points**
Capstone: Applying Exercise Sciences
A supervised project course that will focus on applying theoretical knowledge to practical skills. Opportunities will include laboratory and clinic-based research projects, science communication or public engagement projects. Students will work in groups, but will also engage in individual activities to demonstrate their own understanding of topics.
Prerequisite: 15 points from EXERSCI 301, 303, 305, 307

Diploma Courses

EXERSCI 690A **15 Points**
EXERSCI 690B **15 Points**
Graduate Diploma Research Project
To complete this course students must enrol in EXERSCI 690 A and B

Postgraduate 700 Level Courses

EXERSCI 702 **15 Points**
Projects in the Exercise Sciences
Provides students with an opportunity to collect data in an area of interest, with the aim of validating an area of study towards their theses.
Restriction: SPORTSCI 702

EXERSCI 703 **15 Points**
Cardiac Rehabilitation
Seminal literature is used to explore the effects of exercise, physical activity and sedentary behaviour on cardiovascular physiology and pathophysiology within the context of disease prevention and rehabilitation.
Restriction: EXERSCI 720, 721, SPORTSCI 703

EXERSCI 704 **15 Points**
Advanced Techniques in Biomechanics
A laboratory-based course which explores the current biomechanics methodology for quantifying human

movements. Emphasis on motion capture, force measurement, accelerometers, clinical gait analysis, balance assessment, and electromyography. Students will apply biomechanical methods to clinical assessment.
Restriction: SPORTSCI 704

EXERSCI 705 **15 Points**
Research in the Exercise Sciences
Examines the nature and value of research contributions in the Exercise Sciences and their application to further research and evidence-based practice. Evaluates the process of research, inclusive of the development of research questions and hypotheses, the planning and collection of data in an ethical and unbiased manner, the analysis, interpretation and presentation of data and the dissemination of results.
Restriction: SPORTSCI 705

EXERSCI 706 **15 Points**
Seminar in Advanced Exercise Physiology
A seminar-based course examining the physiological responses and adaptations to physical exercise or inactivity. Students evaluate, present, and discuss seminal and contemporary research publications on selected topics largely focusing on the cardiovascular, metabolic, and musculoskeletal systems. Emphasis will be placed upon investigations of the explanatory elements of adaptation, from the level of the genome to the living human, and the use of relevant contemporary experimental techniques.
Restriction: PHYSIOL 706, SPORTSCI 706

EXERSCI 708 **15 Points**
Advanced Seminar in Movement Neuroscience
Seminar based course which examines brain organisation and function related to movement in health and disease. Emphasis is placed on contemporary techniques and paradigms in the field of movement neuroscience, with special emphasis on clinical populations that exhibit impaired movement. Neural plasticity is a central theme.
Restriction: SPORTSCI 708

EXERSCI 710 **15 Points**
Exercise Rehabilitation
The role of exercise and physical activity in the rehabilitation of people living with chronic and long-term health conditions. Professional practice in Aotearoa New Zealand. Evidence-based exercise prescription and outcome measurement for selected client populations.
Restriction: EXERSCI 720, 721, SPORTSCI 710

EXERSCI 711 **15 Points**
Exercise and Performance Psychology
Examines the basis of exercise motivation and to examine how psychological states can influence movement control and performance in work, sports, and daily life. The course covers theoretical foundations and involves active discussion of recent empirical studies.

EXERSCI 714 **15 Points**
Special Topics in the Exercise Sciences
Prerequisite: Head of Department approval
Restriction: SPORTSCI 714

EXERSCI 719 **15 Points**
Seminar in Exercise Physiology
A seminar-based course examining physiological responses and adaptations to exercise, physical activity and inactivity. Students evaluate, present, and discuss seminal and high-quality contemporary research on selected topics with a focus on cardiorespiratory, metabolic, neuromuscular and mental health condition responses to exercise, physical activity and inactivity. Emphasis is on critical analysis of contemporary experimental techniques to explain physiological responses and adaptations.

EXERSCI 720 **15 Points**
Clinical Exercise Physiology 1
Develops specialist knowledge in clinical exercise physiology practice, clinical exercise testing, and the effects of medication on exercise responses in people with cardiovascular, pulmonary and metabolic health conditions. Explores the evidence-based, physiological foundations underlying exercise assessment and prescription for people with these chronic health conditions.

EXERSCI 721 **15 Points**
Clinical Exercise Physiology 2
Develops specialist knowledge in the evidence-based, physiological foundations underlying exercise assessment and prescription for people with orthopaedic, musculoskeletal, neuromuscular, neoplastic, immunologic and mental health-related chronic conditions. Covers treatment planning and reporting, and the critical analysis of the role of exercise in short and long-term chronic disease management.
Prerequisite: EXERSCI 720

EXERSCI 722 **15 Points**
Critical Evaluation of Research in Rehabilitation - Level 9
Evaluating existing research to inform the design of rehabilitation-focused research studies. This course requires students to obtain and critically evaluate relevant literature, use evidence-based arguments to develop a suitable research question, and design a rehabilitation-related study with appropriate ethical considerations.
Prerequisite: EXERSCI 719

EXERSCI 723 **15 Points**
Research in Rehabilitation - Level 9
A seminar-based course providing opportunities to collect and analyse, perform appropriate statistical analyses on, and report on results from data obtained from research in clinical rehabilitation settings. Students interpret, disseminate and defend findings in a forum that replicates the rehabilitation setting.
Prerequisite: EXERSCI 722

EXERSCI 724 **15 Points**
Seminar in Advanced Clinical Exercise Physiology - Level 9
A body of advanced, specialised and emerging areas of clinical exercise physiology practice. Students will be introduced to advanced practitioner roles and associated leadership opportunities within the profession. Professional and inter-professional relations will be addressed.
Prerequisite: EXERSCI 720, 721

EXERSCI 731 **15 Points**
EXERSCI 731A **7.5 Points**
EXERSCI 731B **7.5 Points**
Physiotherapy Healthcare
Students will apply specialist knowledge about the regulation of the practice of physiotherapy in New Zealand supporting professional, legal, ethical, evidence-based and culturally safe practice. Knowledge and skills include Te Tiriti o Waitangi, Māori models of health, government legislation and health strategies, whānau-centred care, interprofessional practice, teamwork, effective communication, and developing a critical consciousness to promote equity in healthcare delivery.
To complete this course students must enrol in EXERSCI 731 A and B, or EXERSCI 731

EXERSCI 732 **15 Points**
Exercise for Rehabilitation
Students will apply clinical reasoning and deduction to assessment and treatment of individuals across the lifespan living with chronic health conditions to increase life-long physical activity and reduce sedentary behaviours. Knowledge and skills include aerobic capacity testing, functional assessments, exercise intervention, outcome measurement and self-management support for people undergoing cardiac rehabilitation or living with chronic health conditions and older adults.

EXERSCI 733 **15 Points**
Musculoskeletal Outpatients
Students will evaluate assessments, planning and delivery of interventions for clients with musculoskeletal, orthopaedic, women's health and rheumatologic conditions across the lifespan. Client scenarios will develop clinical reasoning skills underpinning safe, effective and holistic delivery of therapy. Students will learn to formulate differential diagnoses, prioritise clinical problems and implement an evidence-based treatment plan, using manual therapy, exercise and modality-based interventions.

EXERSCI 734 **15 Points**
Physiotherapy Practice
Students will assess, plan and deliver interventions for case-studies with spinal musculoskeletal, orthopaedic, and rheumatological conditions across the lifespan. Students will formulate differential diagnoses, prioritise clinical problems and generate solutions using knowledge and skills of physiotherapy practice. Students will implement culturally safe, evidence-based treatment plans to a range of clinical case scenarios across the lifespan.

EXERSCI 735 **15 Points**
Neurological Rehabilitation
Students will apply specialist knowledge to develop skills in evidence-based assessment and intervention across health care settings, focusing on interdisciplinary rehabilitation of neurological and neurodevelopmental conditions through the lifespan. The emphasis will be on normal development and milestones to underpin learning in paediatric rehabilitation. Motor learning principles will be applied to rehabilitate mobility, walking, balance and upper-limb function, including integration of assistive technology.

EXERSCI 736 **15 Points**
Acute Care
Students will apply advanced knowledge in physiotherapy management of acute respiratory, cardiac, surgical and neurological conditions across the lifespan, and to operate effectively in an interdisciplinary healthcare team. Students will learn to provide cardiopulmonary care for medical, surgical and acute neurological patients and the fundamentals of managing patients in an intensive care unit (ICU) including the role of physiotherapist in an ICU.

EXERSCI 737 **15 Points**
Physiotherapy in the Community
Students will advance generic skills to manage chronic conditions commonly delivered by healthcare services in urban and rural communities. Learning will include manual therapy and exercise interventions for spinal conditions, chronic pain management, falls prevention, movement disorders, amputees, cancer survivors and paediatric respiratory conditions. Students will learn to deliver e-health rehabilitation and to deliver whānau-centred care for Māori and Pasifika communities.

EXERSCI 738 **15 Points**
Professional Practice
Students will apply specialist knowledge and skills to support graduate practice. Topics include: advanced professional practice, registration and ongoing professional competency, reflections to enhance critical consciousness, and strategies to maintain physical and mental health. Students will gain essential knowledge for business practices such as Accident Compensation Corporation, private insurance, legal and ethical obligations and occupational health and safety.
Prerequisite: EXERSCI 741, 752, 753

EXERSCI 741 **15 Points**
Advanced Physiotherapy Practice - Level 9
Students will apply advanced knowledge and skills in specialised and emerging areas of physiotherapy practice, including advanced practitioner roles. Applying critical thinking and evidence-based practices, students will independently develop and evaluate management plans for complex cases. Case scenarios include integration of Hauora Māori, paediatric/neonatal ICU, burns/plastics, spinal cord injury, gender health, hand therapy, palliative care and emergency department physiotherapy.
Prerequisite: EXERSCI 735-737

EXERSCI 751 **15 Points**
EXERSCI 751A **7.5 Points**
EXERSCI 751B **7.5 Points**
Physiotherapy Practicum 1
Students will undertake supervised practice in clinical settings. This is the first of 5 clinical practicums across different physiotherapy settings. Students will complete supervised practice for 25 days, usually during a 5- or 6-week block, following a compulsory pre-clinical programme. Students will develop competencies in assessment of clients' problems, analysis of findings, goal setting and implementation and evaluation of interventions.
To complete this course students must enrol in EXERSCI 751 A and B, or EXERSCI 751

EXERSCI 752 **15 Points**
Physiotherapy Practicum 2
Students will undertake supervised practice in a clinical setting. This is the second of 5 clinical practicums across different physiotherapy settings. Students will complete supervised practice for 25 days over a 5-week block. Students will develop competencies in assessment of clients' problems, analysis of findings, goal setting and implementation and evaluation of interventions appropriate to the specific clinical setting.
Prerequisite: EXERSCI 751

EXERSCI 753 **15 Points**
Physiotherapy Practicum 3
Students will undertake supervised practice in a clinical setting. This is the third of 5 clinical practicums across different physiotherapy practice settings. Students will complete supervised practice for 25 days over a 5-week block. Students will develop competencies in assessment of clients' problems, analysis of findings, goal setting and implementation and evaluation of interventions appropriate to the specific clinical setting.
Prerequisite: EXERSCI 751

EXERSCI 754 **15 Points**
Physiotherapy Practicum 4
Students will undertake supervised practice in a clinical setting. This is the fourth of 5 clinical practicums across different physiotherapy practice settings. Students will

complete supervised practice for 25 days over a 5-week block. Students will develop competencies in assessment of clients' problems, analysis of findings, goal setting and implementation and evaluation of interventions appropriate to the specific clinical setting.
Prerequisite: EXERSCI 751-753

EXERSCI 755 **15 Points**
Physiotherapy Practicum 5
Students will undertake supervised practice in a clinical setting. This is the final of 5 clinical practicums across different physiotherapy practice settings. Students will complete supervised practice for 25 days over a 5-week block. Students will develop competencies in assessment of clients' problems, analysis of findings, goal setting and implementation and evaluation of interventions appropriate to the specific clinical setting.
Prerequisite: EXERSCI 751-753

EXERSCI 775 **15 Points**
Seminar in Clinical Exercise Physiology
A body of advanced theoretical and administrative work related to exercise prescription and service delivery. The principles of exercise physiology related to clinical populations, especially individuals who have cardiac, musculoskeletal, neurological, pulmonary, immunological, neoplastic, mood, and metabolic disorders, post-surgical cases, the elderly, and for individuals at risk of developing diseases as a consequence of inactivity. Professional and inter-professional relations will be addressed.
Restriction: SPORTSCI 775, 783

EXERSCI 776 **30 Points**
Clinical Exercise Physiology Practicum I
Individual interdisciplinary practice in exercise screening, exercise and physical activity assessment, exercise prescription and supervision, exercise, physical activity and health education and promotion in clinical populations. The course integrates ethical, safe, reflective and culturally responsive practice through supervised clinical work of not less than 200 hours.

EXERSCI 777 **30 Points**
Clinical Exercise Physiology Practicum II
Individual interdisciplinary practice in exercise screening, exercise and physical activity assessment, exercise prescription and supervision, exercise, physical activity and health education and promotion in clinical populations. The course integrates ethical, safe, reflective and culturally responsive practice through supervised clinical work of not less than 200 hours.
Prerequisite: EXERSCI 776

EXERSCI 778 **30 Points**
EXERSCI 778A **15 Points**
EXERSCI 778B **15 Points**
Clinical Exercise Physiology Practicum III
Individual and interdisciplinary practice in exercise screening, exercise and physical activity assessment, exercise prescription and supervision, exercise, physical activity and health education and promotion in clinical populations. The course integrates ethical, safe, reflective and culturally responsive practice through supervised clinical work placements of not less than 200 hours.
Prerequisite: EXERSCI 777
To complete this course students must enrol in EXERSCI 778 A and B, or EXERSCI 778

EXERSCI 779 **30 Points**
Clinical Exercise Practicum 4
Individual and interdisciplinary practice in exercise screening, exercise and physical activity assessment, exercise prescription and supervision, exercise and physical activity counselling and health education and promotion in clinical populations. The course integrates ethical, safe, reflective and culturally responsive practice through supervised clinical work of not less than 200 hours.
Prerequisite: EXERSCI 771 or 776, and EXERSCI 772 or 777, and EXERSCI 773 or 778
Restriction: EXERSCI 774, SPORTSCI 774, 782

EXERSCI 780A **22.5 Points**
EXERSCI 780B **22.5 Points**
BSc(Hons) Dissertation in Exercise Sciences - Level 9
Restriction: SPORTSCI 788, 789
To complete this course students must enrol in EXERSCI 780 A and B

EXERSCI 781 **30 Points**
EXERSCI 781A **15 Points**
EXERSCI 781B **15 Points**
Research Project - Level 9
Restriction: SPORTSCI 691
To complete this course students must enrol in EXERSCI 781 A and B, or EXERSCI 781

EXERSCI 782 **60 Points**
EXERSCI 782A **30 Points**
EXERSCI 782B **30 Points**
Dissertation - Level 9
Restriction: EXERSCI 780
To complete this course students must enrol in EXERSCI 782 A and B, or EXERSCI 782

EXERSCI 790A **15 Points**
EXERSCI 790B **15 Points**
Research Project in Physiotherapy - Level 9
Students will apply skills in research and rangahau to undertake a practice-oriented research project. Students will critically interpret and disseminate project findings with reference to systematic reviews, meta-analyses and clinical guidelines to inform evidence-based physiotherapy practice. Individually, or as part of a small group, students will work under the direct supervision of a staff member.
Prerequisite: EXERSCI 741, 752, 753
Corequisite: EXERSCI 738
To complete this course students must enrol in EXERSCI 790 A and B

EXERSCI 792A **22.5 Points**
EXERSCI 792B **22.5 Points**
MSc Dissertation in Clinical Exercise Physiology - Level 9
A scholarly discussion of a topic related to clinical exercise physiology.
Restriction: SPORTSCI 786, 787
To complete this course students must enrol in EXERSCI 792 A and B

EXERSCI 796A **60 Points**
EXERSCI 796B **60 Points**
MSc Thesis in Exercise Sciences - Level 9
Restriction: SPORTSCI 796
To complete this course students must enrol in EXERSCI 796 A and B

Food Science

Stage I

FOODSCI 100 **15 Points**
Foundations of Food and Nutrition
Introduces students to the multifaceted nature of Food Science and Nutrition with a focus on the interplay between food, nutrition and health. Introduce the chemical, biological, sensory, and processing aspects of foods. Societal, economic, legislative and regulatory aspects will also be introduced. Concepts will be illustrated using real food systems with a focus on lipids, water and vitamin C.
Restriction: FOODSCI 201

FOODSCI 110 **15 Points**
Concepts in Food and Nutrition
Introduces students to the multifaceted nature of food science and nutrition with a focus on the interplay between food, nutrition and health. Provides general insights relating food molecules to food function and health. Societal, economic, legislative and regulatory aspects will also be explored. No background in science is assumed.
Restriction: FOODSCI 100

Stage II

FOODSCI 200 **15 Points**
Food Composition and Nutrition
Covers the composition and structure of food. The approach will extend the FOODSCI 100 content from lipids to proteins, carbohydrates and key minor food components. There will be a focus on the molecular structure of the major food components and how they relate to the physical, sensory and nutritional properties of foods.
Prerequisite: 15 points from BIOSCI 106, CHEM 110, FOODSCI 100
Restriction: FOODSCI 201

FOODSCI 202 **15 Points**
Food Preservation
Food is spoilt by microbiological, chemical, biochemical and physical processes. It is important to understand the mechanism of spoilage caused by each of these processes in order to prevent or minimise such degradation. This course includes fundamental principles covering the preservation and processing of different food products. The principles involved in the development of food safety and HACCP programmes, as well as New Zealand food laws are also covered.
Prerequisite: 15 points from FOODSCI 200, 201, 15 points from MATHS 108, 110
Restriction: FOODSCI 302

Stage III

FOODSCI 301 **15 Points**
Food Quality Attributes
Attributes that make food attractive, such as colour, flavour, and texture, and how they alter during processing are studied. Texture measurement and methods of studying food structure will be discussed. Lectures will be given on non-destructive testing of food.
Recommended preparation: BIOSCI 203
Prerequisite: FOODSCI 200 or 201

FOODSCI 303 **15 Points**
Sensory Science
Human perception and preference of food products. Design of experiments, statistical methodologies and applications in industry and research. Sampling of foods is undertaken in this course.
Prerequisite: 15 points from STATS 101, 108 and 15 points from FOODSCI 200, 201
Corequisite: FOODSCI 301 or Permission of the Programme Director/Course Coordinator

FOODSCI 306 **15 Points**
Principles of Food Processing
The fundamental principles of freezing and thawing, thermal processing and canning, fermentation and dehydration are studied. The fundamental areas of engineering relevant for food processing such as heat and mass transfer, are covered. Process impact on food safety, quality and preservation is also discussed.
Prerequisite: FOODSCI 202
Restriction: CHEMMAT 756

FOODSCI 310 **15 Points**
Theory of Food Product Design
Examines the science underpinning human sensory perception and food preferences and how this science interfaces with the design and development of food products as well as the fundamental aspects of food product development.
Prerequisite: FOODSCI 100, 200 and STATS 101 or 108
Restriction: FOODSCI 303, 304

FOODSCI 399 **15 Points**
Capstone: Food and Nutrition
Food and Nutrition pathway students will work together in groups to identify and develop a new food product or food system that addresses or responds to a nutritional issue. Students will focus on the interplay between the nutritional aspects of the product or system and the sensory, stability, convenience, cost, regulatory and processing aspects of the product.
Prerequisite: FOODSCI 303 or 310 and a further 30 points at Stage III in Food Science and Nutrition

Diploma Courses

FOODSCI 691 **30 Points**
FOODSCI 691A **15 Points**
FOODSCI 691B **15 Points**
Postgraduate Diploma Research Project
To complete this course students must enrol in FOODSCI 691 A and B, or FOODSCI 691

Postgraduate 700 Level Courses

FOODSCI 703 **15 Points**
Food Processing
Preservation of food by standard methods including freezing, dehydration and thermal processing. New developments in food preservation. Unit operations, mass and energy balance, and heat transfer are covered. Chemical and physical changes food undergoes during processing.

FOODSCI 705 **15 Points**
Project in Food Science
Prerequisite: Permission of Programme Director

FOODSCI 706 **15 Points**
Food Safety
An understanding of the changing regulations that apply to the New Zealand food industry is of paramount importance. Pathogen awareness and control from an industry

perspective are examined. HACCP and risk management plans will be generated.
Prerequisite: Permission of Programme Director

FOODSCI 707 **15 Points**
Food Science
Chemical, biological and physical aspects of foods. The decomposition of food due to lipid oxidation. Integrated study of selected basic foods.

FOODSCI 708 **15 Points**
Advanced Food Science
The functions and properties of food additives. Food attributes including colour, flavour and texture. Enzymic and non-enzymic browning. Emulsions and foams. Introduction to the Food Regulations. Interaction of macromolecules.
Prerequisite: Permission of Programme Director

FOODSCI 709 **15 Points**
FOODSCI 709A **7.5 Points**
FOODSCI 709B **7.5 Points**
Selected Topics in Food Science and Technology
Modules will be organised by the staff and invited lecturers. Topics offered will usually be based on the specialist interests of the lecturers, although controversial issues may be included (for example, genetically modified food, irradiated food). Students may be required to participate actively by contributing seminars. Topics may vary from year to year.
To complete this course students must enrol in FOODSCI 709 A and B, or FOODSCI 709

FOODSCI 710 **15 Points**
Industrial Internship - Level 9
The industrial internship is an opportunity for students to experience the food industry at first hand. While the placement would normally be in New Zealand, overseas internships are possible. The student will work in the food organisation on a defined project under the supervision of a suitably qualified person. A detailed written report on the assignment must be submitted.
Prerequisite: Permission of Programme Director

FOODSCI 715 **15 Points**
Food Allergens and Intolerants
An understanding of the epidemiology, management, regulation and classification of food allergens and intolerants in accordance with Food Standard 1.2.3 (Australia New Zealand Food Standards Code). This includes the study of foods or food groups with the major food allergens as identified in the Food Allergen Labeling and Consumer Protection Act (FALCPA), and application to new product development and labeling.

FOODSCI 740 **15 Points**
Food Analysis
Students are provided with an opportunity to experience a range of analytical techniques that are used in food industry laboratories and in food science research.
Restriction: FOODSCI 301, 610

FOODSCI 750 **15 Points**
Advanced Topics in Food Science 1
A modular course consisting of topics chosen from the diverse research interests of the Food Science staff and academic visitors which may vary from year to year.
Prerequisite: Permission of Programme Director
Restriction: FOODSCI 709

FOODSCI 751 **15 Points**
Advanced Topics in Food Science 2
A modular course consisting of topics chosen from the diverse research interests of the Food Science staff and academic visitors which may vary from year to year.
Prerequisite: Permission of Programme Director
Restriction: FOODSCI 709

FOODSCI 752 **15 Points**
Research Proposal - Level 9
A review of the literature and research methods associated with a selected research topic assigned to an individual student. This will be at internationally recognised academic standards and demonstrate a capacity for independent thinking. It will include a consideration of the project from a Vision Mātauranga perspective.
Prerequisite: Permission of Programme Director

FOODSCI 755 **15 Points**
Special Topic
Prerequisite: Programme Director approval

FOODSCI 788 **60 Points**
FOODSCI 788A **30 Points**
FOODSCI 788B **30 Points**
BSc(Hons) Dissertation in Food Science - Level 9
A research proposal will be prepared on the dissertation topic. Students will be required to present an overview of the proposal in a seminar. Students will participate in the critical analysis of scientific papers. The student will carry out an original piece of research. The results will be presented and discussed in a dissertation. A seminar on the research will be given.
Restriction: FOODSCI 789
To complete this course students must enrol in FOODSCI 788 A and B, or FOODSCI 788

FOODSCI 790 **30 Points**
FOODSCI 790A **15 Points**
FOODSCI 790B **15 Points**
Research Project - Level 9
Prerequisite: Permission of Programme Director
To complete this course students must enrol in FOODSCI 790 A and B, or FOODSCI 790

FOODSCI 791 **60 Points**
FOODSCI 791A **30 Points**
FOODSCI 791B **30 Points**
Dissertation - Level 9
Prerequisite: Permission of Programme Director
To complete this course students must enrol in FOODSCI 791 A and B, or FOODSCI 791

FOODSCI 796A **60 Points**
FOODSCI 796B **60 Points**
MSc Thesis in Food Science - Level 9
Prerequisite: Permission of Programme Director
To complete this course students must enrol in FOODSCI 796 A and B

Forensic Science

Postgraduate 700 Level Courses

FORENSIC 701 **15 Points**
Fundamental Concepts in Forensic Science
Ethics and quality assurance in forensic science. Principles of criminal law, principles of evidence and procedure, expert evidence, interpretation of scientific evidence,

probability and statistics. Forensic pathology, psychology and psychiatry.

FORENSIC 702 **15 Points**
Introduction to Forensic Science
Forensic biology, documents, fingerprints, physical evidence, toolmarks, fire examination, explosives, hairs and fibres, drugs, toxicology, alcohol (including blood and breath alcohol), crime scene examination, firearms identification.

FORENSIC 703 **15 Points**
Statistics and Molecular Biology for Forensic Science
Statistics: data summarisation and reduction, laws of probability, conditional probability, likelihood ratios and Bayes theorem. Interpretation of statistical results. Forensic biology: basic principles of population genetics, genomic structure, conventional blood grouping. DNA profiling: structure, enzymology and basic chemistry of nucleic acids, PCR and microsatellites, interpretation of DNA profiles, developing forensic DNA technologies.

FORENSIC 704 **15 Points**
Techniques and Applications for Forensic Science
Analytical techniques: GC, HPLC, GC-MS chromatography, IR and UV spectroscopy. Applications: toxicology, illicit drugs, sports drugs, racing chemistry. Physical and trace evidence.

FORENSIC 706 **15 Points**
Environmental Forensic Science
Concepts of environmental science. Environmental monitoring and spill analysis, environmental legislation, criminal and environmental law. Case studies and practical work.

FORENSIC 707 **30 Points**
FORENSIC 707A **15 Points**
FORENSIC 707B **15 Points**
Project in Forensic Science
A research essay on an aspect of forensic science.
Restriction: FORENSIC 705
To complete this course students must enrol in FORENSIC 707 A and B, or FORENSIC 707

FORENSIC 708 **15 Points**
Special Topic: Forensic Science in a Digital World
Principles and applications of data science and statistics to forensic science. Methods may include machine learning, artificial intelligence, Bayesian inference, data visualisation, data security and the ethical use of data. Applications may include wastewater analysis, DNA sequencing, drug identification, biometrics, and crime detection and prevention. Prior knowledge of basic statistics is assumed. Familiarity with statistical programming language R is beneficial.

FORENSIC 710 **15 Points**
FORENSIC 710A **7.5 Points**
FORENSIC 710B **7.5 Points**
Advanced Topics in Forensic Science
A modular course comprising topics in Forensic Science related to staff research interests.
To complete this course students must enrol in FORENSIC 710 A and B, or FORENSIC 710

FORENSIC 796A **60 Points**
FORENSIC 796B **60 Points**
MSc Thesis in Forensic Science - Level 9
Note: The Forensic Science MSc thesis research courses are mounted with the assistance of the Institute of Environmental Science and Research Ltd (ESR) and ESR facilities and databases will be used for some research. As ESR facilities and databases are relied on in Court proceedings, appropriate steps must be taken to ensure the integrity of ESR's analyses. This means students wishing to use ESR laboratory facilities as part of the MSc programme will be subject to the same type of access requirements as ESR employees. This includes a security clearance (essentially a check of any convictions recorded against you) and a drug test prior to being given access to ESR resources. Students will normally be required to provide a DNA sample to ensure that any allegations of cross-contamination of a DNA sample can be properly investigated. The DNA profile will be retained by ESR. All other information will be returned to the students at the completion of their studies. Students who would like further details of these conditions should contact the Programme Director.
Prerequisite: Permission of Programme Director
To complete this course students must enrol in FORENSIC 796 A and B

Geographic Information Science

Stage II

GISCI 241 **15 Points**
Principles of Remote Sensing
An introduction to remote sensing tools and techniques and their application within the earth, environmental and urban environments. The course focuses on the processing, analysis and interpretation of data collected by government and commercial satellites, Unmanned Aerial Vehicles (UAV) and aerial photography. The course introduces image interpretation, multispectral images, supervised and unsupervised image classification and change detection. Techniques for analysing remote sensing data are introduced through a series and lab-based activities and are applied during an independent project.
Prerequisite: 60 points passed or 30 points from ENV 100-103

GISCI 242 **15 Points**
Principles of GIScience
Spatial analysis and GIScience applications of spatial data handling for built and natural environments within the context of theoretical frameworks for understanding human-driven and physical phenomena. Develops advanced practical knowledge of methodology and applications for changing environments. Focus topics include climate change, air pollution, healthcare access, transportation, and 3D game worlds.
Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: GEOG 318

GISCI 243 **15 Points**
Special Topic

Stage III

GISCI 341 **15 Points**
Remote Sensing of Surface Processes
Key concepts of geographic information science as applied to earth and environmental sciences. Monitoring, analysis, visualisation and modelling of landscape change for terrestrial and coastal environments, using imagery from satellites, airplanes (LiDAR) and UAVs. Principles and practice of field techniques, including RTK-GPS, LiDAR and UAV piloting will be reviewed with application to catchment

management, conservation, natural hazards and civil infrastructure.
Prerequisite: GISCI 241
Restriction: GEOG 317

GISCI 343 **15 Points**
GIScience Programming and Development
Programming and scripting-based techniques for spatial big data analysis, spatial data handling, modelling, automation, and development for the GIScience domain.
Prerequisite: 15 points from GISCI 241, 242, GEOG 317, 318

GISCI 344 **15 Points**
Special Topic

GISCI 390 **15 Points**
Directed Study
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

GISCI 399 **15 Points**
Capstone: GIScience
Students will independently demonstrate domain knowledge through applying their skills as members of groups completing a community-based GIScience projects serving needs identified by community stakeholders. Groups will be assembled based on skillsets of individual students (e.g., programming, remote sensing, advanced vector analysis, etc.), and students will be assessed on their independent contributions to the group project.
Prerequisite: 30 points at Stage III in Geographic Information Science

Geography

Stage I

GEOG 104 **15 Points**
GEOG 104G **15 Points**
Cities and Urbanism
What makes a great city? This course explores 'urbanism' in both historical and contemporary cities to determine the essence of urbanity and the way that citizens (and visitors) experience city life. The dynamics and character of cities are considered in terms of their built environment, environmental systems, population, social diversity, and planning policies and practices.

Stage II

GEOG 202 **15 Points**
Cities, Regions and Communities
A critical examination of geographic processes and consequences in contemporary society. Topics are selected from the instructors' research interests, which include: the transformation of urban places and spaces; the forms and location of industries and retailing; social geographies of the city; New Zealand's linkages with the global economy and society; urban historical geographies; and demographic and social changes in New Zealand and the Pacific region.
Prerequisite: 60 points passed or 30 points from ENV 100-103

GEOG 205 **15 Points**
Environment and Society
A critical exploration of the interconnectedness of environment and society. The course highlights the importance of understanding how different views and attitudes influence people's interactions with the environment. Key themes include governance, management and development, which are addressed through issues such as conservation, climate change adaptation, disasters and resource use. Classes draw on a variety of case studies from New Zealand and overseas.
Prerequisite: 60 points passed or 30 points from ENV 100-103

GEOG 250 **15 Points**
Geographical Research in Practice
A critical exploration of the research experience in geography. Case studies and field work demonstrate approaches to understanding the complex interactions of social and environmental processes. Students will develop practical skills in problem identification, research methodologies, ethics and analytical practices.
Prerequisite: 60 points passed or 30 points from ENV 100-103

GEOG 261 **15 Points**
Climate and Society
Exploration of themes in climatology, meteorology, hydro-climatology and oceanography with a focus on the nature and role of key processes. These will be examined in relation to key issues for society such as extreme weather events, drought, floods, air pollution and climate change.
Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: EARTHSCI 261

GEOG 262 **15 Points**
Geomorphology
Introduces fundamental concepts in geomorphology for geologists and physical geographers. Key aspects of geomorphology, sedimentology, and earth surface processes are introduced by studying the temporal and spatial development of coastal and river landforms. Applied techniques for earth and environmental sciences, including field, remote sensing, GIS mapping, and modelling.
Prerequisite: 60 points passed or 30 points from ENV 100-103
Restriction: EARTHSCI 262

Stage III

GEOG 305 **15 Points**
Population, Health and Society
A survey of major themes in population, health and social geography. An examination of the dynamics of population complements analyses of health and healthcare, the education sector, the welfare state, and the changing character of urban places.
Prerequisite: 30 points at Stage II

GEOG 306 **15 Points**
Special Topic

GEOG 307 **15 Points**
Urban Geography
Analysis of key processes shaping socio-cultural geographies of contemporary cities. Using international and local examples, issues such as the economy of cities, the culture of cities, home and housing, segregation and polarisation, the imaging of cities and sustainability are explored.
Prerequisite: 30 points at Stage II

GEOG 308 **15 Points**
Geopolitics and Indigenous Rights
Examines Indigenous peoples as agents of geopolitical change. Introduces colonial/decolonial geographies to demonstrate the geopolitical implications of Indigenous ways of knowing, being and doing. Key themes include: territory and geopolitics; Indigenous identities, subject-formation and intersectionality; Indigenous knowledges,

rights and political agency; and, Indigenous relationships with non-Indigenous peoples.
Prerequisite: 30 points at Stage II
Restriction: GEOG 312

GEOG 320 **15 Points**
Resources and Environmental Management
Examines the development and conservation of the environment in its use as a resource base, with particular reference to the way in which institutional structures in society determine provision and allocation. Attention is balanced between international experience and the policy framework in New Zealand. The course provides an understanding of key concepts, practices and methods.
Prerequisite: 30 points at Stage II

GEOG 325 **15 Points**
The Human Dimension of Disasters
An overview of the human dimension of disasters which covers crucial concepts and theories, vulnerability and the causes of disasters, disaster risk reduction and management, post-disaster recovery and transversal issues such as culture and gender. The discussions encompass not only theoretical but also policy and practical materials and draw on examples and case studies from throughout the world with a particular focus on the most vulnerable and marginalised areas and communities.
Prerequisite: 30 points at Stage II

GEOG 327 **15 Points**
Politics, Markets and Economies
Uses geographical insights to explore the interrelationships between politics, economy and culture. The course focuses attention on institutions, subjectivity and the making of markets. It examines political projects and economic spaces such as higher education, food and creative economies at the regional, national, and global level.
Prerequisite: 30 points at Stage II

GEOG 335 **15 Points**
Applied Physical Geography
Examines the challenges of 'doing science' in the real world. With particular emphasis on climate, fluvial and coastal processes, the types of data, knowledge and information needed for decision making in environmental contexts are examined. Examines the ways human activities effect, and are affected by, the environmental settings of humans. Seeks improved understanding, and prediction, of the world around humans framed as both a resource and hazard.
Prerequisite: 45 points at Stage II in Geography

GEOG 342 **15 Points**
Technology, Power and Social Change
Technology, algorithms, and Big data are changing our relationships with reality, space and power. This course explores how we know each other, society, and ourselves in this period of unprecedented technological change
Prerequisite: 45 points at Stage II

GEOG 351 **15 Points**
Coastal and Marine Studies
Focuses on the development of coastal landforms across a range of temporal and spatial scales. Introduces natural processes such as waves, tides and circulation, as well as geological-scale coastal evolution driven by changes in sea level and sediment supply. The course has an applied focus with specific emphasis on coastal management problems that affect society. Issues considered include coastal erosion during storms, the impacts of shoreline engineering, climate change and accelerating sea level rise.
Prerequisite: 45 points at Stage II, including EARTHSCI 262 or GEOG 262, or equivalent

GEOG 352 **15 Points**
Landscape, Environment and Heritage
An examination of environmental change from a historical geography perspective. Approaches to investigating and understanding the transformation of environments are explored, and processes driving creation of different types of landscapes including heritage places are considered. The course enables students to place the modern environment within a historical context.
Prerequisite: 30 points at Stage II

GEOG 390 **15 Points**
Directed Study
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

GEOG 399 **15 Points**
Capstone: Geography
An engagement with the research process, as practised in geography. Students will undertake an independent research project and communicate their findings, with due attention to research design, methodology, research ethics, information sources, field practise, data analysis, and research communication. Independent or small group research projects may involve residential or local fieldwork, laboratory analysis, desktop analysis or other research activities.
Prerequisite: GEOG 250 and 30 points at Stage III in Geography

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Postgraduate 700 Level Courses

GEOG 701 **15 Points**
Research in Practice
A reflection on the process of developing research projects from theory to methods, analysis, and the presentation of findings. Attention is directed to the ways in which research is shaped by intellectual histories, pressing social and environmental challenges, and contemporary academic and political debates. The course allows students to develop specialised interests in geography or environmental management.

GEOG 714 **15 Points**
Mobilities and Wellbeing
An exploration of place-based human mobilities and their influence on health and wellbeing, employing current theoretical perspectives. No formal prerequisite, but an understanding of material in Stage III courses in human geography will be assumed.

GEOG 719 **15 Points**
Geographies of Housing and Urban Change
Advanced study of housing and urban issues, including the topics of homeownership, asset-based welfare, the politics of housing affordability, housing reforms and the changing dynamics of gentrification. Contemporary issues such as mortgage market dynamics and social rented housing reforms are examined. The course will consider also urban governance, office property investment and development processes, and sites of consumption and spectacle.

GEOG 725 **15 Points**
People, Participation and Development
A critical overview of issues associated with people's participation in development in their geographical context, including processes and outcomes, accountability,

empowerment and transformation in the context of livelihood strengthening, resource management, health and sanitation, education and disaster risk reduction. The course provides the students with theoretical knowledge but also practical skills through the use in class of participatory tools as both contents and teaching aids. Discussions rely upon concrete examples from throughout the world with a particular focus on marginalised places.

GEOG 737 **15 Points**
Geographies of Public Policy
Exploring 'policy' — an all too familiar and taken for granted term — by focusing on how policies get made, how different actors and varieties of expertise influence the policy process, and how policies shape people and place. It introduces students to transdisciplinary conversations involving geographers, anthropologists, sociologists and urbanists.

GEOG 738 **15 Points**
Future Food and Biological Economies
Investigates contemporary understandings, issues and strategies relating to the development of biological economies and food networks in the context of the globalising food economy. Addresses transformations in agro-food complexes and questions of nature-society relationships to do with 'sustainable' and 'resilient' food production and consumption.

GEOG 745 **15 Points**
Applied Fluvial Geomorphology
Catchment-scale perspectives are used to analyse spatial and temporal variability in river forms and processes. River responses to disturbance are placed in a longer-term evolutionary context. Prospective river futures are appraised using field analyses and numerical modelling applications. These principles and techniques are used to discuss management options. No formal prerequisite but final year undergraduate experience in a related field required.

GEOG 746 **15 Points**
Coastal Environments
Coastal environments are among the most dynamic landscapes on Earth, but face growing pressure from human encroachment, rising sea levels and changing storm patterns. This course provides scientific knowledge and expertise required to grapple with coastal management problems that affect society. Coastal processes and landform development are discussed. Students obtain practical skills in state-of-the-art techniques used to understand coastal change.

GEOG 749 **15 Points**
Applied Climate Science
An examination of climate themes relevant to society. Themes will vary but may include hydrology and water resources, agriculture, human health, ocean-atmosphere interaction and energy in the climate system. The sensitivity of selected biophysical and human activity systems to climate will be explored and the actual and potential impacts of climatic variability and change (past and future) investigated.

GEOG 750 **15 Points**
Environment and Landscape
Environmental change in New Zealand since European settlement, including exploitation of natural resources, the creation of different cultural landscapes, and recognition of places as natural and cultural heritage. Different approaches to investigating and understanding recent environmental change are addressed. The course is suitable for physical and social science students, and will enable them to place the modern environment within a historical context. The course may include short guided walks and a one day or two half-day fieldtrips.

GEOG 759 **15 Points**
Research Topics in Geography
Directed research on an approved topic or topics.
Prerequisite: Approval of Programme Director or Major/ Specialisation Lead

GEOG 760 **15 Points**
Directed Study in Geography
Directed studies on an approved topic or topics.
Prerequisite: Academic Head approval

GEOG 761 **15 Points**
Special Topic: Monitoring Change from Space with Machine Learning
Remotely sensed (satellite) data and machine learning techniques will be used to classify and analyse both commercial and environmental targets through time. Techniques will focus on both pixel classification and object detection and students will experience the latest in satellite imagery analysis with a focus on deriving actionable information.

GEOG 771 **15 Points**
Spatial Analysis and Geocomputation
Approaches to and challenges in analysing spatial data. Specific techniques will include geographical regression, point pattern analysis, interpolation, and newer geocomputation and machine learning methods. Students will gain an advanced knowledge of spatial analysis. An understanding equivalent to GISCI 242 will be assumed.

GEOG 774 **15 Points**
Advanced Spatial Data Handling
Advanced approaches to spatial data handling (processing, management, visualisation, and analysis) in web-based environments, including theoretical debates and implications as well as applications for spatial data handling in integrated open-source and web-based mapping/GIS environments. There will be an applied laboratory component and lecture/seminar component where the broader social and theoretical implications of developments in spatial data handling will be engaged. No formal prerequisite, but an understanding equivalent to GEOG 318 will be assumed.

GEOG 789 **30 Points**
GEOG 789A **15 Points**
GEOG 789B **15 Points**
Honours Research Project - Level 9
To complete this course students must enrol in GEOG 789 A and B, or GEOG 789

GEOG 793 **60 Points**
Dissertation - Level 9

GEOG 796A **60 Points**
GEOG 796B **60 Points**
Masters Thesis in Geography - Level 9
To complete this course students must enrol in GEOG 796 A and B

Geophysics

Stage III

GEOPHYS 310 **15 Points**
Physics of the Earth
Covers the physics of the solid earth from the surface to the core. Specifically, the course explores the Earth's gravitational field (including the rotation and figure of the earth), seismology, heat flow, the magnetic and electromagnetic field to unravel the properties, processes, and structure of the Earth's interior.
Prerequisite: 15 points from EARTHSCI 103, 120, GEOLOGY 103, and 15 points from GEOPHYS 213, PHYSICS 213, and 15 points from ENGSCI 211, MATHS 253, 260, PHYSICS 211
Restriction: GEOPHYS 330

GEOPHYS 311 **15 Points**
Atmosphere, Ocean, and Climate Physics
Examines the physical and dynamic processes shaping the atmosphere and oceans, covering the thermodynamics of the climate system and the dynamics of global atmospheric and oceanic circulations. Explores the fundamental physical processes that control Earth's climate and investigates the dilemmas they present in our current understanding of climate.
Prerequisite: 15 points from PHYSICS 201, 231, and 15 points from GEOPHYS 213, PHYSICS 213, and 15 points from ENGSCI 211, MATHS 253, 260, PHYSICS 211
Restriction: GEOPHYS 331

GEOPHYS 339 **15 Points**
Special Topics in Geophysics

GEOPHYS 361 **15 Points**
Fundamentals and Applications of Geophysical Exploration
The fundamentals of geophysical exploration methods and their application. The course will provide a comprehensive overview of seismic techniques, geophysical borehole methods, and an introduction to gravity, electric, magnetic, electromagnetic, and radar techniques. Applications of these will be considered including hydrocarbon, mineral and geothermal exploration. Geophysical data will be acquired and analysed through field and laboratory work.
Prerequisite: 15 points from EARTHSCI 103, 120, GEOLOGY 103, and GEOPHYS 213 or PHYSICS 213 and MATHS 208 or equivalent
Restriction: EARTHSCI 361, GEOLOGY 361

GEOPHYS 399 **15 Points**
Capstone: Geophysics
Students will employ core methodologies (experimental, observational, computational, numerical) to investigate some aspect of a key geophysical phenomenon, and relate their findings to contemporary research in the field, considering wider societal aspects and issues. Students will develop their skills in communication, critical thinking, teaching and creative problem solving.
Prerequisite: 30 points from GEOPHYS 310, 311, 361
Restriction: EARTHSCI 399, PHYSICS 399

Diploma Courses

GEOPHYS 690 **30 Points**
GEOPHYS 690A **15 Points**
GEOPHYS 690B **15 Points**
Graduate Diploma Research Project
To complete this course students must enrol in GEOPHYS 690 A and B, or GEOPHYS 690

GEOPHYS 691 **30 Points**
GEOPHYS 691A **15 Points**
GEOPHYS 691B **15 Points**
Postgraduate Diploma Research Project
To complete this course students must enrol in GEOPHYS 691 A and B, or GEOPHYS 691

Postgraduate 700 Level Courses

GEOPHYS 780 **15 Points**
Directed Study

GEOPHYS 789 **30 Points**
GEOPHYS 789A **15 Points**
GEOPHYS 789B **15 Points**
Honours Research Project - Level 9
To complete this course students must enrol in GEOPHYS 789 A and B, or GEOPHYS 789

GEOPHYS 796A **60 Points**
GEOPHYS 796B **60 Points**
MSc Thesis in Geophysics - Level 9
To complete this course students must enrol in GEOPHYS 796 A and B

Information Management

Stage I

INFOMGMT 192 **15 Points**
Information Tools for Business
The ability to manage and analyse information is essential in many aspects of business. This course provides a practical introduction to a variety of information tools used to analyse and visualise data relating to aspects of information management. Through these tools and methods students explore using data to inform decisions related to a variety of activities.

Stage III

INFOMGMT 399 **15 Points**
Capstone: Information Management
Students work in a small group to solve a substantial problem. Groups are expected to reason on a problem, devise a solution, produce an artefact and present their work. The capstone provides an opportunity to students to further develop their technical and communication skills.
Prerequisite: BUSAN 201 or INFOMGMT 292, and COMPSCI 230 or INFOSYS 220, and 15 points from COMPSCI 215, INNOVENT 203, OPSMGT 258, SCIGEN 201, and 30 points from BUSAN 300-305, COMPSCI 345, INFOMGMT 390, 392, 393, INFOSYS 300, 320-323, 330, 338, 339, 341, MKTG 308, OPSMGT 357

Marine Science

Stage I

MARINE 100 **15 Points**
MARINE 100G **15 Points**
The Oceans Around Us
A multidisciplinary approach to understanding the importance of our oceans in terms of natural processes and human uses and values. It includes an understanding of the physical and biological processes in the ocean and how they are addressed through ocean management in New Zealand and internationally, allowing informed debate about the future of the ocean realm.

Stage II

MARINE 202 **15 Points**
Principles of Marine Science
An introduction to the physical and biological structure of the oceans, sea floor, coastlines and the biological communities that inhabit them. Subject matter includes an overview of the nature and scope of marine science globally and within the New Zealand and Auckland contexts. A wide coverage of marine science issues are presented with an emphasis on multidisciplinary examples.
Prerequisite: 30 points at Stage I in BSc courses

MARINE 203 **15 Points**
Special Topic

Stage III

MARINE 302 **15 Points**
Dynamics of Marine Systems
Fundamental processes in the marine environment with an emphasis on interdisciplinary linkages in the functioning of marine ecosystems. Topics include: the role of fluid dynamics in the lives of marine animals and in shaping the physical marine environment, and interdisciplinary studies of marine ecosystems.
Prerequisite: MARINE 202

MARINE 303 **15 Points**
Freshwater and Estuarine Ecology
The structure, biodiversity and ecology of lakes, streams, wetlands and estuaries and linkages with near-shore marine habitats. Emphasis is placed on the role of science in monitoring and managing these ecosystems. Case studies include the impact of Auckland's urban sprawl on stream, estuarine and near-shore marine habitats, and local estuaries as nurseries for fish.
Prerequisite: 15 points from BIOSCI 206, ENVSCI 201, MARINE 202
Restriction: BIOSCI 330

MARINE 304 **15 Points**
Advanced Concepts in Marine Science
Independent study on current topics in marine science under the guidance of an individual academic with similar interests to the student, focusing on specialist research techniques in chosen subfields of marine science.
Restriction: MARINE 399

MARINE 306 **15 Points**
Special Topic

MARINE 307 **15 Points**
Directed Study

MARINE 399 **15 Points**
Capstone: Marine Science
Students demonstrate mastery of concepts and skills learnt during their degree through the production and presentation of a project in Marine Science developed in conjunction with a mentor from the academic staff.
Prerequisite: MARINE 202 and 30 points at Stage III in BSc courses
Restriction: MARINE 304

Postgraduate 700 Level Courses

MARINE 701 **15 Points**
Current Issues in Marine Science
An exploration of current topics in Marine Science. The topics and material will recognise the wide range of undergraduate experience across participants and emphasise the value of cross-disciplinary approaches to Marine Science.

MARINE 702 **15 Points**
Field Techniques in Marine Science
An advanced course in the development of practical skills in research design, implementation and analysis in Marine Science.

MARINE 703 **15 Points**
Marine Protected Areas - Level 9
Current research related to marine protected areas is reviewed, including planning principles and processes for designing marine protected areas, and its role in science, conservation of biological diversity, and fisheries. Practical components include visits to marine reserves, exposure to planning software, and analysis of marine protected related data. The knowledge and skills gained are applied with an independent research project.
Restriction: ENVSCI 726

MARINE 704 **15 Points**
Special Topic

MARINE 705 **15 Points**
Ocean Management and Planning
Approaches to management and conservation of global oceans are changing rapidly to address increasingly complex social, economic and environmental issues. Reviews current ocean governance, policy, planning and management approaches, modern ocean management and planning tools using examples from recent international ocean conservation projects.

MARINE 706 **15 Points**
Special Topic

MARINE 707 **15 Points**
Applied Estuarine Ecology
Emphasises multi-disciplinary science that integrates across different empirical and theoretical approaches to better understand the functioning of soft-sediment ecosystems. Covers fundamental ecological principles of soft-sediment systems through to the impacts associated with human activities. Includes practical exercises in experimental field ecology which will introduce students to key research methods. No formal prerequisite but knowledge of Stage III marine ecology or science will be assumed.
Restriction: ENVSCI 702

MARINE 780 **60 Points**
MARINE 780A **30 Points**
MARINE 780B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in MARINE 780 A and B, or MARINE 780

MARINE 790 **30 Points**
MARINE 790A **15 Points**
MARINE 790B **15 Points**
Research Project - Level 9
To complete this course students must enrol in MARINE 790 A and B, or MARINE 790

MARINE 792 **60 Points**
MARINE 792A **30 Points**
MARINE 792B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in MARINE 792 A and B, or MARINE 792

MARINE 794A **45 Points**
MARINE 794B **45 Points**
Thesis in Marine Studies - Level 9
Restriction: MARINE 796
To complete this course students must enrol in MARINE 794 A and B

MARINE 795A **45 Points**
MARINE 795B **45 Points**
Thesis in Marine Conservation - Level 9
To complete this course students must enrol in MARINE 795 A and B

MARINE 796A **60 Points**
MARINE 796B **60 Points**
MSc Thesis in Marine Science - Level 9
To complete this course students must enrol in MARINE 796 A and B

Mathematics

Stage I

MATHS 102 **15 Points**
Functioning in Mathematics
An introduction to calculus that builds mathematical skills and develops conceptual thinking. MATHS 102 works as a refresher course for those who haven't studied Mathematics for some time, a confidence builder for those lacking Mathematical confidence and a preparation course for further study in Mathematics.
Restriction: MATHS 102 may not be taken concurrently with any other Mathematics course, except MATHS 190 and may not be taken after ENGSCI 111 or any Mathematics course at Stage I or above, except MATHS 190/190G

MATHS 108 **15 Points**
General Mathematics 1
A general entry to Mathematics for commerce and the social sciences, following Year 13 Mathematics. Covers selected topics in algebra and calculus and their applications, including: linear functions, linear equations and matrices; functions, equations and inequalities; limits and continuity; differential calculus of one and two variables; integral calculus of one variable.
Prerequisite: MATHS 102 or 110 or at least 13 credits in Mathematics at NCEA Level 3 including the Differentiation Standard 91578, or D in CIE A2 Mathematics or C in CIE AS Mathematics or 3 out of 7 in IB Mathematics: Analysis and Approaches (SL or HL)
Restriction: ENGGEN 150, ENGSCI 111, MATHS 120, 130, 208, 250

MATHS 110 **15 Points**
Mathematics for Natural Sciences
A general entry to Mathematics for the natural sciences, following Year 13 Mathematics. Covers selected topics in algebra and calculus and their application to chemistry, biology and other natural sciences.
Prerequisite: MATHS 102 or 108 or at least 13 credits in Mathematics at NCEA Level 3, or D or better in Cambridge A2 Mathematics, C or better in AS Mathematics, pass in IB Mathematics: Analysis and Approaches (SL or HL)
Restriction: ENGGEN 150, ENGSCI 111, MATHS 208, 250. More than 15 points from MATHS 120 and 130

MATHS 120 **15 Points**
Algebra
A foundation for further mathematics courses, essential for students intending to major in Mathematics, Applied Mathematics, Statistics, Physics, or who want a strong mathematical component to their degree. Develops skills and knowledge in linear algebra, together with an introduction to mathematical language and reasoning, including complex numbers, induction and combinatorics. Recommended preparation: Merit or excellence in the Differentiation Standard 91578 at NCEA Level 3.
Prerequisite: MATHS 208, or B- or higher in MATHS 108, or A- or higher in MATHS 110, or A+ in MATHS 102, or at least 18 credits in Mathematics at NCEA Level 3 including at least 9 credits at merit or excellence, or B in CIE A2 Mathematics, or 5 out of 7 in IB Mathematics: Analysis and Approaches (SL or HL)

MATHS 130 **15 Points**
Calculus
A foundation for further mathematics courses, essential for students intending to major in Mathematics, Applied Mathematics, Statistics, Physics, or who want a strong mathematical component to their degree. Develops skills and knowledge in calculus of functions of a single variable. Recommended preparation: Merit or excellence in the Differentiation Standard 91578 at NCEA Level 3.
Prerequisite: MATHS 208, or B- or higher in MATHS 108, or A- or higher in MATHS 110, or A+ in MATHS 102, or at least 18 credits in Mathematics at NCEA Level 3 including at least 9 credits at merit or excellence, or B in CIE A2 Mathematics, or 5 out of 7 in IB Mathematics: Analysis and Approaches (SL or HL)

MATHS 162 **15 Points**
Computational Mathematics
An introduction to computational mathematics and programming in MATLAB. The course will introduce some basic concepts in computational mathematics and give applications that include cryptography, difference equations, stochastic modelling, graph theory and Markov chains.
Corequisite: ENGGEN 150 or ENGSCI 111 or MATHS 108 or 120
Restriction: MATHS 199

MATHS 190 **15 Points**
Great Ideas Shaping our World
Mathematics contains many powerful and beautiful ideas that have shaped the way we understand our world. This course explores some of the grand successes of mathematical thinking. No formal mathematics background is required, just curiosity about topics such as infinity, paradoxes, cryptography, knots and fractals.
Restriction: MATHS 190 may not be taken after any Mathematics course at Stage III

MATHS 199 **15 Points**
Advancing in Mathematics
An introduction to University level mathematics, for high-achieving students currently at high school. The numerical computing environment MATLAB is used to study beautiful mathematics from algebra, analysis, applied mathematics and combinatorics. Students will learn to write mathematical proofs and create mathematical models to find solutions to real-world problems.
Prerequisite: Departmental approval

Stage II

MATHS 200 **15 Points**
Special Topic

MATHS 208 **15 Points**
General Mathematics 2
This sequel to MATHS 108 features applications from

the theory of multi-variable calculus, linear algebra and differential equations to real-life problems in statistics, economics, finance, computer science, and operations research.
Prerequisite: 15 points from MATHS 108, ENGSCI 111, ENGGEN 150, or MATHS 120 and MATHS 130, or a B- or higher in MATHS 110
Restriction: Cannot be taken, concurrently with, or after MATHS 250, 253

MATHS 250 **15 Points**
Algebra and Calculus 2
Designed for all students who plan to progress further in mathematics, this course follows directly from MATHS 120 and 130. Covering topics from multivariable calculus and linear algebra, which have many applications in science, engineering and commerce. Students will learn mathematical results and procedures as well as the underpinning ideas and mathematical proofs.
Prerequisite: MATHS 120 and 130, or ENGGEN 150, or ENGSCI 111, or MATHS 120 or 130 or 208 with an A or above, and PHYSICS 120 or 121

MATHS 253 **15 Points**
Algebra and Calculus 3
A sequel to MATHS 250, further developing and bringing together linear algebra and calculus. Students will learn about quadratic forms, projections, spectral decomposition, methods of multicriteria optimisation, double, triple and line integrals, Green's theorem and applications.
Prerequisite: MATHS 250

MATHS 254 **15 Points**
Fundamental Concepts of Mathematics
Explores fundamentals of mathematics important to many branches of the subject and its applications. Topics include equivalence relations, elementary number theory, counting techniques, elementary probability, geometry, symmetry and metric spaces. This is an essential course for all students advancing beyond Stage II in pure mathematics, and highly suitable for other students in the mathematical sciences.
Corequisite: MATHS 250

MATHS 260 **15 Points**
Differential Equations
The study of differential equations is central to mathematical modelling of systems that change. This course develops methods for understanding the behaviour of solutions to ordinary differential equations. Qualitative and elementary numerical methods for obtaining information about solutions are discussed, as well as some analytical techniques for finding exact solutions in certain cases. Some applications of differential equations to scientific modelling are discussed. A core course for Applied Mathematics.
Prerequisite: MATHS 208 or 250 or ENGSCI 211 or a concurrent enrolment in MATHS 250

MATHS 270 **15 Points**
Numerical Computation
Many mathematical models occurring in Science and Engineering cannot be solved exactly using algebra and calculus. Students are introduced to computer-based methods that can be used to find approximate solutions to these problems. The methods covered in the course are powerful yet simple to use. This is a core course for students who wish to advance in Applied Mathematics.
Prerequisite: MATHS 120 and 130, or 15 points from ENGGEN 150, ENGSCI 111, MATHS 108, 110 and 15 points from COMPSCI 101, 105, 130, INFOSYS 110, 120, MATHS 162, 199

Stage III

MATHS 302 **15 Points**
Perspectives in Mathematics Education
For people interested in thinking about the social, cultural, political, economic, historical, technological and theoretical ideas that influence mathematics education, who want to understand the forces that shaped their own mathematics education, or who are interested in teaching. Students will develop their ability to communicate ideas in essay form. Recommended preparation: At least 45 points from courses in Mathematics or Statistics.

MATHS 307 **15 Points**
Special Topic

MATHS 308 **15 Points**
Special Topic

MATHS 315 **15 Points**
Mathematical Logic
Logic addresses the foundations of mathematical reasoning. It models the process of mathematical proof by providing a setting and the rules of deduction. This course builds a basic understanding of first order predicate logic, introduces model theory and demonstrates how models of a first order system relate to mathematical structures. Recommended for high level computer science or mathematical logic.
Prerequisite: B+ or higher in COMPSCI 225 or MATHS 254 or PHIL 222

MATHS 320 **15 Points**
Algebraic Structures
This is a framework for a unified treatment of many different mathematical structures. It concentrates on the fundamental notions of groups, rings and fields. The abstract descriptions are accompanied by numerous concrete examples. Applications abound: symmetries, geometry, coding theory, cryptography and many more. This course is recommended for those planning graduate study in pure mathematics.
Prerequisite: MATHS 250, 254

MATHS 326 **15 Points**
Combinatorics
Combinatorics is a branch of mathematics that studies collections of objects that satisfy specified criteria. An important part of combinatorics is graph theory, which is now connected to other disciplines including bioinformatics, electrical engineering, molecular chemistry and social science. The use of combinatorics in solving counting and construction problems is covered using topics that include algorithmic graph theory, codes and incidence structures, and combinatorial complexity.
Prerequisite: MATHS 254, or 250 and a B+ or higher in COMPSCI 225

MATHS 328 **15 Points**
Algebra and Applications
The goal of this course is to show the power of algebra and number theory in the real world. It concentrates on concrete objects like polynomial rings, finite fields, groups of points on elliptic curves, studies their elementary properties and shows their exceptional applicability to various problems in information technology including cryptography, secret

sharing, and reliable transmission of information through an unreliable channel.
Prerequisite: MATHS 250 and 254, or a B+ or higher in COMPSCI 225 and 15 points from MATHS 250, 253

MATHS 332 **15 Points**
Real Analysis
A standard course for every student intending to advance in pure mathematics. It develops the foundational mathematics underlying calculus, it introduces a rigorous approach to continuous mathematics and fosters an understanding of the special thinking and arguments involved in this area. The main focus is analysis in one real variable with the topics including real fields, limits and continuity, Riemann integration and power series.
Prerequisite: MATHS 250, 254

MATHS 333 **15 Points**
Analysis in Higher Dimensions
By selecting the important properties of distance many different mathematical contexts are studied simultaneously in the framework of metric and normed spaces. This course examines carefully the ways in which the derivative generalises to higher dimensional situations. These concepts lead to precise studies of continuity, fixed points and the solution of differential equations. A recommended course for all students planning to advance in pure mathematics.
Prerequisite: MATHS 332 or a B or higher in MATHS 254

MATHS 334 **15 Points**
Algebraic Geometry
Algebraic geometry is a branch of mathematics studying zeros of polynomials. The fundamental objects in algebraic geometry are algebraic varieties i.e., solution sets of systems of polynomial equations.
Prerequisite: MATHS 332, and at least one of MATHS 320, 328 and Departmental approval
Restriction: MATHS 734

MATHS 340 **15 Points**
Real and Complex Calculus
Calculus plays a fundamental role in mathematics, answering deep theoretical problems and allowing us to solve very practical problems. This course extends the ideas of calculus to two and higher dimensions, showing how to calculate integrals and derivatives in higher dimensions and exploring special relationships between integrals of different dimensions. It also extends calculus to complex variables. Recommended preparation: MATHS 253
Prerequisite: MATHS 250

MATHS 341 **15 Points**
Complex Analysis
Explores functions of one complex variable, including Cauchy's integral formula, the index formula, Laurent series and the residue theorem. Many applications are given including a three-line proof of the fundamental theorem of algebra. Complex analysis is used extensively in engineering, physics and mathematics. Strongly recommended: MATHS 333
Prerequisite: MATHS 332 and Departmental approval
Restriction: MATHS 740

MATHS 350 **15 Points**
Topology
Aspects of point-set, set-theoretic and algebraic topology including: properties and construction of topological spaces, continuous functions, axioms of separation, countability, connectivity and compactness, metrisation, covering spaces, the fundamental group and homology theory. Recommended preparation: MATHS 333.
Prerequisite: MATHS 332 and Departmental approval
Restriction: MATHS 750

MATHS 361 **15 Points**
Partial Differential Equations
Partial differential equations (PDEs) are used to model many important applications of phenomena in the real world such as electric fields, diffusion and wave propagation. Covers linear PDEs, analytical methods for their solution and weak solutions. Recommended preparation: MATHS 253
Prerequisite: MATHS 250, 260

MATHS 362 **15 Points**
Methods in Applied Mathematics
Covers a selection of techniques to analyse differential equations including the method of characteristics and asymptotic analysis. These methods are fundamental in the analysis of traffic flows, shocks and fluid flows. Introduces foundational concepts to quantify uncertainty in parameters of differential equations and is recommended for students intending to advance in Applied Mathematics. Recommended preparation: MATHS 253, 361
Prerequisite: MATHS 250, 260

MATHS 363 **15 Points**
Advanced Computational Mathematics
Finite element methods, calculus of variations and control theory are key mathematical tools used to model, compute approximations to model solutions and to understand the control of real-world phenomena. These topics share the same mathematical foundations and can all be described as variational methods. The course offers advanced techniques to handle complicated geometries and optimise desired objectives in applications modelled using differential equations. Recommended preparation: MATHS 253
Prerequisite: MATHS 260 and 270

MATHS 381 **15 Points**
Directed Study

MATHS 382 **15 Points**
MATHS 382A **7.5 Points**
MATHS 382B **7.5 Points**
Directed Study
To complete this course students must enrol in MATHS 382 A and B, or MATHS 382

MATHS 383 **15 Points**
Special Topic

MATHS 384 **15 Points**
Special Topic

MATHS 386 **15 Points**
MATHS 386A **7.5 Points**
MATHS 386B **7.5 Points**
Directed Study
Directed study on a topic or topics approved by the Academic Head or nominee.
To complete this course students must enrol in MATHS 386 A and B, or MATHS 386

MATHS 387 **15 Points**
Directed Study

MATHS 388 **15 Points**
Special Topic

MATHS 389 **15 Points**
Special Topic

MATHS 399 **15 Points**
Capstone: Mathematics
An exploration of the role of mathematics in society and culture, and the activities performed by mathematicians as teachers, critics, and innovators. Students will develop their skills in communication, critical thinking, teaching, and creative problem solving.
Prerequisite: MATHS 250 and 30 points at Stage III in Mathematics

Postgraduate 700 Level Courses

MATHS 701 **15 Points**
Introduction to Research in Mathematics Education
What is Mathematics Education research, and how can it inform practice? This course introduces a range of skills and methods for conducting and critically consuming research in mathematics education. Students will explore issues and techniques in Mathematics Education research as they design their own research studies to inform their teaching and learning practice.
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 702 **15 Points**
Mathematical Processes in the Curriculum
Historically, mathematics curricula have emphasised the what of mathematics (content), at the expense of considering the how. This course uses hands-on experiences and research literature to explore how to teach, learn and do mathematics through processes such as communication, modelling, problem solving, and proving.

MATHS 703 **15 Points**
What Can Be More Practical Than a Good Theory?
An analysis of theoretical perspectives that inform research in mathematics education, with a focus on learning theories, both social and psychological, and their implications for teaching and learning in mathematics.
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 705 **15 Points**
Contemporary Issues in Mathematics Education
This course explores contemporary topics in mathematics education research and their impact on teaching and learning. Students will investigate and critically examine research and scholarly literature, and consider the implications of current knowledge for their own practice.
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 706 **15 Points**
Technology and Mathematics Education
Practical and theoretical perspectives on ways that technology can enhance teaching and learning of mathematics. Students will consider and critically examine affordances, constraints and obstacles in the use of technology.
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 707 **15 Points**
Special Topic
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 708 **15 Points**
Special Topic
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 709 **15 Points**
Special Topic
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 710 **15 Points**
Directed Study in Mathematics Education
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 711 **30 Points**
MATHS 711A **15 Points**
MATHS 711B **15 Points**
Directed Study in Mathematics Education
Prerequisite: MATHS 302 or significant teaching experience or department approval
To complete this course students must enrol in MATHS 711 A and B, or MATHS 711

MATHS 712 **15 Points**
Teaching and Learning in Algebra
Recent theoretical perspectives on the teaching and learning of school and university mathematics are linked to the learning of either calculus or algebra. The focus is on the mathematics content, applications, and effective learning at school and university. Students taking this course should normally have studied mathematics or statistics at 200 level.
Prerequisite: MATHS 302 or significant teaching experience or department approval

MATHS 713 **15 Points**
Logic and Set Theory
A study of the foundations of pure mathematics, formalising the notions of a 'mathematical proof' and 'mathematical structure' through predicate calculus and model theory. It includes a study of axiomatic set theory.
Prerequisite: MATHS 315 or PHIL 305

MATHS 714 **15 Points**
Number Theory
A broad introduction to various aspects of elementary, algebraic and computational number theory and its applications, including primality testing and cryptography.
Prerequisite: B+ in MATHS 328 or 320

MATHS 715 **15 Points**
Graph Theory and Combinatorics
A study of combinatorial graphs (networks), designs and codes, illustrating their application and importance in other branches of mathematics and computer science.
Prerequisite: 15 points from MATHS 320, 326, 328 with a B or higher

MATHS 720 **15 Points**
Group Theory
A study of groups focusing on basic structural properties, presentations, automorphisms and actions on sets, illustrating their fundamental role in the study of symmetry (for example in crystal structures in chemistry and physics), topological spaces, and manifolds.
Prerequisite: MATHS 320

MATHS 721 **15 Points**
Representations and Structure of Algebras and Groups
Representation theory studies properties of abstract groups and algebras by representing their elements as

linear transformations of vector spaces or matrices, thus reducing many problems about the structures to linear algebra, a well-understood theory.
Prerequisite: MATHS 320

MATHS 725 **15 Points**
Lie Groups and Lie Algebras
Symmetries and invariants play a fundamental role in mathematics. Especially important in their study are the Lie groups and the related structures called Lie algebras. These structures have played a pivotal role in many areas, from the theory of differential equations to the classification of elementary particles. Strongly recommended for students advancing in theoretical physics and pure mathematics. Recommended preparation: MATHS 333.
Prerequisite: MATHS 320 and 332

MATHS 730 **15 Points**
Measure Theory and Integration
Presents the modern elegant theory of integration as developed by Riemann and Lebesgue. This course includes powerful theorems for the interchange of integrals and limits, allowing very general functions to be integrated, and illustrates how the subject is both an essential tool for analysis and a critical foundation for the theory of probability. Strongly recommended: MATHS 333
Prerequisite: MATHS 332

MATHS 731 **15 Points**
Functional Analysis
Provides the mathematical foundations behind some of the techniques used in applied mathematics and mathematical physics; it explores how many phenomena in physics can be described by the solution of a partial differential equation, for example the heat equation, the wave equation and Schrödinger's equation. Recommended preparation: MATHS 730 and 750.
Prerequisite: MATHS 332 and 333

MATHS 734 **15 Points**
Algebraic Geometry
Algebraic geometry is a branch of mathematics studying zeros of polynomials. The fundamental objects in algebraic geometry are algebraic varieties i.e., solution sets of systems of polynomial equations.
Prerequisite: MATHS 332 and at least one of MATHS 320, 328
Restriction: MATHS 334

MATHS 735 **15 Points**
Analysis on Manifolds and Differential Geometry
Studies surfaces and their generalisations, smooth manifolds, and the interaction between geometry, analysis and topology; it is a central tool in many areas of mathematics, physics and engineering. Topics include Stokes' theorem on manifolds and the celebrated Gauss Bonnet theorem. Strongly recommended: MATHS 333 and 340.
Prerequisite: MATHS 332

MATHS 740 **15 Points**
Complex Analysis
An introduction to functions of one complex variable, including Cauchy's integral formula, the index formula, Laurent series and the residue theorem. Many applications are given including a three line proof of the fundamental theorem of algebra. Complex analysis is used extensively in engineering, physics and mathematics. Strongly recommended: MATHS 333.
Prerequisite: MATHS 332
Restriction: MATHS 341

MATHS 750 **15 Points**
Topology
Aspects of point-set, set-theoretic and algebraic topology including: properties and construction of topological spaces, continuous functions, axioms of separation, countability, connectivity and compactness, metrization, covering spaces, the fundamental group and homology theory. Strongly recommended: MATHS 333.
Prerequisite: MATHS 332
Restriction: MATHS 350

MATHS 761 **15 Points**
Dynamical Systems
Mathematical models of systems that change are frequently written in the form of nonlinear differential equations, but it is usually not possible to write down explicit solutions to these equations. This course covers analytical and numerical techniques that are useful for determining the qualitative properties of solutions to nonlinear differential equations.
Prerequisite: B- in both MATHS 340 and 361

MATHS 763 **15 Points**
Advanced Partial Differential Equations
A study of advanced exact and numerical methods for both linear and non-linear partial differential equations.
Prerequisite: B- in both MATHS 340 and 361

MATHS 764 **15 Points**
Mathematical Biology
A course introducing central concepts in mathematical biology, with emphasis on modelling of physiological systems and gene dynamics.
Prerequisite: B- in both MATHS 340 and 361

MATHS 765 **15 Points**
Mathematical Modelling
Advanced topics in mathematical modelling, including selected topics in a range of application areas, principally taken from the physical and biological sciences.
Prerequisite: At least B- or better in both MATHS 340 and 361

MATHS 766 **15 Points**
Inverse Problems
Covers the mathematical and statistical theory and modelling of unstable problems that are commonly encountered in mathematics and applied sciences.
Prerequisite: At least B- in both MATHS 340 and 363, or PHYSICS 701

MATHS 767 **15 Points**
Inverse Problems and Stochastic Differential Equations
Covers stochastic differential equations and inverse problems, including: continuous time processes, random walks and Wiener processes, Itō calculus, and applications of SDEs, Hilbert spaces and linear operator theory, singular value decomposition and pseudoinverses, Tikhonov regularisation, nonlinear problems and iterative methods.
Prerequisite: B- or higher in MATHS 340 and 361
Restriction: MATHS 766, 769, 787

MATHS 769 **15 Points**
Stochastic Differential and Difference Equations
Differential and difference equations are often used as preliminary models for real world phenomena. The practically relevant models that can explain observations are, however, often the stochastic extensions of differential and difference equations. This course considers stochastic differential and difference equations and applications such

as estimation and forecasting. Recommended preparation: MATHS 363.
Prerequisite: B- in both MATHS 340 and 361

MATHS 770 **15 Points**
Advanced Numerical Analysis
Covers the use, implementation and analysis of efficient and reliable numerical algorithms for solving several classes of mathematical problems. The course assumes students have done an undergraduate course in numerical methods and can use Matlab or other high-level computational language.
Prerequisite: B- in MATHS 270, 340 and 361

MATHS 776 **30 Points**
MATHS 776A **15 Points**
MATHS 776B **15 Points**
Honours Research Project - Level 9
Restriction: MATHS 791
To complete this course students must enrol in MATHS 776 A and B, or MATHS 776

MATHS 777 **15 Points**
Project in Mathematics 1 - Level 9
A supervised investigation or research project including seminar presentation in pure or applied mathematics.

MATHS 779 **60 Points**
MATHS 779A **30 Points**
MATHS 779B **30 Points**
Dissertation in Mathematics Education - Level 9
To complete this course students must enrol in MATHS 779 A and B, or MATHS 779

MATHS 781 **15 Points**
Special Topic

MATHS 782 **15 Points**
Special Topic

MATHS 783 **15 Points**
Special Topic

MATHS 784 **15 Points**
Special Topic

MATHS 785 **45 Points**
MATHS 785A **15 Points**
MATHS 785B **30 Points**
Dissertation in Mathematics Education - Level 9
To complete this course students must enrol in MATHS 785 A and B, or MATHS 785

MATHS 786 **15 Points**
Special Topic

MATHS 787 **15 Points**
Special Topic

MATHS 788 **15 Points**
Special Topic

MATHS 789 **15 Points**
Special Topic

MATHS 793 **15 Points**
Project in Mathematics 2 - Level 9
An investigation into a topic from pure or applied mathematics, under the supervision of one or more staff members.

MATHS 794 **30 Points**
Project in Mathematics 3 - Level 9
An investigation into a topic from pure or applied mathematics, under the supervision of one or more staff members.

MATHS 795A **60 Points**
MATHS 795B **60 Points**
MSc Thesis in Applied Mathematics - Level 9
To complete this course students must enrol in MATHS 795 A and B

MATHS 796A **60 Points**
MATHS 796B **60 Points**
Masters Thesis Mathematics - Level 9
To complete this course students must enrol in MATHS 796 A and B

MATHS 798A **45 Points**
MATHS 798B **45 Points**
Research Portfolio in Mathematics - Level 9
To complete this course students must enrol in MATHS 798 A and B

Physics

Stage I

PHYSICS 100 **15 Points**
PHYSICS 100G **15 Points**
Models and Reality
Explore the role of models in physical science and what they contribute to our understanding of the world, and the concepts of reductionism and emergence. Topics include particle physics, materials science, and climate; and the use of models that explain dynamics of populations and artificial systems, including epidemiology, flocking in birds and fish, and the spread of information in social networks.

PHYSICS 102 **15 Points**
Basic Concepts of Physics
An introduction to the basic principles of physics. Key topics are the physical description of motion, electricity and magnetism. The course focuses on the science of everyday phenomena and the understanding of important physical concepts. This course will equip students with little prior knowledge of physics to succeed in PHYSICS 120 or 160.
Restriction: PHYSICS 103

PHYSICS 120 **15 Points**
Advancing Physics 1
For students progressing in physical science. Key topics are mechanics, energy, rotation, oscillations, waves and thermodynamics. This is a calculus based course, focusing on fundamental principles, problem solving and hands-on exercises.
Prerequisite: PHYSICS 102, or at least 4 credits in the Mechanics (91524) or Waves (91523) standards in NCEA Level 3 Physics and at least 6 credits in the Differentiation (91578) or Integration (91579) standards in NCEA Level 3 Calculus, or equivalent with departmental approval
Restriction: PHYSICS 160

PHYSICS 121 **15 Points**
Advancing Physics 2
For students progressing in physical science. Key topics are electrostatics, electromagnetism, circuits, optics, relativity and quantum mechanics. This is a calculus based course, focusing on fundamental principles, problem solving and hands-on exercises.
Prerequisite: PHYSICS 120, or 24 credits in the Mechanics (91524), Electricity (91526), Differentiation (91578),

Integration (91579) standards in NCEA Level 3 at merit or excellence, or equivalent with departmental approval
Restriction: PHYSICS 150

PHYSICS 140 **15 Points**
Digital Fundamentals
An introduction to the physical basis of modern computing for Computer Science students and anyone with an interest in modern Information Technology. Key topics are Boolean Algebra, logic circuits, and digital information processing. Hands-on laboratory work is a key component of the course. No prior electronics or programming knowledge is assumed.
Restriction: PHYSICS 219, 243

PHYSICS 160 **15 Points**
Physics for the Life Sciences
Designed for students intending to advance in the biomedical and life sciences, this course is focused on physical principles relevant to biological systems. Key topics are motion, waves, thermal physics, electricity and instrumentation. The course is primarily algebra-based and includes lectures, laboratories and tutorials. Recommended preparation is NCEA Level 2 Physics and Mathematics, or equivalent.
Restriction: PHYSICS 120

Stage II

PHYSICS 201 **15 Points**
Classical and Thermal Physics
Classical mechanics and thermal physics. Key topics are linear and rotational motion in three dimensions, fluids, oscillations and mechanical waves, and the laws of thermodynamics. The course will cover both fundamental principles and applied topics, such as planetary dynamics and spacecraft navigation, ultrasound, atmospheric physics and materials science.
Prerequisite: 15 points from PHYSICS 120, 121, 150, 160 and 15 points from ENGSCI 211, MATHS 130, 208, PHYSICS 211
Restriction: PHYSICS 230, 231

PHYSICS 202 **15 Points**
Electromagnetism
Key topics are electric and magnetic fields, the generation of magnetic fields by currents, the derivation of Maxwell's equations, the interpretation of light as an electromagnetic wave and polarisation. Both fundamental principles and applied topics, including fibre optics, LEDs, physical optics and interferometers are covered.
Prerequisite: 15 points from PHYSICS 121, 150 and 15 points from ENGSCI 211, MATHS 130, 208, PHYSICS 211
Restriction: PHYSICS 260, 261

PHYSICS 203 **15 Points**
Relativity and Quantum Physics
Special relativity, quantum mechanics and nuclear physics. Key topics are the Lorentz transformation, mass-energy equivalence, the Schrödinger equation in one dimension, the hydrogen atom, atomic and molecular bonds, isotopes and radioactivity. Both fundamental principles and applied topics, including isotope production, nuclear medicine, and dosimetry are covered.
Prerequisite: 15 points from PHYSICS 121, 150 and 15 points from ENGSCI 211, MATHS 130, 208, PHYSICS 211
Restriction: PHYSICS 250, 251

PHYSICS 244 **15 Points**
Electronics and Imaging
Provides students with skills in electronics and imaging technologies that will support future work in technology-focused careers, experimental science, medical physics, and photonics. Key topics include networks, resonance, amplifiers, semiconductors, Fourier analysis, imaging systems, MRI systems and biomedical imaging.
Prerequisite: 15 points from PHYSICS 120, 121, 140, 160 and 15 points from COMPSCI 120, ENGGEN 150, ENGSCI 111, MATHS 108, 110, 120, 130, 150
Restriction: PHYSICS 240

Stage III

PHYSICS 309 **15 Points**
Special Study
Directed study on a topic or topics approved by the Academic Head or nominee.
Prerequisite: 45 points from PHYSICS 201-203, 244

PHYSICS 331 **15 Points**
Classical Mechanics and Electrodynamics
Advanced topics in classical mechanics and electromagnetism, including variational and least action principles in mechanics, the physical basis of magnetism, and the four-vector treatment of special relativity and electromagnetism.
Prerequisite: 15 points from PHYSICS 201, 231, 15 points from PHYSICS 202, 261 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211
Restriction: PHYSICS 315, 325

PHYSICS 332 **15 Points**
Fluid Mechanics
Surveys fluid mechanics using the Navier-Stokes equations, covering Newtonian and simple non-Newtonian fluids, and examples from soft condensed matter. Different flow regimes will be studied, from small-scale laminar flows to large-scale turbulent and potential flows, and flows in rotating frames of reference. Applications range from microfluidics to geophysical fluids. Numerical approaches and computational tools will be introduced.
Prerequisite: 15 points from PHYSICS 201, 231 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211

PHYSICS 333 **15 Points**
Lasers and Electromagnetic Waves
Surveys the basic principles of lasers and explains how the behaviour and propagation of light can be understood in terms of electromagnetic waves described by Maxwell's equations. The theory and applications of several key optical components will be described, including lasers and resonators.
Prerequisite: 15 points from PHYSICS 202, 261 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211
Restriction: PHYSICS 326

PHYSICS 334 **15 Points**
Statistical Physics and Condensed Matter
Covers statistical physics and condensed matter physics, and describes how macroscopic properties of physical systems arise from microscopic dynamics. Topics in statistical physics include temperature, the partition function and connections with classical thermodynamics. Topics in condensed matter physics include crystal structures, phonons, electronic band theory, and semiconductors.
Prerequisite: 15 points from PHYSICS 201, 231, 15 points from PHYSICS 203, 251 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211
Restriction: PHYSICS 315, 354

PHYSICS 335 **15 Points**
Quantum Mechanics
Develops non-relativistic quantum mechanics with applications to the physics of atoms and molecules and to quantum information theory. Topics include the Stern-Gerlach effect, spin-orbit coupling, Bell's inequalities, interactions of atoms with light, and the interactions of identical particles.
Prerequisite: 15 points from PHYSICS 203, 251 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211
Restriction: PHYSICS 350

PHYSICS 340 **15 Points**
Electronics and Signal Processing
Electronics and digital signal processing with a strong emphasis on practical circuit design and data acquisition techniques. Topics will be selected from: linear circuit theory, analytical and numeric network analysis, feedback and oscillation, operational amplifier circuits, Fourier theory, sampling theory, digital filter design, and the fast Fourier transform.
Prerequisite: PHYSICS 240 or 244
Restriction: PHYSICS 341
Concurrent enrolment in PHYSICS 390 is recommended

PHYSICS 356 **15 Points**
Particle Physics and Astrophysics
Particle physics topics covered will include relativistic dynamics and application to fundamental particle interactions, the properties of strong, weak and electromagnetic interactions and the particle zoo. Astrophysics topics will include some of the following: the Big Bang, "concordance cosmology", redshifts, theories of dark matter, extra-solar planets, stellar evolution, supernovae, gravitational wave sources, nuclear astrophysics and the origin of the elements.
Prerequisite: 15 points from PHYSICS 201, 231, 15 points from PHYSICS 203, 251 and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211
Restriction: PHYSICS 355
Concurrent enrolment in PHYSICS 390 is recommended

PHYSICS 371 **15 Points**
Special Topic

PHYSICS 390 **15 Points**
Experimental Physics
Covers advanced experimental techniques, giving students choices between a wide range of classic physics experiments and open-ended investigations of physical phenomena.
Prerequisite: 15 points from PHYSICS 201, 202, 203, 231, 240, 244, 251, 261

PHYSICS 399 **15 Points**
Capstone: Physics
Students will undertake experimental, observational, computational and numerical investigations of key physical phenomena, working individually and in groups, producing both written and oral reports.
Prerequisite: 30 points from PHYSICS 201-261 and 30 points from PHYSICS 309-356

Diploma Courses

PHYSICS 624 **15 Points**
Mechanics and Electrodynamics
Advanced topics in classical mechanics and electromagnetism, including variational and least action principles in mechanics, the physical basis of magnetism, and the four-vector treatment of special relativity and electromagnetism. Advanced Laboratory work is included in relevant topics.
Prerequisite: Departmental approval
Restriction: PHYSICS 331

PHYSICS 625 **15 Points**
Lasers and Electromagnetic Waves
Surveys the basic principles of lasers and explains how the behaviour and propagation of light can be understood in terms of electromagnetic waves described by Maxwell's equations. The theory and applications of several key optical components will be described, including lasers and resonators. Advanced Laboratory work is included in relevant topics.
Prerequisite: Departmental approval
Restriction: PHYSICS 333

PHYSICS 626 **15 Points**
Quantum Physics
Develops non-relativistic quantum mechanics with applications to the physics of atoms and molecules and to quantum information theory. Topics include the Stern-Gerlach effect, spin-orbit coupling, Bell's inequalities, interactions of atoms with light, and the interactions of identical particles. Advanced Laboratory work is included in relevant topics.
Prerequisite: Departmental approval
Restriction: PHYSICS 335

PHYSICS 681 **15 Points**
Directed Study
Directed study on a research topic approved by the Academic Head or nominee.

PHYSICS 690A **15 Points**
PHYSICS 690B **15 Points**
Graduate Diploma Research Project
To complete this course students must enrol in PHYSICS 690 A and B

PHYSICS 691 **30 Points**
PHYSICS 691A **15 Points**
PHYSICS 691B **15 Points**
Postgraduate Diploma Research Project - Level 9
To complete this course students must enrol in PHYSICS 691 A and B, or PHYSICS 691

Postgraduate 700 Level Courses

PHYSICS 703 **15 Points**
Advanced Quantum Mechanics
An advanced development of nonrelativistic quantum mechanics in the Dirac formulation is presented. Emphasis is placed on the simplicity and generality of the formal structure, lifting the reliance of introductory courses on wave mechanics.

PHYSICS 715 **15 Points**
Directed Study
Enrolment requires approval of the Head of Department and the choice of subject will depend on staff availability or on the needs of particular students.
Prerequisite: Departmental approval

PHYSICS 741 **15 Points**
Advanced Classical Mechanics and Electrodynamics
Develops and deepens students' knowledge and understanding of advanced topics in classical mechanics and electromagnetism, including variational and least action principles in mechanics, the physical basis of

magnetism; and the four-vector treatment of special relativity and electromagnetism.
Restriction: PHYSICS 331, 705

PHYSICS 742 **15 Points**
Advanced Statistical Mechanics and Condensed Matter
Advanced concepts in statistical mechanics and condensed matter. Topics to be covered include the theory of magnetism, mean field theory, the Ising model, superconductivity, phase transitions, complex systems, and networks.
Restriction: PHYSICS 708

PHYSICS 743 **15 Points**
Waves and Potentials
Presents the universal mathematical physics of waves and potential fields and discusses related applications. Topics include derivations and solutions for electromagnetic and elastic wave equations, propagation of waves in media, reflection and transmission of waves at interfaces, guided waves in geophysics and optics, and fundamentals of potential theory.

PHYSICS 746 **15 Points**
Relativistic Quantum Mechanics and Field Theory
Examines quantum field theory. Covers the relativistic generalisations of the Schrödinger equation and many-particle quantum mechanics, quantum electrodynamics is explored using Feynman diagram techniques. Extensions of scalar field theory to include path integrals, statistical field theory, broken symmetry, renormalisation and the renormalisation group.
Restriction: PHYSICS 706, 755

PHYSICS 748 **15 Points**
General Relativity
Discusses Einstein's General Theory of Relativity with application to astrophysical problems, drawn from black hole physics, gravitational waves, cosmology, astrophysical lensing and solar system and terrestrial tests of the theory. The course includes the mathematical background needed to describe curved spacetimes in arbitrary coordinate systems and the covariant description of fundamental physical relationships.

PHYSICS 751 **15 Points**
Special Topic

PHYSICS 752 **15 Points**
Photonics
Advanced topics in photonics including optical detection, semiconductor and modelocked lasers, the propagation of light in optical fibres, and the physics and applications of nonlinear optics.
Restriction: PHYSICS 726, 727

PHYSICS 753 **15 Points**
The Dynamic Universe
Covers topics in modern astronomy and astrophysics relating to the evolution and dynamics of key astrophysical systems. Topics will be drawn from: stellar structure and stellar evolution; the formation of planets and the evolution of planetary systems; stellar and galactic dynamics; the large scale dynamical behaviour of the expanding universe.

PHYSICS 754 **15 Points**
Condensed Matter Physics
Covers topics and methods that are important for current condensed matter research. Topics include ferroelectricity, soft condensed matter, experimental materials physics, electronic structure theory, techniques for condensed matter simulation, and renormalisation group theory.

PHYSICS 757 **15 Points**
Quantum Optics and Quantum Information
The nonrelativistic quantum treatment of electromagnetic radiation (light) and its interaction with matter (atoms, quantum dots, superconducting qubits) is presented. Emphasis is placed on what is strictly quantum mechanical about light compared with a description in terms of Maxwell waves, and on the concepts and methods underlying modern advances in quantum measurement theory and quantum technologies, e.g., quantum communication/cryptology and quantum simulation/computation.
Restriction: PHYSICS 760

PHYSICS 780 **15 Points**
Advanced Imaging Technologies
Covers the physical basis and use of new imaging technologies and data processing in medicine, biomedicine and biotechnology. Makes use of practical examples from techniques such as computer assisted tomgraphy, nonlinear microscopy, optical coherence tomography, fluorescence or microarray analysis. No formal prerequisite, but an understanding of material to at least a B grade standard in PHYSICS 244, 340, and 15 points from PHYSICS 211, MATHS 253, 260, ENGSCI 211 is recommended.

PHYSICS 786 **45 Points**
PHYSICS 786A **15 Points**
PHYSICS 786B **30 Points**
BAdvSci(Hons) Dissertation in Physics - Level 9
To complete this course students must enrol in PHYSICS 786 A and B, or PHYSICS 786

PHYSICS 787 **45 Points**
PHYSICS 787A **15 Points**
PHYSICS 787B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in PHYSICS 787 A and B, or PHYSICS 787

PHYSICS 788 **15 Points**
Project in Physics

PHYSICS 789 **30 Points**
PHYSICS 789A **15 Points**
PHYSICS 789B **15 Points**
Honours Research Project - Level 9
To complete this course students must enrol in PHYSICS 789 A and B, or PHYSICS 789

PHYSICS 791 **15 Points**
Special Topic

PHYSICS 792 **15 Points**
Special Topic

PHYSICS 796A **60 Points**
PHYSICS 796B **60 Points**
MSc Thesis in Physics - Level 9
To complete this course students must enrol in PHYSICS 796 A and B

Psychology

Stage I

PSYCH 108 **15 Points**
Individual, Social and Applied Psychology
Topics covered may include: developmental and social

psychology including group behaviour, the measurement of mental abilities, intelligence, models of personality, clinical and health psychology, methods of therapeutic intervention, and the psychological similarities and differences between cultures. A laboratory component, in which students are required to participate as subjects, forms part of the course.

PSYCH 109 **15 Points**
PSYCH 109G **15 Points**
Mind, Brain and Behaviour
Topics covered may include: the nature of sensory and perceptual processes, the cause of perceptual illusions, the structure and function of the human brain, approaches to animal and human learning, models of human language and memory, and the design of psychological experiments. A laboratory component, in which students are required to participate as subjects, forms part of the course.

Stage II

PSYCH 200 **15 Points**
Foundations of Developmental Psychology
How do children's minds develop, how do they work, and how do they influence children's behaviour? Students will learn the theoretical perspectives and methods that scientists use to investigate the developing mind in infancy through late childhood. Topics of particular focus include learning and memory, concepts and categories, language, the self and identity, social cognition, attachment, and emotion.
Prerequisite: 30 points at Stage I in Psychology

PSYCH 201 **15 Points**
Perception and Cognition
An introduction to a variety of topics in human experimental psychology. Topics covered may include: perceptual processes, attention, memory, mental imagery, language development, theory of mind, problem solving and decision making. Participation in the laboratory component of this course is compulsory.
Prerequisite: 30 points at Stage I in Psychology

PSYCH 202 **15 Points**
Biopsychology
Provides a basic introduction to the structure and function of the brain, neuropsychology, and genetic and hormonal influences on behaviour. This course includes a compulsory laboratory component.
Prerequisite: 30 points at Stage I in Psychology or 15 points from BIOSCI 101, 103

PSYCH 203 **15 Points**
Learning and Behaviour
A consideration of the environmental factors that control and modify animal (including human) behaviour. Generally, an experimental laboratory approach is taken, and quantitative theories are stressed. Topics include: classical and operant conditioning, theories of reinforcement, the stimulus control of operant behaviour, behavioural analyses of problem solving, concept learning and language, choice, self control, remembering and experimental design. This course includes a compulsory laboratory component.
Prerequisite: 30 points at Stage I in Psychology or 15 points from BIOSCI 101, 103

PSYCH 204 **15 Points**
Social Psychology
Focuses on humans as social beings. Covers topics such as social cognition, attitudes, group processes, interpersonal relationships, and language communication. The course may include participation in and completion of a research project.
Prerequisite: 30 points at Stage I in Psychology

PSYCH 207 **15 Points**
Theories of Personality and Development
The major personality theories are presented including: Behavioural, Cognitive, Social-Cognitive, Psychodynamic, Humanistic/Phenomenological, Trait/Dispositional and Biological/Evolutionary. The hypotheses generated by these theories, about development from early childhood onwards and about 'normal' and 'abnormal' behaviour, will be discussed and evaluated in terms of empirical evidence and utility. Attention will be paid to cultural issues of relevance in a New Zealand context.
Prerequisite: 30 points at Stage I in Psychology

PSYCH 208 **15 Points**
Producing Psychological Knowledge
How do you address research questions in psychology? What is a research question anyway? Which methodology and analytical method will provide the answers you are looking for? Examines what we do and can know in psychology, and how we know it, including philosophy of science, quantitative and qualitative methodologies, statistics for psychological research, ethics, and research outcomes and communication.
Prerequisite: 30 points at Stage I in Psychology
Restriction: PSYCH 306

PSYCH 209 **15 Points**
Special Topic

PSYCH 211 **30 Points**
Psychology for Society
Examines what we do and can know in psychology, and why and how we know it, including philosophy of science, methodology, ethics, research outcomes, and particular methods. Embeds a focus on the cultural context of Aotearoa New Zealand within which psychological knowledge is applied. Introduces broad content in preparation for more advanced study.

PSYCH 212 **15 Points**
Special Topic
Prerequisite: 30 points at Stage I in Psychology

Stage III

PSYCH 300 **15 Points**
Applied Psychology
Discusses psychological issues relating to illnesses and well-being of people in the workplace. Consideration will be given both to the theoretical models which have been developed and to the types of methodology used in their investigation. Emphasis is given to the interplay between science and practice.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 302 **15 Points**
Special Topic
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 303 **15 Points**
Cognitive Science
Provides an introduction to cognitive science and cognitive neuroscience. Topics covered include: visual and auditory perception, attention, memory, thinking and problem-

solving. Participation in the laboratory component of this course is compulsory.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 304 **15 Points**
Special Topic
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 305 **15 Points**
Human Neuroscience
Covers material relating to the neural basis of cognitive processes, including perception, attention, memory and language. Students will be introduced to different methods of inferring mind-brain relations in normal and neurologically-impaired individuals, and different ways of conceptualising mind-brain relations, such as connectionism and modularism.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125, or MEDSCI 206 or PHYSIOL 220

PSYCH 306 **15 Points**
Research Methods in Psychology
Deals with principles and practices relevant to psychological research, including philosophy of science, research ethics, research design, measurement of dependent variables, describing and analysing data, and interpreting results. Participation in the laboratory component of this course is compulsory.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125
Restriction: PSYCH 208

PSYCH 308 **15 Points**
PSYCH 308A **7.5 Points**
PSYCH 308B **7.5 Points**
Directed Study
A course of research supervised by a staff member and written up as a course for publication instead of a final examination.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125
Corequisite: Student must be enrolled in (or have completed) an additional 45 points at Stage III in Psychology courses and Programme Director approval
To complete this course students must enrol in PSYCH 308 A and B, or PSYCH 308

PSYCH 309 **15 Points**
Learning
A discussion of how behaviour is controlled and modified by discriminative stimuli and by consequential reinforcers and punishers. The emphasis is on laboratory research with animals, but with some human data also considered. Topics include: choice behaviour, punishment, avoidance, psychophysics, memory, and cognition. This course includes a compulsory laboratory component.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125, or 45 points at Stage II in Biological Sciences
Restriction: PSYCH 362

PSYCH 310 **15 Points**
Introduction to Clinical Psychology
Describes and evaluates psychological approaches to the assessment and treatment of those mental health problems, in adults and children, most commonly encountered by clinical psychologists. Consideration is given to work in mental health, corrections, child protection and neuropsychology rehabilitation. Issues relevant to Māori mental health, gender, cross-cultural work and prevention are included.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 311 **15 Points**
Advanced Topics in Social Psychology
Focuses on a number of key topics in social psychology. Modules examine interpersonal influence and close relationships, collective behaviour, prejudice and social issues, and social identity and well-being.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 313 **15 Points**
Psychology of Communication
Studies the links between psychological processes and communication difficulties. Hearing, speech, language and voice will be covered. A range of communication difficulties and communication differences will be introduced and the psychosocial aspects will be discussed, including impact on self-esteem, health-related quality of life, peer/interpersonal relationships and educational and behavioural consequences in children and adults.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 315 **15 Points**
Special Topic

PSYCH 317 **15 Points**
Evolution, Behaviour and Cognition
How does behaviour in non-human animals evolve? Do other animals have language? Do they have culture? Can human behaviour be explained in evolutionary terms? This course addresses these questions and the methods that can be used to answer them.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125, or 45 points at Stage II in Biological Sciences

PSYCH 319 **15 Points**
Psychology and Gender
The study of gender is crucial to understanding many everyday aspects of our lives, as well as many contemporary social issues. This course provides an introduction to selected key issues in the critical psychology of gender, from a social constructionist perspective. Topics that will be covered include gendered bodies, masculinity and femininity, sexuality, rape, and mental health.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125, or 30 points at Stage II in Gender Studies

PSYCH 320 **15 Points**
Culture and Psychology
It is through culture that we make sense of ourselves and our world. Of key interest is how culture, ethnicity and context all play a major role in understanding human experience including behaviour, thoughts, and emotions. Emphasis is placed on critical thinking and analytic skills, and helping students think about their own values and norms from a cultural perspective.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125

PSYCH 323 **30 Points**
Changes across the Lifespan
Development is a lifelong process. Classic and modern theories of development provide a foundation for understanding changes and continuities across the lifespan. Students will learn how we develop key social,

emotional, and cognitive abilities across infancy, childhood, adolescence, and adulthood. Developmental psychology will then be applied to understand developmental challenges, atypical development, and the role of social context.
Prerequisite: PSYCH 211

PSYCH 324 **30 Points**
The Behaving Brain
Human brains are enormously complex, and they serve a wide range of human needs, from perception to language to social interactions. Brains are also subject to growth, learning, insult, and ageing. Introduces research and theory on neural and cognitive science, as well as opportunities to apply this knowledge.
Prerequisite: PSYCH 211

PSYCH 325 **30 Points**
Social Processes
Social processes heavily influence how we think, feel, and behave. Students will learn about how social cognition, social influence, attitudes, politics, and identity shape our lived experiences. Explores various topics, which may include prejudice and intergroup relationships, romantic relationships, workplace and organisational dynamics, gendered practices, indigenous psychologies, and the evolution of religion.
Prerequisite: PSYCH 211

PSYCH 326 **15 Points**
Life Span Development
The development of people across the life span is studied. Describes key milestones in development and examines the causes and processes that produce stability and change in people's development over time. Topics discussed will include aspects of cognitive, social and physical development with consideration given to biological, societal and family influences. Attention will also be given to development within the New Zealand context.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125
Restriction: PSYCH 316

PSYCH 327 **15 Points**
Special Topic

PSYCH 328 **15 Points**
Special Topic

PSYCH 370 **15 Points**
PSYCH 370A **7.5 Points**
PSYCH 370B **7.5 Points**
Research Project
The main focus of the research project is to undertake practical research-related activities under the direction of a supervisor. The work undertaken will be communicated by the student in the form of a research report. The research activities across the year will give students a broader experience of research and academic activities in the School of Psychology.
Prerequisite: 45 points at Stage II in Psychology and 15 points from STATS 100-125
Corequisite: 45 points at Stage III or above in Psychology and Head of School approval
Restriction: PSYCH 308
To complete this course students must enrol in PSYCH 370 A and B, or PSYCH 370

PSYCH 399 **15 Points**
Capstone: Communicating Psychology
Focuses on communicating psychological ideas and research using different media (e.g., podcast, short film, print media, symposia, grant proposals). Students will be required to work in groups, but to also engage in individual activities to demonstrate their own understanding of the topics explored by them and others in this course.
Prerequisite: 30 points at Stage III in Psychology and 15 points from STATS 100-125

Diploma Courses

PSYCH 651A **30 Points**
PSYCH 651B **30 Points**
Practicum
This includes a practical component of up to 1,500 hours of supervised work in an approved applied psychology setting, with an emphasis on the application of research principles and designs. Evaluation is by internal assessment and assessment by field supervisors.
Restriction: PSYCH 650
To complete this course students must enrol in PSYCH 651 A and B

PSYCH 690A **15 Points**
PSYCH 690B **15 Points**
Graduate Diploma Research Project
To complete this course students must enrol in PSYCH 690 A and B

PSYCH 691A **15 Points**
PSYCH 691B **15 Points**
Postgraduate Diploma Research Project
To complete this course students must enrol in PSYCH 691 A and B

Postgraduate 700 Level Courses

PSYCH 700 **15 Points**
Political Psychology
Provides an overview of the intersecting fields of psychology and political science. Seminar-based topics include personality and politics, political socialisation, voting behaviour, media effects, rational choice vs. symbolic politics, the competency of the electorate, the psychology of legitimacy, and other timely issues. Attention will be paid to the international literature, though New Zealand-based research will also be discussed.

PSYCH 707 **15 Points**
Psychology of Offending
Covers psychological theories of crime and violence, empirical research relevant to the assessment and treatment of youth and adult offending, with particular emphasis on violent and sexual offending, and the range of roles for psychologists in forensic and correctional settings such as prisons, community and forensic psychiatric hospitals.

PSYCH 708A **15 Points**
PSYCH 708B **15 Points**
Clinical Neuropsychology
Consists of: an introduction to neuroanatomy and neuropathology, seminars on the major areas of neuropsychological dysfunction, introduction to community-used test materials and theoretical issues of neuropsychological assessment, neuropsychological dysfunction, individual assessment and individual case studies.
To complete this course students must enrol in PSYCH 708 A and B

PSYCH 714 **15 Points**
Cognitive Neuroscience
An advanced seminar on cognitive neuroscience. Topics may include: neuroanatomy, neuroimaging methodologies, neurological and developmental disorders, and the organisation of higher cognitive functions such as attention, language, memory and executive functions. Emphasis will be placed on current developments relevant to the understanding of human psychological processes.

PSYCH 715 **15 Points**
Psychology and Sustainability
Human behaviour and thinking is central to both the sustainability problem and viable solutions. This course considers the psychological barriers to thinking and acting sustainably and how theories and research on emotions, modelling, identity, belonging, moral development and the evolution of cooperation can be applied to overcome these barriers. There will be particular emphasis on how to develop 'sustainability consciousness' in individuals and organisations.

PSYCH 716 **15 Points**
Social Psychology and Interpersonal Processes
Key empirical and theoretical areas in contemporary social psychology form the basis of this seminar-based course. Topics will include social cognition, interpersonal influence, communication, and close personal relationships. Students will also conduct small research projects investigating central topics covered in the course.

PSYCH 717 **15 Points**
Community Psychology
The application of psychological knowledge and research skills to issues faced by communities. Students will design an intervention relevant to a social issue. Theoretical approaches to working in community settings and the practical challenges involved will be discussed.

PSYCH 718 **15 Points**
Psychotherapeutic Assessment and Formulation
Major theories used in clinical practice to understand psychological problems will be discussed, including behavioural, cognitive-behavioural, systems and psychodynamic models. Emphasis is on assessment and formulation of clients' problems rather than therapeutic intervention. Approaches covered are those that are most commonly employed by psychologists practicing in New Zealand.
Prerequisite: PSYCH 723
Restriction: PSYCH 709

PSYCH 720A **15 Points**
PSYCH 720B **15 Points**
Directed Study
To complete this course students must enrol in PSYCH 720 A and B

PSYCH 721 **15 Points**
Consciousness and Cognition
Discusses recent research on consciousness from the perspective of cognitive neuroscience. Topics covered may include: implicit learning, implicit memory, blindsight, the split-brain syndrome, amnesia and hemineglect.

PSYCH 722 **15 Points**
Human Learning and Development
Focuses on the processes and factors that influence human learning in infancy through childhood. Topics discussed may include: early social cognition, language development and the factors that influence school and life success. Consideration will be given to diverse contexts and populations.

PSYCH 723 **15 Points**
Mental Health Problems: Aetiology and Assessment
Provides an overview of common mental health problems in childhood and adulthood and the methods that clinical psychologists use to assess these. Examines theories of causation and risk factors for a number of mental health problems. Also introduces and critiques diagnostic tools and psychometric instruments used in assessment.
Corequisite: PSYCH 718

PSYCH 725 **15 Points**
Evolution and Human Behaviour
Investigates the psychology of humans from an evolutionary perspective. Specific topics may include the evolution of language, religion, mental time travel, social learning, and cognitive nudges, biases and heuristics.

PSYCH 726 **15 Points**
Emotion and Identity
Explores current psychological theory and research on emotion, adding perspectives from sociology, history and cultural studies as well as neuroscience. Topics include the embodied nature of affect; emotion, relationships and social life; emotion and sense of self, subjectivity, narrative and personal history; emotional contagion in crowds and groups; and the power of social norms around public emotional expression.

PSYCH 727 **15 Points**
Functional MRI
A comprehensive overview of functional magnetic resonance imaging (fMRI) with a focus on its use in the cognitive neuroscience of memory and aging. Designed for beginners, topics include experimental design, image acquisition and pre-processing, analysis methods, localisation/anatomy and interpretation. Classes will include a lecture and/or a seminar followed by a hands-on laboratory working with fMRI data to consolidate learning.

PSYCH 728 **30 Points**
PSYCH 728A **15 Points**
PSYCH 728B **15 Points**
Portfolio in ABA
A series of written clinical assessment and intervention projects in applied behaviour analysis demonstrating appropriate use of the scientist-practitioner model. Projects will be conducted within each of the placements completed during the internship course PSYCH 651. The portfolio should provide evidence of appropriate mastery of basic behaviour-analytic skills, client-centred responsibilities, and foundational knowledge of applied behaviour analysis.
Prerequisite: PSYCH 750, 751, 754
Corequisite: PSYCH 651, 757
To complete this course students must enrol in PSYCH 728 A and B, or PSYCH 728

PSYCH 730 **15 Points**
Professional Psychology Practice in New Zealand
Aims to equip students with knowledge and skills required for registration as a psychologist with the New Zealand Psychologists Board. Topics include the structure and functions of the Psychologists Board/Health and Disability Commissioner, cultural competency (obligations under the Treaty of Waitangi and cultural safe practice), professional ethics (Code of Ethics for Psychologists Working in Aotearoa/New Zealand) and related legislation.

PSYCH 731 **15 Points**
Social Psychology and Intergroup Processes
Focuses on the application of social psychological knowledge and theory to the understanding of broad social and cultural processes and phenomena, such as violence, prejudice, group behaviour and conflict, intergroup dynamics, collective behaviour, social beliefs, cultural differentiation and contact.

PSYCH 733 **15 Points**
Critical Health Psychology
Utilising the frameworks of critical psychology, including gendered, Indigenous and intersectional frameworks, this course examines ways of theorising, understanding and promoting health for individuals, communities and societies.

PSYCH 736 **15 Points**
Human Brain Mapping
Introduces human brain mapping based on structural magnetic resonance imaging (MRI). Topics include MRI data acquisition, processing and analysis, as well as interpretation of analysis outcomes and fundamentals of neuroanatomy.

PSYCH 737 **15 Points**
Work and Well-Being
Reviews concepts, methods, applications and current research relevant to the impact of work on employee well-being, including topics such as the employee lifecycle, stress, well-being, positive psychology, emotion, bullying and work-life balance.

PSYCH 741 **15 Points**
ABA: Communicating Behaviourally
Provides the opportunity to gain practical experience with a range of mediums for communicating behavioural concepts.

PSYCH 742 **15 Points**
Neuroscience of Awareness
An advanced seminar on the neuroscience of awareness and related topics. The course will primarily consist of student-led discussion of original research, with particular emphasis on areas of active controversy or debate. In addition to the theoretical discussion of human awareness, there will be a strong focus on the methods and practice of research in human neuroscience.

PSYCH 743 **15 Points**
Critical Qualitative Research in Aotearoa
Equips students with conceptual, theoretical, political and practical understandings of what it means to do critical, qualitative research in psychology in Aotearoa. Situates methods in relation to who researchers are, where we are, and how we collaborate, including obligations and opportunities provided by Te Tiriti o Waitangi, and Indigenous-led approaches.

PSYCH 744 **15 Points**
Experimental Design and Quantitative Methods for Psychology
Covers applications of the general linear model to research design and analysis. Topics include: univariate techniques (analysis of variance, analysis of covariance, regression) and multivariate techniques (multivariate analysis of variance, discriminant analysis, multivariate regression, and factor analysis).
Prerequisite: PSYCH 306

PSYCH 746 **15 Points**
Perception, Cognition, Action
Seminar-based introduction to theories and models linking (human, animal and machine) perception, cognition and action, with emphasis on competing approaches to perceptual-motor control and learning, using evidence from classic and contemporary research in experimental psychology and cognitive neuroscience.

PSYCH 749 **15 Points**
Applied Behaviour Analysis Ethics
Investigates the similarities and differences between the NZPB and BACB codes and discusses how to reconcile the two in practical situations. Discusses the current legislation and frameworks that apply to clinicians working with vulnerable people, and the impact of culture when applying codes and working ethically. Different methods of ethical problem solving are covered.

PSYCH 754 **15 Points**
Developmental and Intellectual Disabilities
Study of the behavioural aspects, aetiologies and therapeutic interventions for disorders usually diagnosed during childhood that are associated with reduced abilities to learn. Examples include intellectual disabilities and pervasive developmental disorders (e.g., autism).
Restriction: PSYCH 752

PSYCH 755 **15 Points**
Gender, Power, and Sexuality
This seminar-based course will allow students to explore a broad range of topics such as: sexual coercion, prostitution, rape, pornography, safer sex, lesbian and gay sexuality, heterosexuality, bisexuality, sexology, sex therapy, intersex, transgender, sexuality and culture. The emphasis will be on looking at questions from the perspective of theoretical approaches such as Foucault's work on sexuality and feminist theories.

PSYCH 756 **15 Points**
Dynamics of Brain and Behaviour
Examines the behavioural and neural changes that result from normal development, those that may arise in the context of neurological diseases and disorders, and the changes that can be elicited via interventions. Topics include the design and implementation of interventions to improve mental and physical health, methods to evaluate characteristics of change, and the precise mechanisms of neural and behavioural change. Recommended preparation: PSYCH 305

PSYCH 757 **15 Points**
PSYCH 757A **7.5 Points**
PSYCH 757B **7.5 Points**
Advanced Applied Behaviour Analysis
Advanced education and training in applied behaviour analysis (ABA) in preparation for a professional career. Topics include ethical, professional, and practical issues confronting behaviour analysts in employment; recent research in ABA and other sciences with respect to clinical, educational, and other populations with whom behaviour analysts typically work.
Prerequisite: PSYCH 750, 751
Corequisite: PSYCH 651
Restriction: PSYCH 753
To complete this course students must enrol in PSYCH 757 A and B, or PSYCH 757

PSYCH 758 **15 Points**
Ethnicity, Identity and Culture
Students will draw upon Indigenous and cultural psychological frameworks to examine how psychological research is conducted with ethnic communities, and will examine the influences of culture, values and beliefs across selected topics (e.g. resiliency, language and masculinity).

PSYCH 759 **15 Points**
Advanced Behavioural Psychology
Examination of selected topics in contemporary behavioural psychology. The specific topics covered depend partly on student interest, exploring research on the relation between behaviour and environment, considering both animal and human behaviour, and both lab-based research and translation of that research into understanding behaviour of significance to society.

PSYCH 761 **15 Points**
Organisational Psychology
Focuses on attitudes and behaviours at work that reflect or impact on the relationship between employee and employer, with a particular emphasis on topics that are proposed to impact on employee well-being and productivity (e.g., job satisfaction, motivation, leadership). Students will be encouraged to adopt a scientist-practitioner perspective, through class discussions and assignments.

PSYCH 763 **45 Points**
PSYCH 763A **22.5 Points**
PSYCH 763B **22.5 Points**
Portfolio of Professional Practice Reports
A portfolio of original reports associated with the student's practicum experience and demonstrating the ability to make appropriate use of the scientific literature in solving problems in professional practice, as required by the New Zealand Psychologists Board for the practice of psychology.
Corequisite: PSYCH 651
To complete this course students must enrol in PSYCH 763 A and B, or PSYCH 763

PSYCH 764 **15 Points**
Dual Process Theories of Human Cognition
Explores how dual-process theories in cognitive, social and developmental psychology account for human thought and action in terms of the interaction between automatic (implicit, parallel) and controlled (explicit, serial) processes. Topics of focus include memory, learning, numerical cognition, theory of mind, moral reasoning, attribution, executive functioning and decision making.

PSYCH 765 **15 Points**
Special Topic: Pacific Psychologies
Explores how Pacific knowledges and worldviews shape and are shaped by Pacific communities to make meaning of and respond to a broad range of topics relevant to psychology.

PSYCH 766 **15 Points**
Occupational Health Psychology
Students will focus on the in-depth treatment of this area, focusing primarily on occupational stress, including coverage of topics such as: work, life, and family, job insecurity, workplace incivility, abusive supervision, positive aspects of workplaces, as well as stress management interventions.

PSYCH 767 **15 Points**
Gender Violence
What does it mean to say that violence is gendered? How does a gender analysis shape our understanding of the nature of problems like sexual violence, domestic violence, street harassment and online abuse? And how does it guide our responses to the harm of violence and our strategies for prevention? This course will bring a critical feminist lens to understanding key questions, theories and debates in research on gender violence.

PSYCH 768 **15 Points**
Special Topic: Sex and Well-Being

PSYCH 769 **15 Points**
Special Topic: Developmental Psychology: A Critical Lens

PSYCH 770 **15 Points**
Behavioural Insights
Explores how cognitive biases and errors cause us to behave in irrational ways and how nudging and debiasing can mitigate these effects. Introduces students to methods to run behavioural insight analyses in real-world settings.

PSYCH 771A **30 Points**
PSYCH 771B **30 Points**
Clinical Practice 1 and Professional Issues
Consists of two parts: First, psychological assessment and therapy for diverse clinical populations, including adult, and child and family. Cognitive behaviour therapy and family therapy are central, but other models are included. Consideration of psychotherapy research and practical exercises are incorporated. Secondly, ethics, bicultural and cross-cultural practice, and other professional issues relevant to the practice of clinical psychology are covered. Evaluation is by internal assessment.
To complete this course students must enrol in PSYCH 771 A and B

PSYCH 772A **30 Points**
PSYCH 772B **30 Points**
Clinical Practice 2
Advanced psychological assessment and therapy for diverse clinical populations, including adult, and child and family. Cognitive behaviour therapy, narrative therapy, psychodynamic therapy, and the trauma model are emphasised. Includes two, 200 hour placements, in either an adult setting or a child and family setting. Evaluation is by internal assessment, including assessment by field supervisors.
To complete this course students must enrol in PSYCH 772 A and B

PSYCH 773A **60 Points**
PSYCH 773B **60 Points**
Clinical Internship
Includes a practical component of supervised clinical work of not less than 1500 hours in an approved health setting. Emphasis is placed on the application of research principles and designs in routing clinical practice. A university-based seminar series that covers topics relevant to advanced, intern-level practice is included. Evaluation is by internal assessment, and assessment by field supervisors.
To complete this course students must enrol in PSYCH 773 A and B

PSYCH 775 **15 Points**
Special Topic: Visual Perception in Brains and Machines
Explores current debates on how to build and assess computational models of human visual perception. Students will learn how state-of-the-art artificial systems perform visual tasks, and gain hands-on experience interacting with these systems. Literature from the field of visual neuroscience will examine the ways in which these models may work similarly to, and differently from, human vision.

PSYCH 776 **15 Points**
Special Topic

PSYCH 777 **15 Points**
Special Topic: Illusory Line Motion

PSYCH 778 **15 Points**
Topics in Sensation and Perception
A range of topics in Sensation and Perception will be explored, including those of applied interest, experimental approaches, and methods. Examples include cross-modal effects on taste perception, misophonia and misokinesia, the five basic tastes, false memory for foods, threshold estimation, preference testing, the auditory sensory meridian response, and other contemporary topics.

PSYCH 779A **7.5 Points**
PSYCH 779B **7.5 Points**
Research and Communication Skills - Level 9
Advanced skills associated with developing innovative research designs and communicating information about research designs, outcomes, and the implications of one's findings are essential to the research process. Students will undertake exercises designed to develop these advanced skills, including writing a research proposal, presenting a seminar on their research project, preparing and presenting a research poster, and additional seminar-based exercises directed at research skill development.
Corequisite: PSYCH 780
Restriction: PSYCH 788, 789
To complete this course students must enrol in PSYCH 779 A and B

PSYCH 780A **15 Points**
PSYCH 780B **15 Points**
Honours Research Project - Level 9
Corequisite: PSYCH 779
Restriction: PSYCH 788, 789
To complete this course students must enrol in PSYCH 780 A and B

PSYCH 788A **22.5 Points**
PSYCH 788B **22.5 Points**
Honours Dissertation in Psychology - Level 9
Restriction: PSYCH 789
To complete this course students must enrol in PSYCH 788 A and B

PSYCH 790 **45 Points**
PSYCH 790A **15 Points**
PSYCH 790B **30 Points**
Dissertation in Organisational Psychology - Level 9
To complete this course students must enrol in PSYCH 790 A and B, or PSYCH 790

PSYCH 793 **60 Points**
PSYCH 793A **30 Points**
PSYCH 793B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in PSYCH 793 A and B, or PSYCH 793

PSYCH 794A **30 Points**
PSYCH 794B **60 Points**
Thesis in Organisational Psychology - Level 9
To complete this course students must enrol in PSYCH 794 A and B

PSYCH 796A **60 Points**
PSYCH 796B **60 Points**
Masters Thesis in Psychology - Level 9
To complete this course students must enrol in PSYCH 796 A and B

Psychology

Postgraduate 700 Level Courses

PSYCHOL 700 **15 Points**
Special Topic: Wairua, Wellbeing and Cultural Considerations
Wairua is multi-faceted and central to holistic wellbeing. This course privileges Mātauranga Māori in the exploration of wairua and wellbeing and will provide a strong foundation for working with Māori. Students engage with topics relevant to indigenous cultural considerations in psychological research and practice. Includes self-reflection and group work in a wānaga/noho marae setting.

PSYCHOL 701 **15 Points**
Special Topic

PSYCHOL 702 **30 Points**
The Science of Behaviour Analysis
A study of the science of behaviour analysis that helps students to understand and articulate the core principles of behaviour, the philosophy of behaviourism, and the interaction between experimental and applied research. The course introduces core approaches and concepts in behaviour analysis such as reinforcement, stimulus control, measurement, small-N design, and radical behaviourism. The underlying approach to understanding behaviour is constructional.

PSYCHOL 703 **30 Points**
Clinical Behaviour Analysis
A study of the methods and tactics used to produce behaviour change in a range of real-world and clinical settings. Students will learn the relationship between interventions and assessments and the behavioural principles that underpin them.

PSYCHOL 793 **60 Points**
PSYCHOL 793A **15 Points**
PSYCHOL 793B **45 Points**
Dissertation in Organisational Psychology - Level 9
To complete this course students must enrol in PSYCHOL 793 A and B, or PSYCHOL 793

Psychology

Named Doctoral Courses

PSYCH 800 **120 Points**
Scientist-practitioner Model
Advanced research based psychological assessment and therapy skills for diverse ages, cultures and clinical settings, and for complex clinical issues. Cognitive, behavioural, systemic, and mātauranga Māori models are central. Development of leadership, integrity, cultural sensitivity and other professional competences to allow registration with the New Zealand Psychologists Board. Supervised practicum experience includes three 200-hour placements and a 1,500 hour internship.

PSYCH 801 **30 Points**
Scientist-practitioner Model 1
Research based psychological assessment and therapy skills for diverse clinical populations, including adult, child and family. Cognitive-behaviour therapy and family therapy are central, but other models are included. Advanced clinical research design, ethics, bicultural and cross-cultural practice, supervision practice, and other professional issues relevant to the practice of clinical psychology are covered. Evaluation is by internal assessment. Includes one 200-hour placement in either an adult or a child and family setting. Evaluation is by internal assessment, including assessment by field supervisors.

PSYCH 802 **30 Points**
Scientist-practitioner Model 2
Advanced psychological assessment and therapy skills for diverse clinical populations, including adult, and child and family. Cognitive-behaviour therapy, family therapy, narrative therapy, psychodynamic therapy, and the trauma model are emphasised. Includes two 200-hour placements, in either an adult setting or child and family setting. One of these may, depending on staff availability, be in a specialist setting. Options may include: clinical neuropsychology, forensic psychology, assessment and psychological treatment of psychoses, child and adolescent clinical psychology, drug and alcohol addiction, and others. Evaluation is by internal assessment, including assessment by field supervisors.
Prerequisite: PSYCH 801

PSYCH 803 **60 Points**
Internship
This includes a practical component of supervised clinical work of not less than 1,500 hours in an approved setting. Emphasis is placed on the application of research principles and designs in routine psychological clinical practice. A university based seminar course that covers topics relevant to advanced, intern-level practice is included. Evaluation is by internal assessment, and assessment by field supervisors.
Prerequisite: PSYCH 801, 802

PSYCH 897 **90 Points**
Portfolio of Clinical Research
Five original research projects demonstrating appropriate use of the scientist-practitioner model (single case design, programme evaluation or group research may be included). One project will be conducted within each of the three placements associated with the courses PSYCH 801 and 802, and two within the Internship, PSYCH 803. At least one project should be related to research with an adult population, and at least one with a child and family population. The Portfolio will be examined by two internal academic psychologists and assessed by the two external Thesis examiners.
Restriction: PSYCH 894, 895

PSYCH 899 **150 Points**
Thesis
An original research dissertation completed over the three years of the degree (75 points in year 1, 60 points in year 2, and 15 points in year 3). The research may be basic or applied, but must be relevant to some area of clinical psychology and represent a significant contribution to knowledge in the field.
Restriction: PSYCH 896

Pūtaiao

Stage II

PŪTAIAO 200 **15 Points**
Mātauranga and Kaupapa Māori Science
Mātauranga is central to the future practice of science in Aotearoa New Zealand. Explores foundational understandings of mātauranga Māori and Kaupapa Māori for scientists. Students will meaningfully and respectfully engage with te ao Māori through place-based relational learning and case studies grounded in whanaungatanga. Students will experience Māori ways of being, knowing, and doing.
Prerequisite: 60 points at Stage I

Regional Development

Postgraduate 700 Level Courses

REGDEV 701 **15 Points**
Regional Futures
Examines the changing nature of the region as a spatial category of social and political economy. The course draws on place-based understandings of regional development to address how regions are being reassembled and what that means for the futures of people and place. Particular reference, in the New Zealand context, is made to the interconnections between regional and iwi developments.

Science Enterprise

Postgraduate 700 Level Courses

SCIENT 701 **15 Points**
Accounting and Finance for Scientists
Builds upon scientific numeracy in exploring the sources, uses and reporting of accounting and financial information in science-based enterprises; application of capital budgeting and valuation theory to science-relevant situations; and key bases for financially-informed project and enterprise decision-making and the management of economic resources.

SCIENT 702 **15 Points**
Marketing for Scientific and Technical Personnel
Examines the intermediaries and end-users of technical and research-related applications, products and services; their 'customers', 'value chain', 'marketing', and related concepts in both highly-regulated and open markets; and how effective science-related marketing strategies and promotional efforts are developed and communicated.

SCIENT 703 **15 Points**
Frontiers in Biotechnology - Level 9
An examination of how breakthrough discoveries in contemporary life sciences develop through to commercialisation. Students will integrate their advanced biological skills with business knowledge to critically analyse the commercialisation of scientific discoveries and communicate their findings effectively to both scientists and industry stakeholders.

SCIENT 704 **15 Points**
Law and Intellectual Property
An explanation of the legal system including basic concepts of contract and corporate law in a biotechnology context. Emphasis will be upon intellectual property laws in particular patent law and practice and other means of

protecting new ideas, discoveries and inventions. Also covered will be technology licensing and basic competition and marketing law.

SCIENT 705 **15 Points**
Research Commercialisation
Integrative exploration of common theories, processes and models involved in commercialising scientific research. Topics include technology transfer, technological entrepreneurship, commercial potential, risk, and valuation assessment and related tools. Utilises multiple learning approaches including case studies and a 'hands-on' term project.
Prerequisite: SCIENT 701, 702

SCIENT 706 **15 Points**
Commercialisation Project
A supervised practical application of the theories, concepts and techniques of commercialisation, covered in courses SCIENT 701-705, to a research-based opportunity and its related intellectual property estate.
Prerequisite: SCIENT 701, 702, 704
Corequisite: SCIENT 703, 705

SCIENT 707 **15 Points**
Special Topic

SCIENT 720 **15 Points**
Science Enterprise Research Methods
Students will become familiar with underlying theory and best practices in the principal qualitative and quantitative methods applicable to, and useful in, thesis research on commercialisation and science-based enterprise.

SCIENT 721 **15 Points**
Product Development and Regulatory Environments
Aims to give students an understanding of the stages of product development for therapeutics, diagnostics and medical devices, as well as the regulatory requirements affecting product development in the Life Sciences. Project management tools and processes will also be covered in the context of product development.

SCIENT 722 **15 Points**
Current Issues in Bioscience Enterprise
An exploration of trends and developments of importance to Life Sciences-related enterprises and industries. Utilises multiple learning approaches, e.g., independent reading, case studies, projects, guest speakers, presentations and related discussions.

SCIENT 794A **45 Points**
SCIENT 794B **45 Points**
Thesis - Level 9
Research project addressing a topic relevant to the commercialisation of research. Overseen jointly by both academic and industry supervisors.
To complete this course students must enrol in SCIENT 794 A and B

SCIENT 795A **30 Points**
SCIENT 795B **60 Points**
Thesis - Level 9
Research project addressing a topic relevant to the commercialisation of research. Overseen jointly by both academic and industry supervisors.
To complete this course students must enrol in SCIENT 795 A and B

Science General

Stage I

SCIGEN 101 **15 Points**
SCIGEN 101G **15 Points**
Communicating in a Knowledge Society
Effective communication is required for specialists in all fields to engage meaningfully with society. In this course students gain an understanding of the important role communication plays in a knowledge society. Through case studies and practical experience students learn about the responsibilities and skills required to communicate with a variety of audiences. They learn how to effectively manage and present data and practice oral, written, visual and electronic communication.

SCIGEN 102 **15 Points**
SCIGEN 102G **15 Points**
Contemporary Science in Aotearoa New Zealand
What does it mean to do science here and now? This course considers how knowledge of place enhances your learning, the significance of Te Tiriti o Waitangi, and how knowledge systems frame understanding. Students will think critically about the relationships between science and our environment, along with the ethics of science in practice.

SCIGEN 189 **10 Points**
Special Topic
Selected topics in Science designed as a short credit course for exchange students coming to New Zealand. This course is only available to inbound exchange students.
Prerequisite: Permission of Head of Department

Stage II

SCIGEN 201 **15 Points**
Innovating in a Knowledge Society
Interdisciplinary examination of science innovation at policy, organisational and project levels including context, impacts and roles of business and research organisations, and ways innovations are presented and received. Case study analysis of the business environment including how innovation is both enabled and constrained in science-based organisations and society, and innovation strategies in science–based organisations.

Stage III

SCIGEN 301 **15 Points**
Engaging in a Knowledge Society
Addressing complex issues requires knowledge experts to engage with a variety of people. Solutions will be gained from collaborations that co-produce knowledge in transdisciplinary partnerships that lead to new ways of thinking. This course explores meaningful ways to engage with communities, and reassesses current ways of knowing and doing.
Prerequisite: Any 180 points

SCIGEN 310 **15 Points**
Directed Study
Directed study on a topic or topics approved by the Academic Head.
Prerequisite: Approval of Academic Head or nominee and Dean or nominee

SCIGEN 311 **0 Points**
Scholarship Research Project
Prerequisite: Approval of Academic Head or Nominee

SCIGEN 399 **15 Points**
Capstone: Science
A multidisciplinary capstone for students coming from any science discipline. Students apply their cumulative knowledge and skills to a scientific phenomenon from a list of topics, considering the science in the context of sociocultural, ethical, or environmental challenges. Emphasises team as well as self-directed work to support mastery of academic competencies and key transferable skills.
Prerequisite: 45 points passed at Stage III and Associate Dean (Academic) or nominee approval
Restriction: Any other BSc capstone

Science Scholars

Stage I

SCISCHOL 100 **15 Points**
SCISCHOL 100A **7.5 Points**
SCISCHOL 100B **7.5 Points**
Science in Action
An introduction to the big questions in science, approaches to scientific research, and how science and scientists play a role in society. Students will explore scientific knowledge and enquiry from a broad, cross-disciplinary perspective.
Prerequisite: Programme Director approval
Restriction: SCISCHOL 101
To complete this course students must enrol in SCISCHOL 100 A and B, or SCISCHOL 100

SCISCHOL 101 **0 Points**
Science in Action 1
An introduction to the big questions in science, approaches to scientific research, and how science and scientists play a role in society. Students will explore scientific knowledge and enquiry from a broad, cross-disciplinary perspective.
Prerequisite: Programme Director approval

SCISCHOL 102 **0 Points**
Science in Action 2
An advanced introduction to the big questions in science, approaches to scientific research, and how science and scientists play a role in society. Students will explore scientific knowledge and enquiry from a broad, cross-disciplinary perspective.
Prerequisite: Programme Director approval

Stage II

SCISCHOL 201 **0 Points**
Introduction to Science and Innovation
An exploration of issues affecting Science in Society, including governance, funding and policies. Students will also explore the development of modern scientific method and the challenges of engaging in scientific research.
Prerequisite: Programme Director approval

SCISCHOL 202 **15 Points**
SCISCHOL 202A **7.5 Points**
SCISCHOL 202B **7.5 Points**
Research and Discovery
An exploration of scientific research skills and communication. Students will develop an understanding of the impact of culture on scientific discovery, the skills to develop and document a research proposal, and how to communicate scientific work in an area of choice.
Prerequisite: Programme Director approval
To complete this course students must enrol in SCISCHOL 202 A and B, or SCISCHOL 202

Stage III

SCISCHOL 301 **0 Points**
Advanced Science and Innovation
Explores the role of science in relation to the New Zealand and global economy and discusses issues including ownership, exploitation and stewardship of resources, indigenous science, biodiversity and National Science Challenges. Students will also explore the position of science nationally and globally and current scientific debates.
Prerequisite: Programme Director approval

SCISCHOL 302 **15 Points**
SCISCHOL 302A **7.5 Points**
SCISCHOL 302B **7.5 Points**
Science Scholars Project
Building on the research proposal developed in SCISCHOL 202, students will respond to a research question requiring data collection, analysis and interpretation, discussion and presentation of project outcomes.
Prerequisite: Programme Director approval
To complete this course students must enrol in SCISCHOL 302 A and B, or SCISCHOL 302

Speech Science

Postgraduate 700 Level Courses

SPCHSCI 701 **15 Points**
Dysphagia for Speech Language Therapists
Assessment, analysis and intervention for children and adults with dysphagia. This is a fully online course for qualified Speech-language Therapists.
Restriction: SPCHSCI 721

SPCHSCI 711 **15 Points**
Introduction to Communication in Children and Adults
Communication development and disorders. Normal communication development across the lifespan, in the context of total child development, of major changes in expectations such as school and literacy, and of variations such as cultural differences and multilingualism. Applications of these concepts in an introduction to the assessment and management of communication disorders in children and of acquired disorders in adults.

SPCHSCI 712 **15 Points**
Linguistics for Speech Language Therapy
The study of articulatory phonetics, phonemic transcription using the International Phonetic Alphabet, and the relationship between phonetics and phonology. Additional language analysis covering morphology, syntax, semantics and pragmatics.

SPCHSCI 713 **15 Points**
Anatomy and Physiology for Speech Language Therapy
Anatomy and physiology of speech, language and hearing, including the respiratory, phonatory, articulatory, auditory and peripheral and central nervous systems underlying spoken communication. Application of this knowledge is through manipulation of human models and supported computer laboratories.

SPCHSCI 714 **15 Points**
Speech Language Therapy Clinical Practicum 1
Clinical observation under supervisor guidance in a variety of settings, establishing links between theory and practice. This course is supported by weekly tutorial sessions.

SPCHSCI 721 **15 Points**
Dysphagia - Level 9
Assessment and management of dysphagia (adult and paediatrics). Critical evaluation and synthesis of knowledge are presented in a substantial individual report.
Prerequisite: SPCHSCI 713
Restriction: SPCHSCI 701

SPCHSCI 722 **15 Points**
Speech, Language and Communication Needs in Children 1
The nature of speech, language and communication needs in children is introduced by focusing on pre-verbal and very early communication, the development of speech, language and communication through preschool and primary school ages, and adolescence. Topics will include developmental language disorders and phonological disorders in children as well as contextual approaches to assessment and intervention, incorporating clinical decision-making, cultural and linguistic diversity and evidence-based practices.
Prerequisite: SPCHSCI 711

SPCHSCI 723 **15 Points**
Communication Disorders in Adults
This course examines theoretical, research and clinical issues in the field of acquired neurogenic communication disorders. It builds on existing knowledge and presents the process of assessment, differential diagnosis, intervention procedures and treatment specifically designed for these conditions. Skills are developed in analysing client-specific approaches, therapeutic programmes and incorporating measures of efficacy into therapy plans.
Prerequisite: SPCHSCI 713

SPCHSCI 724 **15 Points**
Speech Language Therapy Clinical Practicum 2
Clinical observation and practice in a variety of settings, enabling students to work with clients under supervision. This course is supported by weekly tutorials.
Prerequisite: SPCHSCI 714

SPCHSCI 733 **15 Points**
Audiology for Speech Language Therapy
Study of types of hearing impairment, pathologies of the hearing mechanism, tests and clinical procedures used in audiological evaluations and hearing instrumentation.
Prerequisite: SPCHSCI 713
Restriction: SPCHSCI 732

SPCHSCI 734 **15 Points**
Speech Language Therapy Clinical Practicum 3 - Level 9
Clinical practice in a variety of settings with students taking responsibility for the assessment and management of cases with supervisor guidance. The management plan and decision-making process for the client and their family are outlined and the project outcomes after analysis are presented, in a substantial report. Weekly tutorials support the course.
Prerequisite: SPCHSCI 724

SPCHSCI 736 **15 Points**
Topics in Communication Disorders in Adults - Level 9
Advanced study of speech-language therapy (SLT) in adult populations including working with Māori, bilingualism, progressive conditions, palliative care, lifelong disability and ageing effects on audition and language. It includes highly specialised theoretical and clinical approaches which underpin the content, with implications for SLT practice in the New Zealand context being the predominant focus. Involves an individual management plan for a client resulting in a substantial individual report.
Prerequisite: SPCHSCI 723
Restriction: SPCHSCI 741

SPCHSCI 743 **15 Points**
Speech, Language and Communication in Needs in Children 2 - Level 9
Extends topics introduced in SPCHSCI 722 by focusing on advanced topics in speech, language and communication needs in children. This includes in-depth learning in speech sound disorders, oromotor difficulties, intellectual and/or physical disability, autism spectrum disorder as well as language disorders in adolescents. Consolidating and extending knowledge of evidence-based practice in child speech and language will include critical evaluation and synthesis of terminology and concepts.
Prerequisite: SPCHSCI 722
Restriction: SPCHSCI 732

SPCHSCI 744 **15 Points**
Speech Language Therapy Clinical Practicum 4 - Level 9
Clinical practice in a variety of settings with the student demonstrating independent practice and problem solving skills. Involves an individual e-portfolio which includes management session plans with clients as well as peer and supervisor feedback. Supervisory guidance will be given and the course will be supported by weekly tutorials.
Prerequisite: SPCHSCI 734

SPCHSCI 746 **15 Points**
Voice and Fluency - Level 9
Voice - study of the voice and the assessment and management of voice disorders (adult and paediatrics). Fluency - assessment and management of dysfluency disorders (adult and paediatrics). Critical evaluation and synthesis of knowledge are presented in substantial individual case reports.
Prerequisite: SPCHSCI 713, 733
Restriction: SPCHSCI 731

SPCHSCI 751 **15 Points**
Special Topic

SPCHSCI 752 **15 Points**
Research Project

SPCHSCI 753 **15 Points**
Special Topic

SPCHSCI 754 **15 Points**
Special Topic

SPCHSCI 790 **30 Points**
SPCHSCI 790A **15 Points**
SPCHSCI 790B **15 Points**
Research Project - Level 9
Restriction: SPCHSCI 735, 742, 745
To complete this course students must enrol in SPCHSCI 790 A and B, or SPCHSCI 790

SPCHSCI 796A **60 Points**
SPCHSCI 796B **60 Points**
MSc Thesis in Speech Science - Level 9
To complete this course students must enrol in SPCHSCI 796 A and B

Statistics

Stage I

STATS 100 **15 Points**
Concepts in Statistics
A first exposure to statistics that builds data handling and literacy skills and develops conceptual thinking through active participation in problems using real data, computer simulations and group work. STATS 100 makes full use of appropriate technology and prepares students to use statistics in their own disciplines.
Restriction: May not be taken with, or after passing, any other Statistics course

STATS 101 **15 Points**
Introduction to Statistics
Intended for anyone who will ever have to collect or make sense of data, either in their career or private life. Steps involved in conducting a statistical investigation are studied with the main emphasis being on data analysis and the background concepts necessary for successfully analysing data, extrapolating from patterns in data to more generally applicable conclusions and communicating results to others. Other topics include probability; confidence intervals, statistical significance, t-tests, and p-values; nonparametric methods; one-way analysis of variance, simple linear regression, correlation, tables of counts and the chi-square test.
Restriction: STATS 102, 107, 108, 191

STATS 108 **15 Points**
Statistics for Commerce
The standard Stage I Statistics course for the Faculty of Business and Economics or for Arts students taking Economics courses. Its syllabus is as for STATS 101, but it places more emphasis on examples from commerce.
Restriction: STATS 101, 102, 107, 191

STATS 125 **15 Points**
Probability and its Applications
Probability, conditional probability, Bayes theorem, random walks, Markov chains, probability models. Illustrations will be drawn from a wide variety of applications including: finance and economics; biology; telecommunications, networks; games, gambling and risk.
Corequisite: ENGSCI 111 or MATHS 108 or 110 or 120 or 130
Restriction: STATS 210

STATS 150 **15 Points**
Communicating Statistics
Examines the uses, limitations and abuses of statistical information in a variety of activities such as polling, public health, sport, law, marketing and the environment. The statistical concepts and thinking underlying data-based arguments will be explored. Emphasises the interpretation and critical evaluation of statistically based reports as well as the construction of statistically sound arguments and reports. Some course material will be drawn from topics currently in the news.

Stage II

STATS 201 **15 Points**
Data Analysis
A practical course using the R language in the statistical analysis of data and the interpretation and communication of statistical findings. Includes exploratory data analysis, analysis of linear models including multiple regression and analysis of variance, generalised linear models including logistic regression and analysis of counts, time series analysis.
Prerequisite: 15 points from STATS 101-108, 191
Restriction: STATS 207, 208

STATS 208 **15 Points**
Data Analysis for Commerce
A practical course using the popular R language in the statistical analysis of data and the interpretation and communication of statistical findings. Includes exploratory data analysis, analysis of linear models including multiple regression and analysis of variance, generalised linear models including logistic regression and analysis of counts, time series analysis.
Prerequisite: 15 points from STATS 101-108, 191
Restriction: STATS 201, 207

STATS 210 **15 Points**
Statistical Theory
Probability, discrete and continuous distributions, likelihood and estimation, hypothesis testing.
Prerequisite: 15 points from ENGSCI 111, ENGGEN 150, STATS 125
Corequisite: 15 points from MATHS 208, 250, ENGSCI 211 or equivalent

STATS 220 **15 Points**
Data Technologies
Explores the processes of data acquisition, data storage and data processing using current computer technologies. Students will gain experience with and understanding of the processes of data acquisition, storage, retrieval, manipulation, and management. Students will also gain experience with and understanding of the computer technologies that perform these processes.
Prerequisite: 15 points at Stage I in Computer Science or Statistics

STATS 225 **15 Points**
Probability: Theory and Applications
Covers the fundamentals of probability through theory, methods, and applications. Topics should include the classical limit theorems of probability and statistics known as the laws of large numbers and central limit theorem, conditional expectation as a random variable, the use of generating function techniques, and key properties of some fundamental stochastic models such as random walks, branching processes and Poisson point processes.
Prerequisite: B+ or higher in ENGGEN 150 or ENGSCI 111 or STATS 125, or a B+ or higher in MATHS 120 and 130
Corequisite: 15 points from ENGSCI 211, MATHS 208, 250

STATS 240 **15 Points**
Design and Structured Data
An introduction to research study design and the analysis of structured data. Blocking, randomisation, and replication in designed experiments. Clusters, stratification, and weighting in samples. Other examples of structured data.
Prerequisite: STATS 101 or 108
Restriction: STATS 340

STATS 255 **15 Points**
Optimisation and Data-driven Decision Making
Explores methods for using data to assist in decision making in business and industrial applications. Software packages will be used to solve practical problems. Topics such as linear programming, transportation and assignment models, network algorithms, queues, Markov chains, inventory models, simulation, analytics and visualisation will be considered.
Prerequisite: ENGSCI 211 or STATS 201 or 208, or a B+ or higher in either MATHS 108 or 120 or 130 or 162 or 199 or STATS 101 or

108, or a concurrent enrolment in either ENGSCI 211 or STATS 201 or 208
Restriction: ENGSCI 255

Stage III

STATS 302 **15 Points**
Applied Multivariate Analysis
Covers the exploratory analysis of multivariate data, with emphasis on the use of statistical software and reporting of results. Topics covered include: techniques for data display, dimension reduction and ordination, cluster analysis, multivariate ANOVA and associated methods.
Prerequisite: ENGSCI 314 or STATS 201 or 208
Restriction: STATS 767

STATS 310 **15 Points**
Introduction to Statistical Inference
Estimation, likelihood methods, hypothesis testing, multivariate distributions, linear models.
Prerequisite: STATS 210 or 225, and 15 points from MATHS 208, 250 or equivalent
Restriction: STATS 732

STATS 313 **15 Points**
Advanced Topics in Probability
Characterisations of and relations between different kinds of random objects including random functions, random paths and random trees. Modes of convergence; the Law of Large Numbers and Central Limit Theorem.
Prerequisite: STATS 225
Restriction: STATS 710

STATS 320 **15 Points**
Applied Stochastic Modelling
Construction, analysis and simulation of stochastic models, and optimisation problems associated with them. Poisson process, Markov chains, continuous-time Markov processes. Equilibrium distribution, reaching probabilities and times, transient behaviour. Use of R to simulate simple stochastic processes. Examples drawn from a range of applications including operations research, biology, and finance.
Prerequisite: 15 points from STATS 125, 210, 225 and 15 points from STATS 201, 208, 220, or ENGSCI 314

STATS 325 **15 Points**
Stochastic Processes
Introduction to stochastic processes, including generating functions, branching processes, Markov chains, random walks.
Prerequisite: B+ or higher in STATS 125 or B or higher in ENGSCI 314 or STATS 210 or 225 or 320, and 15 points from ENGSCI 211, MATHS 208, 250
Restriction: STATS 721

STATS 326 **15 Points**
Applied Time Series Analysis
Components, decompositions, smoothing and filtering, modelling and forecasting. Examples and techniques from a variety of application areas.
Prerequisite: 15 points from ECON 211, ENGSCI 314, STATS 201, 208
Restriction: STATS 727

STATS 330 **15 Points**
Statistical Modelling
Application of the generalised linear model and extensions to fit data arising from a range of sources including multiple regression models, logistic regression models, and log-linear models. The graphical exploration of data.
Prerequisite: ENGSCI 314 or STATS 201 or 208

STATS 331 **15 Points**
Introduction to Bayesian Statistics
Introduces Bayesian data analysis using the WinBUGS software package and R. Topics include the Bayesian paradigm, hypothesis testing, point and interval estimates, graphical models, simulation and Bayesian inference, diagnosing MCMC, model checking and selection, ANOVA, regression, GLMs, hierarchical models and time series. Classical and Bayesian methods and interpretations are compared.
Prerequisite: 15 points from ENGSCI 263, STATS 201, 208 and 15 points from ENGSCI 111, ENGGEN 150, STATS 125

STATS 369 **15 Points**
Data Science Practice
Modern predictive modelling techniques, with application to realistically large data sets. Case studies will be drawn from business, industrial, and government applications.
Prerequisite: STATS 220 and STATS 210 or 225 and 15 points from ECON 221, STATS 201, 208, or ENGSCI 233 and 263
Restriction: STATS 765

STATS 370 **15 Points**
Financial Mathematics
Mean-variance portfolio theory; options, arbitrage and put-call relationships; introduction of binomial and Black-Scholes option pricing models; compound interest, annuities, capital redemption policies, valuation of securities, sinking funds; varying rates of interest, taxation; duration and immunisation; introduction to life annuities and life insurance mathematics.
Prerequisite: 15 points at Stage II in Mathematics and 15 points at Stage II in Statistics
Restriction: STATS 722

STATS 380 **15 Points**
Statistical Computing
Statistical programming using the R computing environment. Data structures, numerical computing and graphics.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 208, 220

STATS 383 **15 Points**
The Science and Craft of Data Management
A structured introduction to the science and craft of data management, including: data representations and their advantages and disadvantages; workflow and data governance; combining and splitting data sets; data cleaning; the creation of non-trivial summary variables; and the handling of missing data. These will be illustrated by data sets of varying size and complexity, and students will implement data processing steps in at least two software systems.
Prerequisite: ENGSCI 314 or STATS 201 or 208, and COMPSCI 101 or ENGSCI 233 or STATS 220

STATS 392 **15 Points**
Directed Study
Directed study on a topic from Data Science, Statistics or Probability approved by the Academic Head or nominee.

STATS 399 **15 Points**
Capstone: Statistics in Action
Provides opportunities to integrate knowledge in statistics and data science, and collaborate with others through a succession of group projects and activities.
Prerequisite: 30 points at Stage III in Statistics

Postgraduate 700 Level Courses

STATS 701 **15 Points**
Advanced SAS Programming
A continuation of STATS 301, with more in-depth coverage of programming in the SAS language. Topics covered will include advanced use of the SAS language, advanced data step programming, macros, input and output, connectivity to other software platforms, SAS SQL.
Prerequisite: STATS 301

STATS 702 **15 Points**
Special Topic in Statistics 2

STATS 703 **15 Points**
Special Topic in Statistics 1

STATS 705 **15 Points**
Topics in Official Statistics
Official statistics, data access, data quality, demographic and health statistics, other social statistics, economic statistics, analysis and presentation, case studies in the use of official statistics.

STATS 707 **15 Points**
Computational Introduction to Statistics
An advanced introduction to statistics and data analysis, including testing, estimation, and linear regression.
Prerequisite: 15 points from STATS 101, 108 and 15 points from COMPSCI 101, MATHS 162
Restriction: ENGSCI 314, STATS 201, 207, 208, 210, 225

STATS 708 **15 Points**
Topics in Statistical Education
Covers a wide range of research in statistics education at the school and tertiary level. There will be a consideration of, and an examination of, the issues involved in statistics education in the curriculum, teaching, learning, technology and assessment areas.

STATS 709 **30 Points**
Predictive Modelling
Predictive modelling forecasts likely future outcomes based on historical and current data. Following an advanced introduction to statistics and data analysis, the course will discuss concepts for modern predictive modelling and machine learning.
Prerequisite: COMPSCI 130, MATHS 108, and 15 points from STATS 101, 108, or equivalent
Restriction: STATS 201, 207, 208, 210, 225, 707, 765

STATS 710 **15 Points**
Probability Theory - Level 9
Fundamental ideas in probability theory; sigma-fields, laws of large numbers, characteristic functions, the Central Limit Theorem, modes of convergence. Advanced topics may include Poisson random measures, random trees, Lévy processes, random spatial models. Students will undertake assigned individual research projects based on a journal article or advanced textbook, including a detailed explanation of the techniques of probability theory exemplified therein.
Prerequisite: B+ or higher in STATS 225 or 15 points from STATS 310, 320, 325

STATS 720 **15 Points**
Stochastic Processes
Stochastic models and their applications. Discrete and continuous-time jump Markov processes. A selection of topics from point processes, renewal theory, Markov decision processes, stochastic networks, inference for stochastic processes, simulation of stochastic processes, and computational methods using R.
Prerequisite: STATS 320 or 325

STATS 721 **15 Points**
Foundations of Stochastic Processes
Fundamentals of stochastic processes. Topics include: generating functions, branching processes, Markov chains, and random walks.
Prerequisite: 15 points from STATS 125, 210, 225, 320 with at least a B+ and 15 points from MATHS 208, 250, 253
Restriction: STATS 325

STATS 722 **15 Points**
Foundations of Financial Mathematics
Fundamentals of financial mathematics. Topics include: mean-variance portfolio theory; options, arbitrage and put-call relationships; introduction of binomial and Black-Scholes option pricing models; compound interest, annuities, capital redemption policies, valuation of securities, sinking funds; varying rates of interest, taxation; duration and immunisation; introduction to life annuities and life insurance mathematics.
Prerequisite: 15 points at Stage II in Statistics or BIOSCI 209, and 15 points at Stage II in Mathematics
Restriction: STATS 370

STATS 725 **15 Points**
Special Topic

STATS 726 **15 Points**
Time Series
Stationary processes, modelling and estimation in the time domain, forecasting and spectral analysis.
Prerequisite: STATS 210, and 15 points from STATS 326, 786

STATS 727 **15 Points**
Foundations of Applied Time Series Analysis
Fundamentals of applied time series analysis. Topics include: components, decompositions, smoothing and filtering, modelling and forecasting. Examples and techniques from a variety of application areas are presented.
Prerequisite: 15 points from ECON 221, STATS 201, 207, 208, 707
Restriction: STATS 326

STATS 730 **15 Points**
Statistical Inference - Level 9
Fundamental topics in estimation and statistical inference. Advanced topics in modelling including regression with dependent data, survival analysis, methods to handle missing data. Advanced topics in current statistical practice researched by students. Students will undertake and present individual research projects on assigned topics, consisting in a literature search and a computational application to a data analysis task.
Prerequisite: STATS 310 or 732

STATS 731 **15 Points**
Bayesian Inference
A course in practical Bayesian statistical inference covering: the Bayesian approach specification of prior distributions, decision-theoretic foundations, the likelihood principle, asymptotic approximations, simulation methods, Markov Chain Monte Carlo methods, the BUGS and CODA software, model assessment, hierarchical models, application in data analysis.
Prerequisite: STATS 331 and 15 points from STATS 210, 225

STATS 732 **15 Points**
Foundations of Statistical Inference
Fundamentals of statistical inference including estimation,

hypothesis testing, likelihood methods, multivariate distributions, joint, marginal, and conditional distributions, vector random variables, and an introduction to decision theory and Bayesian inference.
Prerequisite: STATS 210 or 225, and 15 points from MATHS 208, 250
Restriction: STATS 310

STATS 740 **15 Points**
Sample Surveys
The design, management and analysis of sample surveys. Topics such as the following are studied. Types of Survey. Revision of statistical aspects of sampling. Preparing surveys. Research entry: problem selection, sponsorship and collaboration. Research design: methodology and data collection; Issues of sample design and sample selection. Conducting surveys: Questionnaires and questions; Non-sampling issues; Project management; Maintaining data quality. Concluding surveys: Analysis; Dissemination.
Prerequisite: 15 points from STATS 240, 330, 340, and 15 points from Stage II Mathematics

STATS 741 **15 Points**
Sample Surveys and Experimental Design
Design, implementation and analysis of sample surveys and of experiments. This course covers the foundations of both areas.
Prerequisite: 15 points from STATS 201, 207, 208
Restriction: STATS 340

STATS 747 **15 Points**
Statistical Methods in Marketing
Stochastic models of brand choice, applications of General Linear Models in marketing, conjoint analysis, advertising media models and marketing response models.
Prerequisite: 15 points from STATS 201, 207, 208, 210, 707

STATS 750 **15 Points**
Experimental Design
The design and analysis of data from experiments involving factorial and related designs and designs which have the property known as general balance (this includes most of the standard designs), and more general designs with blocking and replication. Response surface methodology. Sequential experimentation.
Prerequisite: 15 points from STATS 240, 330, 340, 762

STATS 761 **15 Points**
Mixed Models
Linear mixed effect models for the analysis of data from small experiments, particularly those cases where the data are unbalanced. Methods include restricted maximum likelihood for the estimation of variance components.

STATS 762 **15 Points**
Regression for Data Science
Application of the generalised linear model to fit data arising from a wide range of sources, including multiple linear regression models, Poisson regression, and logistic regression models. The graphical exploration of data. Model building for prediction and for causal inference. Other regression models such as quantile regression. A basic understanding of vector spaces, matrix algebra and calculus will be assumed.
Prerequisite: 15 points from STATS 210, 225, 707, and 15 points from ENGSCI 314, STATS 201, 207, 208
Restriction: STATS 330

STATS 763 **15 Points**
Advanced Regression Methodology
Generalised linear models, generalised additive models, survival analysis. Smoothing and semiparametric regression. Marginal and conditional models for correlated data. Model selection for prediction and for control of confounding. Model criticism and testing. Computational methods for model fitting, including Bayesian approaches.
Prerequisite: STATS 210 or 225, and 15 points from STATS 330, 762 and 15 points at Stage II in Mathematics

STATS 765 **15 Points**
Statistical Learning for Data Science
Concepts of modern predictive modelling and machine learning such as loss functions, overfitting, generalisation, regularisation, sparsity. Techniques including regression, recursive partitioning, boosting, neural networks. Application to real data sets from a variety of sources, including data quality assessment, data preparation and reporting.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208 and 15 points from STATS 210, 225, 707
Corequisite: May be taken with STATS 707
Restriction: STATS 369

STATS 766 **15 Points**
Multivariate Analysis
A selection of topics from multivariate analysis, including: advanced methods of data display (e.g., Correspondence and Canonical Correspondence Analysis, Biplots, and PREFMAP) and an introduction to classification methods (e.g., various types of Discriminant Function Analysis).
Prerequisite: STATS 310 or 732

STATS 767 **15 Points**
Foundations of Applied Multivariate Analysis
Fundamentals of exploratory analysis of multivariate data, with emphasis on the use of statistical software and reporting of results. Topics covered include: techniques for data display, dimension reduction and ordination, cluster analysis, multivariate ANOVA and associated methods.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208, 707
Restriction: STATS 302

STATS 768 **15 Points**
Longitudinal Data Analysis
Exploration and regression modelling of longitudinal and clustered data, especially in the health sciences: mixed models, marginal models, dropout, causal inference.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208, 210, 707

STATS 769 **15 Points**
Advanced Data Science Practice
Databases, SQL, scripting, distributed computation, other data technologies.
Prerequisite: 15 points from STATS 220, 369, 380 and 15 points from ENGSCI 314, STATS 201, 207, 208, 707

STATS 770 **15 Points**
Introduction to Medical Statistics
An introduction to ideas of importance in medical statistics, such as measures of risk, basic types of medical study, causation, ethical issues and censoring, together with a review of common methodologies.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208 and 15 points from STATS 210, 225, 707

STATS 771 **15 Points**
Special Topic

STATS 773 **15 Points**
Design and Analysis of Clinical Trials
The theory and practice of clinical trials, including:

design issues, data management, common analysis methodologies, intention to treat, compliance, interim analyses and ethical considerations.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208, 707

STATS 774 **60 Points**
STATS 774A **30 Points**
STATS 774B **30 Points**
Dissertation in Statistics Education - Level 9
To complete this course students must enrol in STATS 774 A and B, or STATS 774

STATS 776 **15 Points**
Estimating Animal Abundance
Fundamentals of the statistical methods that underly capture-recapture, distance sampling and occupancy analysis, focusing on the critical role that p, the probability of detection, plays in estimating n, the number of animals, or psi, the probability of species presence. Extensions to these fundamental tools including spatially explicit, genetic, and hierarchical methods will be covered.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208, 707

STATS 779 **15 Points**
Professional Skills for Statisticians
Statistical software, data management, data integrity, data transfer, file processing, symbolic manipulation, document design and presentation, oral presentation, professional ethics.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 208, 707

STATS 780 **15 Points**
Statistical Consulting
Students will learn about the practicalities of statistical consulting. Students will carry out a statistical consulting project, including the writing of a report, under the supervision of a member of the academic staff.
Prerequisite: STATS 330 or 762

STATS 781 **30 Points**
STATS 781A **15 Points**
STATS 781B **15 Points**
Research Project - Level 9
Restriction: STATS 789
To complete this course students must enrol in STATS 781 A and B, or STATS 781

STATS 782 **15 Points**
Statistical Computing
Professional skills, advanced statistical programming, numerical computation and graphics.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 208, 707

STATS 783 **15 Points**
Simulation and Monte Carlo Methods
A practical introduction to modern simulation and Monte Carlo techniques and their use to simulate real situations and to solve difficult statistical inferential problems whose mathematical analysis is intractable.

STATS 784 **15 Points**
Statistical Data Mining
Data cleaning, missing values, data warehouses, security, fraud detection, meta-analysis, and statistical techniques for data mining such as regression and decision trees, modern and semiparametric regression, neural networks, statistical approaches to the classification problem.
Prerequisite: 15 points from STATS 210, 225, and 15 points from STATS 330, 762

STATS 785 **15 Points**
Foundations of Statistical Data Management
SAS statistical software with an emphasis on using SAS as a programming language for purposes of database manipulation, simulation, statistical modelling and other computer-intensive methods.
Prerequisite: 15 points from ENGSCI 314, STATS 201, 207, 208, 707
Restriction: STATS 301

STATS 786 **15 Points**
Time Series Forecasting for Data Science
Delivers a comprehensive understanding of widely used time series forecasting methods, illustrates how to build models to uncover the structure in time series and perform model diagnostics to assess the fit of models, and develops analytical and computer skills that are necessary for analysing time series data. Familiarity with coding in R is recommended.
Prerequisite: 15 points from STATS 201, 208
Restriction: STATS 326, 727

STATS 787 **15 Points**
Data Visualisation
Effective visual presentations of data. Topics may include: how to present different types of data; human perception; graphics formats; statistical graphics in R; interactive graphics; visualising high-dimensional data; visualising large data.
Prerequisite: 15 points from STATS 220, 369, 380 and 15 points from ENGSCI 314, STATS 201, 207, 208, 707

STATS 790 **30 Points**
STATS 790A **15 Points**
STATS 790B **15 Points**
Research Project - Level 9
Restriction: STATS 796
To complete this course students must enrol in STATS 790 A and B, or STATS 790

STATS 792 **45 Points**
STATS 792A **22.5 Points**
STATS 792B **22.5 Points**
Dissertation in Statistics Education - Level 9
To complete this course students must enrol in STATS 792 A and B, or STATS 792

STATS 793 **45 Points**
STATS 793A **22.5 Points**
STATS 793B **22.5 Points**
Dissertation - Level 9
To complete this course students must enrol in STATS 793 A and B, or STATS 793

STATS 796A **60 Points**
STATS 796B **60 Points**
MSc Thesis in Statistics - Level 9
To complete this course students must enrol in STATS 796 A and B

STATS 798A **45 Points**
STATS 798B **45 Points**
Masters Thesis in Statistics - Level 9
Prerequisite: 15 points from STATS 310, 732 and 15 points from STATS 330, 762, or approval of Head of Department
Restriction: STATS 790, 796
To complete this course students must enrol in STATS 798 A and B

Sustainability

Stage I

SUSTAIN 100 **15 Points**

SUSTAIN 100G **15 Points**

Sustainability and Us

What is sustainability? Discusses what sustainability means, and its underpinning values, history and operation within complex physical systems. Students complete a group project to develop skills in collective decision making with a solution focus. Explores two sustainability issues in depth.

Stage II

SUSTAIN 200 **15 Points**

The Sustainable Community

What is the sustainable community? The course unpacks the nature of complex social and ecological systems with a particular focus on large organisations and cities. Students undertake a group project to enhance their skills in collective decision making, and to develop skills in integrating information and presenting sustainability solutions. The course explores two sustainability issues in depth.

Prerequisite: 60 points passed

Stage III

SUSTAIN 300 **15 Points**

A Sustainable World

Is it possible to have a sustainable global system? The course explores two sustainability issues in depth. Focussing on large scale social institutions with consideration of politics, the media, national and international law and economics. Students undertake a group project to develop skills in researching and integrating information from a range of experts and recommending sustainability solutions to decision makers.

Prerequisite: 30 points passed at Stage II

Tertiary Foundation Certificate Biological Science

Foundation Courses

TFCBIO 91F **15 Points**

Foundation Biology 1

An introduction to biological sciences with an emphasis on organism diversity, which includes bacteria, plants, fungi and animals. Fundamentals of classification, ecology and evolution are introduced and the study of a current topic in biology is used to develop research and critical thinking skills. Practical classes are both laboratory-based and field based.

Restriction: BIOSCI 91F, 91P

TFCBIO 92F **15 Points**

Foundation Biology 2

Concepts introduced in TFCBIO 91F are further developed with an emphasis on the structures and processes of living things at cellular and molecular levels. Cell biology, genetic principles and biochemistry are explored and further developed in a human biological context. Laboratories focus on students developing key practical skills.

Prerequisite: TFCBIO 91F or Director approval
Restriction: BIOSCI 91F, 92F, 91P, 92P

Tertiary Foundation Certificate Chemistry

Foundation Courses

TFCCHEM 91F **15 Points**

Foundation Chemistry 1

Introduction to elements, compounds, the periodic table, atomic structure, covalent bonding, molecular shape and polarity. Quantitative chemistry, including balancing equations, calculating moles and particles present, calculation of concentration in mol L-1. Energy and thermo-chemistry. Laboratories include practical skills and qualitative analysis, and simple modelling.

Restriction: CHEM 91F, 91P

TFCCHEM 92F **15 Points**

Foundation Chemistry 2

Introduces further principles of chemistry. Physical chemistry and qualitative inorganic analysis, including chemical kinetics and chemical equilibrium. Organic chemistry, including hydrocarbons, oxygen-containing functional groups, isomerism and reaction classifications, acids, bases, buffer solutions and titrations. Laboratories include reactions of hydrocarbon and oxygen-containing organic compounds, chromatography, testing for anions and cations in solution, acid-base titrations.

Prerequisite: TFCCHEM 91F or Director approval
Restriction: CHEM 92F

Tertiary Foundation Certificate Environmental Stud

Foundation Courses

TFCENV 91F **15 Points**

Geography

Provides an introductory overview of geography, exploring the relationship between people and place. Examines environmental change, natural hazards, physical and social processes, and geospatial thinking through a variety of local and global case studies.

TFCENV 92F **15 Points**

Earth and Environmental Sciences

How do biophysical processes shape the Earth and the environmental issues we face on it? Introduces students to the physical processes that shapes our world, from earthquakes deep underground to glaciers on mountain tops. Explores how physical and biological processes on Earth interact in pressing environmental issues like climate change, pollution and species conservation.

Tertiary Foundation Certificate Mathematics

Foundation Courses

TFCMATHS 89F **15 Points**

Mathematics for Arts

Includes several important mathematical ideas within historical, environmental, societal, political, financial, justice, entertainment and cultural contexts. Will also be guided by the interests of its learners as citizens and consumers, who will be encouraged to draw on the mathematics they are already familiar with. Aimed at linking mathematics to the world of students who are likely to be non-STEM majors.

TFCMATHS 90F **15 Points**
Preparatory Skills in Mathematics
Development of fundamental mathematics concepts including an understanding of arithmetic ideas as expressed in fractions, decimals and percentages, ratio and proportion, measurement and algebraic thinking. Application of these concepts in contexts such as financial literacy, problem solving, and real-life mathematics will form the basis of this course.
Restriction: EDFOUND 15F, TFCEDUC 15F

TFCMATHS 91F **15 Points**
Foundation Mathematics 1
This mathematics course aims to promote an understanding of number skills, including an introduction to algebra. Students will learn how to use simple technology and develop their problem solving abilities.
Restriction: MATHS 91P, 92F

TFCMATHS 92F **15 Points**
Foundation Mathematics 2
This mathematics course aims to use the skills learnt in TFCMATHS 91F to develop an understanding of functions in their tabular, algebraic and graphical representations. Prepares students for MATHS 102. Recommended preparation: TFCMATHS 91F or TFCMATHS 93F.
Restriction: MATHS 92F

TFCMATHS 93F **15 Points**
Foundation Mathematics 3
This mathematics course aims to promote an understanding of numerical and algebraic skills at a deeper level than TFCMATHS 91F. Students will learn how to use simple technology and develop their problem solving abilities.
Restriction: MATHS 93F, 93P

TFCMATHS 94F **15 Points**
Foundation Mathematics 4
This mathematics course aims to use the skills learnt in TFCMATHS 93F to develop an understanding of functions, including differential functions, in their tabular, algebraic and graphical representations. This course prepares students for MATHS 102.
Prerequisite: TFCMATHS 93F or Director approval
Restriction: MATHS 94F

Tertiary Foundation Certificate Physics

Foundation Courses

TFCPHYS 91F **15 Points**
Foundation Physics
An introductory course for students who have not previously studied physics. Topics include the nature of light; wave motion; basic mechanics of motion in a straight line, including the concepts of momentum and energy; an introduction to heat.
Restriction: PHYSICS 91F, 91P

TFCPHYS 92F **15 Points**
Foundation Physics 2
A second foundation course for students who understand the basic mechanics of motion in a straight line. Further mechanics, including equilibrium, projectile motion, rotational motion and gravitation. Electromagnetism, including electrostatics, elementary circuits and the effects of magnetic fields.
Prerequisite: TFCPHYS 91F or Director approval
Restriction: PHYSICS 92F

Tertiary Foundation Certificate Statistics

Foundation Courses

TFCSTATS 92F **15 Points**
Foundation Statistics
Provides an introduction to statistics for anyone who will ever have to collect, analyse or interpret data, either in their career or private life. Statistical skills will be developed through Exploratory Data Analysis of real data using appropriate technology and statistical techniques. An important aspect of the course will involve communication of results.

Transdisciplinary Environmental Futures

Stage I

TDENVF 100 **15 Points**
Our Environmental Futures: Te Taiao Tāngata
Explores the complex relationships between environmental systems and humans. Working in teams, students examine environmental, social, economic and cultural perspectives in the real-world contexts of waitā (sea), waitī (freshwater) and whenua (land). Students will respond to environmental issues by recognising ora (wellbeing) and Ki Uta ki Tai (the interconnectedness of ecosystems) and develop a transdisciplinary mindset to tackle current and future environmental challenges.

Transdisciplinary The Future of Food

Stage I

TDFOOD 100 **15 Points**
The Future of Food Systems
Explores the global food system with a focus on sustainability, health, culture, science and technology, particularly within Aotearoa, New Zealand. Students will work in teams to analyse future trends and propose innovative solutions, using a transdisciplinary approach to envision and design sustainable food systems and practices that respect diverse cultural perspectives.

Waipapa Taumata Rau

Stage I

WTRSCI 100 **15 Points**
Waipapa Taumata Rau: Contemporary Science in Aotearoa New Zealand
Ko Waipapa Taumata Rau tātou. Welcome to your study in Te Whare Pūtaiao, the Faculty of Science. This core course considers how knowledge of place enhances your learning, the significance of Te Tiriti o Waitangi, and how knowledge systems frame understanding. It provides foundational essential skills to support you in your first year and future studies. Sustainability is used as a lens to to explore what it means to practise contemporary science in Aotearoa New Zealand.
Restriction: SCIGEN 102, 102G, WTR 100, 101, WTRBUS 100, WTRENG 100, WTRMHS 100

Wine Science

Stage II

WINESCI 201 **15 Points**
Introduction to Wine Science
An introduction to grape growing and wine. Topics covered include history of wine, geography and terroir, grape growing, winemaking technology, microbiology, sensory evaluation, and health considerations of wine. A special emphasis on grape growing and winemaking in New Zealand.
Prerequisite: Any 120 points passed

Postgraduate 700 Level Courses

WINESCI 701 **15 Points**
Winemaking in a New Zealand Setting
The principles and practices of local winemaking are reviewed and compared with international counterparts to highlight the distinctive characteristics of winemaking in New Zealand. A microvinification project is undertaken in which students begin with an allotment of grapes, monitor the fermentation using a range of analytical techniques, and make decisions which affect the style of wine they produce.

WINESCI 702 **15 Points**
The Science Behind Grape Production
Develops understanding of the contemporary scientific knowledge and research that is of relevance to grape production for winemaking. The application of traditional and modern molecular methods in plant science and plant pathology will be discussed in relation to the selection, improvement and management of vines and grape attributes. Research issues of national and international relevance to viticulture will also be addressed.

WINESCI 703 **15 Points**
The Science Behind Winemaking
Follows on from 702 and focuses on the contemporary scientific knowledge and research that is of relevance to winemaking, commencing from the point of grape harvest. The application of traditional and modern methods in biochemistry and microbiology will be discussed. Research issues of national and international relevance to winemaking will also be addressed.

WINESCI 704 **15 Points**
Sensory Evaluation and Statistical Methods
The principles of sensory science, sensory analysis of wine, differences among wine types, regional styles and grape types will be covered. Emphasis will be placed on those components which influence sensory appeal. The application of statistical methods to wine sampling and to the design of sensory panels will be overviewed.

WINESCI 705 **15 Points**
WINESCI 705A **7.5 Points**
WINESCI 705B **7.5 Points**
Project in Wine Science
Students will gain a thorough understanding of the current knowledge on a selected topic associated with wine science and have experience in writing a research proposal and in giving a presentation to the peer group.
To complete this course students must enrol in WINESCI 705 A and B, or WINESCI 705

WINESCI 706 **15 Points**
The Business of Wine Production
Students will be introduced to the economics of grape growing, winemaking, winery design and management. Distribution and marketing will be introduced. Special topics including wine law, use and negotiation of contracts small business development, stock valuation, issues of appellations, labelling and brand development will be taught. Environmental and resource management issues and health and safety regulations will be covered.

WINESCI 707 **15 Points**
WINESCI 707A **7.5 Points**
WINESCI 707B **7.5 Points**
Topics in Wine Science
A number of advanced or special topics in wine science. This course may not be offered every year; further information may be obtained from the School of Chemical Sciences.
To complete this course students must enrol in WINESCI 707 A and B, or WINESCI 707

WINESCI 708 **15 Points**
Post-fermentation Processes in Winemaking
Covers the theory and practice of fining, filtration and other methods of wine clarification. Chemical and sensory effects of barrel and tank aging of red and white wine will be covered as well as blending decisions and stabilisation. Quality control methods used during processing, aging and packaging will also be addressed.

WINESCI 792 **45 Points**
WINESCI 792A **22.5 Points**
WINESCI 792B **22.5 Points**
Research Project - Level 9
To complete this course students must enrol in WINESCI 792 A and B, or WINESCI 792

WINESCI 793 **60 Points**
WINESCI 793A **30 Points**
WINESCI 793B **30 Points**
Dissertation - Level 9
To complete this course students must enrol in WINESCI 793 A and B, or WINESCI 793

WINESCI 796A **60 Points**
WINESCI 796B **60 Points**
MSc Thesis in Wine Science - Level 9
Advanced research on an aspect of wine science. This may be undertaken with the Wine Industry CRIs and University staff.
To complete this course students must enrol in WINESCI 796 A and B