UNIVERSITY OF AUCKLAND
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NEW ZEALAND

ENGINEERING

BIOMEDICAL ENGINEERING

Biomedical Engineering aims to improve the quality of our lives by resolving technological challenges to contribute to a more efficient and effective healthcare industry.

Offered by our Department of Engineering Science and Biomedical Engineering, this specialisation may suit you if you enjoy biology, design, mathematics, mechanical technologies, medical sciences, and physiology.

Scan to learn more!

BIOLOGICAL MODELLING

Use mathematics, physiology, and computational tools to analyse biological systems, ranging from cells to whole organs. You will formulate mathematical descriptions of specific physiological processes in order to design and improve medical therapies and devices.

EXPERIMENTATION

Design and carry out measurements to gather information about the structure, function and properties of living organisms and tissues. You will learn how to incorporate imaging, biochemical, mechanical, as well as electrical measurements into testing and refining models, therapies, and devices.

BIOINSTRUMENTATION

Build your knowledge in electronics, design and measurement principles. This is essential for developing devices to support bodily functions, and to record and process biological signals. You will also gain first-hand experience in the processes involved in improving health outcomes for patients, including diagnosing and treating diseases.

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ENGINEERING

CHEMICAL & MATERIALS ENGINEERING

Chemical and Materials Engineering involves the transformation of new and novel chemical, materials, and biological discoveries into large-scale practical applications with optimal products and processes.

Offered by our Department of Chemical and Materials Engineering, this specialisation may suit you if you are interested in chemistry, mathematics, physics, and taking on the key challenges that are facing humanity, such as those in food, water, energy, and health and wellbeing.

Scan to learn more!

HEALTH AND WELLBEING

Today's chemical engineer is also a biochemical engineer, a tissue engineer, and even a biomaterials engineer. You will learn about the relevant processes in molecular biology and biocatalysis, and apply them to materials engineering aspects to discover how new and functional biomaterials are designed and manufactured.

WATER

The great demand for new clean water is exacerbated by the need to also keep our existing water resource clean. You will learn the relevant theory and techniques in biotechnology and bioprocessing, membrane filtration and reverse osmosis, and chemical and enzyme kinetics — to transform polluted water to clean water.

INNOVATIVE PROCESSES

Our industries require innovative engineering applications in production and manufacturing to remain competitive, and to meet global marketplace standards. There is also increasing motivation to improve safety and sustainable practice. As a chemical engineer, you will be trained to be fluent in unit operations, applied physical chemical processing, process control, and machine learning with big data processing.

FOOD

Our goal is to make better use of our resources, improve the way food can be mass produced, and create technologies for new foods. The subjects covered are rheology, transport phenomena, and thermodynamics, which will provide the fundamentals required for solving problems in this area, and advanced electives include topics such as spray drying, food texture characterisation and food process control.

NEW AND NOVEL MATERIALS

The materials engineering focus of our degree equips our chemical engineers with an advantage over others in New Zealand. Our curriculum covers the vast range of materials, their properties and characterisation, as well as the selection of — and techniques to — create new and novel materials, from the nano to the micro and macro scales.

ENERGY

The study of energy processes is essential to this field — you will develop a sound understanding of the practical applications of thermodynamics, and concepts like chemical potential, fugacity and activities, and applications to vapour-liquid equilibria and chemical reactor engineering.

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ENGINEERING

CIVIL ENGINEERING

Civil Engineering involves the technical, social, and environmental aspects of the design, planning and construction of our built environment.

Offered by our Department of Civil and Environmental Engineering, this specialisation may suit you if you are interested in design and construction, the planning and management of infrastructure networks, and reducing our social, cultural and environmental impacts of our growing population.

Scan to learn more!

ENVIRONMENTAL ENGINEERING

It's critical that all civil and environmental engineering projects are planned and executed to minimise negative environmental, social, and cultural impacts. Environmental engineers design, develop and evaluate structures, equipment and systems to treat and minimise waste, as well as mitigate and contain sources of pollution.

GEOTECHNICAL ENGINEERING

Our built environment is supported by the rock and soil beneath our feet, and we need to understand these materials to inform effective design. Geotechnical Engineering focuses on designing the foundations that support buildings and bridges, stabilising slopes along our highways, and mitigating the effects of earthquakes.

TRANSPORTATION ENGINEERING

Transport networks are the socio-economic backbone of society, enabling the movement of people and goods across the country. Transportation engineers assess the planning, design, construction, maintenance and operation of transport systems, and the influence of electric and self-driving vehicles.

WATER ENGINEERING

We seek to understand the behaviour of coastal and river environments that surround our built environment, and design of engineered systems that use water to support society. This includes the delivery of reliable sources of water for consumption and protection against the impacts of flooding and climate change.

CONSTRUCTION ENGINEERING AND MANAGEMENT

Construction is a highly dynamic, complex and unpredictable industry. Here, you can learn the necessary project management principles that support the efficient implementation of civil and environmental engineering projects, and the use of data and new technologies to improve the way we view, plan and inform the construction process.

STRUCTURAL ENGINEERING

Structures form our homes, our places of work, and many components of the wider built environment. They experience a variety of forces during their lifetime, and in New Zealand, a key emphasis is on their performance during earthquakes. This requires the assessment and improvement of existing buildings, and development of new design approaches.

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ENGINEERING

COMPUTER SYSTEMS ENGINEERING

Computer Systems Engineering utilises both software and hardware knowledge to design, develop, and build the smart products that are ubiquitous in our society.

Offered by our Department of Electrical, Computer, and Software Engineering, this specialisation may suit you if you enjoy coding, electronics, mathematics, mechanical technologies, and physics.

Scan to learn more!

COMPUTER ARCHITECTURE AND MICROCONTROLLERS

Having in-depth knowledge of modern computer systems architecture permits you to optimise application-specific hardware and software. You'll explore various aspects of hardware/software interfaces, memory systems, and systems architecture by learning the internal design of advanced modern processors such as the Graphics Processing Units and multi-core processors used in smartphones, gaming consoles and data servers.

EMBEDDED SYSTEMS DESIGN

The cyber-physical systems for real-time, safety-critical applications like robotics, automotive products, medical devices and industrial automation systems require a thorough understanding of modelling concurrency, as well as different computational and task models. Through practical projects, you'll develop your own interfaces to process signals and actuators to perform complex physical tasks in real time.

HARDWARE DESIGN OF DIGITAL SYSTEMS

Smart technology possesses increasingly complex and sophisticated hardware, making their system designs more challenging. Learn to solve these problems using state-of-the-art approaches, including hardware description languages and design abstraction levels. Using advanced electronic design automation tools, you'll regulate, simulate, debug, and implement system models to meet the speed and performance requirements of smart devices.

SOFTWARE DESIGN PRACTICE

Put your software design skills to the test in real-world projects — gain extensive hands-on experience in object-oriented programming, data structures and algorithms, multithreaded programming, scripting languages, and online peer-to-peer communication. You will also be introduced to essential programming languages like C++, Java and Python.

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ENGINEERING

ELECTRICAL & ELECTRONIC ENGINEERING

Electrical and Electronic Engineering involves the design of equipment and systems that provide essential services such as power, communications, and electronics.

Offered by our Department of Electrical, Computer, and Software Engineering, this specialisation may suit you if you enjoy mathematics, electronics, physics, and resource management.

Scan to learn more!

POWER ELECTRONICS

If you are interested in developing electronic devices for a wide range of applications in power systems and automation, you may opt to focus on power electronics. You will tackle the challenges of inductive power transfer in applications like automotive material handling, charging electric vehicles, and in medicine, such as a heart pump design.

ROBOTICS AND SIGNAL PROCESSING

Get involved with the in-depth details of robotics — you will be exposed to their design, construction, operation, development, and applications in various engineering fields, including medicine, factory automation and driverless vehicle production. You'll also learn about sophisticated signal processing algorithms in computer platforms to develop your understanding of complex robotic systems, such as vision and navigation.

COMMUNICATION AND INFORMATION SYSTEMS

The communications between both people and automated devices are a vital part of our daily lives. You'll be introduced to, and perform experimental investigations on the theory and practice of electrical communication systems, including mathematical modelling, simulation and their design.

POWER SYSTEMS AND CONTROL

We literally depend on electricity and electronic circuitry to power our daily lives — from factories, machines, offices and homes to computers and handheld gadgets. Here, you will learn how to generate, transmit and efficiently use electrical power.

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ENGINEERING

ENGINEERING SCIENCE

Engineering Science is a discipline focusing on using advanced mathematics and technology to design ways to model and optimise engineering systems.

Offered by our Department of Engineering Science and Biomedical Engineering, this specialisation may suit you if you enjoy using mathematics, optimisation methods, statistics, data science and coding to model performance and underpin decision making in fields such as engineering mechanics, operations research and resource management.

Scan to learn more!

COMPUTATIONAL MECHANICS

Mechanics involves understanding how solids and fluids behave under different conditions and in different processes, and how modern computational techniques can be applied to a variety of materials, such as industrial products and muscle. Computational Mechanics involves the use of mathematical modelling and powerful computers to solve a wide range of problems, from managing energy reservoirs and systems, visualising fluid motion in the human body, to the aerodynamic design of aircraft components and satellites.

OPERATIONS RESEARCH

Sometimes referred to as “the science of better’, operations research involves the use of mathematical modelling to optimise practices—your ability to wrangle relevant data and apply advanced optimisation algorithms will be beneficial to decision-making processes in many areas. Applying optimisation to industrial settings involves the improvement of processes and production to attain maximum output, usually by reorganising resources. You’ll also gain insights into what’s possible within this field through our researchers’ work, including: ensuring that essential resources such as electricity and water are managed efficiently, roster management for emergency services, using operations research to shape policy, and more.

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ENGINEERING

MECHANICAL ENGINEERING

Mechanical Engineering involves the development and application of scientific principles to improving our vital mechanical systems, and shaping new technologies.

Offered by our Department of Mechanical and Mechatronics Engineering, this specialisation may suit you if you enjoy coding, electronics, mechanical technologies, and physics.

Scan to learn more!

MECHANICS OF MATERIALS

Learn about failure mechanisms, safe working loads, and product life-expectancy to develop efficient, cost-effective structures and components. You'll also explore the vast potential of composite materials in the next generation of engineering applications.

THERMODYNAMICS AND FLUID MECHANICS

Thermodynamics and fluid mechanics play a strong, and often hidden, role in modern technology, from the cooling of the modern smartphone CPU through clean energy generation to the aerodynamic performance and efficiency of a modern aircraft. Understand the fundamental principles that govern these phenomena to meet the technological challenges of a sustainable, energy-efficient future.

DESIGN

Engineering design is about addressing real-world problems with modern engineering tools and knowledge, such as computer-aided design and manufacturing, and finite element analysis. You will gain experience through a series of open-ended design projects that have increasing complexity, preparing you to meet the engineering challenges of the future.

DYNAMICS AND CONTROL

From precisely positioning surgical robots to controlling autonomous vehicles, many exciting technological opportunities involve systems that vary over time. Use mathematical skills to model, analyse, predict, control and optimise the behaviour of these dynamic systems, and subsequently develop the next generation of technology—faster, quieter, safer, and more accurate and efficient than its predecessors.

MANUFACTURING SYSTEMS

Being at the forefront of rapid technological change in manufacturing gives you a competitive advantage. Key topics include Smart Manufacturing Solutions, Industry 4.0, IoT-enabled manufacturing, Cyber-physical production systems, Internet of Services, human-machine cooperation, CAD/CAM/CNC, cloud manufacturing, additive manufacturing, and manufacturing systems design and simulation.

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ENGINEERING

MECHATRONICS ENGINEERING

Mechatronics Engineering blends Mechanical, Electronics, Computer, and Software Engineering disciplines to focus on the modelling, analysis, design, development and control of mechatronics devices, robots, and intelligent systems.

Offered by our Department of Mechanical and Mechatronics Engineering, this specialisation may suit you if you enjoy coding, electronics, mechanical technologies, and physics.

Scan to learn more!

MECHANICS, KINEMATICS AND DYNAMICS

Mechanical behaviours like motion and forces are fundamental to analysing, designing, and developing novel mechatronic devices, robots or other intelligent systems. You'll focus on how mechanics, materials, kinematics and dynamics are used to simulate, analyse and design mechanical functionalities.

MECHATRONIC SYSTEMS TECHNOLOGIES AND DESIGN

System integration is performed at all the levels of the product development process of mechatronic devices, from concept, modelling and design, through 3D prototyping and hardware-in-the-loop simulations, to manufacture and deployment. You'll learn how to analyse, model and design mechatronic and robotic devices and other intelligent systems, as well as how to develop and deploy them in practical applications through hands-on projects. Our diverse spectrum of case studies will also expose you to the latest technologies in robotics, medical devices, and intelligent and autonomous systems.

INTERFACING ELECTRONICS AND PROGRAMMING

Signals from sensors are processed by electronic circuits and driven by software in real time, while actuators are commanded by embedded and programmed intelligence, and driven by power electronics. Learn to design interfacing circuits and real-time programmes that enable the intelligent and autonomous behaviours of a system.

SENSORS, ACTUATORS AND CONTROLS

A robot or smart machine achieves its intelligence by sensing its own motion and surroundings through coordinated actuations under closed-loop control. You'll engage with both classical and modern techniques in the sensors, actuators and controls essential to mechatronic systems.

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ENGINEERING

SOFTWARE ENGINEERING

Software Engineering is integral to the foundation of virtually all sectors in today's economy, from small but powerful handheld devices to massive telecommunications networks.

Offered by our Department of Electrical, Computer, and Software Engineering, this specialisation may suit you if you enjoy coding, mathematics, and project management.

Scan to learn more!

HUMAN-COMPUTER INTERACTION

Effective design and usability of software systems are essential to the devices that permeate our world. You'll primarily explore interfaces between people, computers, and robots, with emphasis on human-centred design for a variety of areas such as child-computer interaction, educational or serious games, smart energy consumption, and educational and learning aids for Te Reo.

ROBOTICS AND MACHINE LEARNING

Good software engineers are equipped to manipulate noisy, incomplete data to create reliable and efficient decisions. To achieve this, you will address the fundamental challenges in knowledge representation, scalable machine learning, and cognitive systems, then apply your understanding to autonomous robots and intelligent software agents that assist humans.

SOFTWARE DEVELOPMENT PROCESS

You will be provided with a solid foundation in the building blocks needed to specify, design, develop, test and maintain software systems. As a preparation for real-world software development scenarios, you'll also be exposed to the sociotechnical aspects of teamwork and coordination between developers, software project management, and popular software development processes including Agile and Lean methods.

HIGH PERFORMANCE COMPUTING

Most computing devices — from smart watches to supercomputers — are parallel systems with multiple processors. High performance can only be achieved on such parallel systems with a good understanding of the systems and specific parallel programming. You'll learn about different software engineering approaches to parallel programming and the underlying computer architectures. This includes Big Data processing, Cloud computing and the use of special acceleration devices such as graphics cards and FPGAs.

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ENGINEERING

STRUCTURAL ENGINEERING

Structural Engineering involves designing infrastructure of all scales that are safe, functional, sustainable, and economical with consideration of all natural and man-made forces and demands.

Offered by our Department of Civil and Environmental Engineering, this specialisation may suit you if you enjoy physics, mathematics, and sustainable design and construction.

Scan to learn more!

SOLID MECHANICS AND DYNAMICS

At the core of the structural engineering field — and its design equations and building standards — is solid mechanics. This is a branch of applied science that leverages engineering's understanding of forces, stresses, strains and strength of material. Structural engineers use these to ensure structures are safe within their design's lives. Structural dynamics involve the response of structures due to dynamic loads. Structural engineers apply these engineering principles with their creative problem-solving skills to design structures in our built environment against violent events such as earthquakes and hurricanes.

BEHAVIOURS AND PROPERTIES OF MATERIALS

You'll explore the properties of materials such as stretching and yielding in individual courses that focus specifically on timber, steel, and concrete within the context of structural systems. You'll also understand loading standards — within gravitational, wind and seismic conditions — through case studies that emulate real-world processes.

STRUCTURAL FORMS AND DESIGN

You'll be exposed to ways of interpreting built structures — from simple to complex — grounded in concepts such as post-and-beam, trusses, and frames. As you progress further in your degree, these core understandings will inform systems-level projects, and applications in both low-rise and multistorey buildings.

CONSTRUCTION AND PROJECT MANAGEMENT

Construction projects centre around people and communities of all scales — from housing estates to workplaces. Understanding project management principles and possessing fluency in skills such as engineering communications are complementary to the technical and theoretical foundations that make great structural engineers.

GEOTECHNICAL ENGINEERING

Geotechnical engineers are responsible for the foundations that many structural engineering projects depend on, so there is benefit in understanding the language of the profession. This field covers the characterisation, applications, and principles that govern the mechanical behaviour of soil and rocks.

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