Engineering Science

Engineering scientists are problem solvers. They use their intellect and advanced computing and mathematical skills to find better solutions for many aspects of our daily lives.

Engineering scientists are becoming increasingly important to modern society as their understanding of science, mathematics and computing underpins how everything operates around us.

Engineering Science equips students with the knowledge and means to provide answers relevant to the real world.

- How can a forest be managed to make a profit while still remaining environmentally friendly?
- How can a sail be designed to work in low wind conditions?
- What prices should be charged for airline tickets to maximise the revenue from a given flight?

These are all questions an engineering scientist can answer by using the power of computers, mathematics and human intelligence. Engineering scientists are very flexible, and can apply their skills to an extremely broad range of everyday problems.

Kavinesh Singh (BE and PhD in Engineering Science) is a Risk Analyst at Mighty River Power.

Career outlook

Engineering Science is a globally respected discipline.

Our graduates can be found in many of New Zealand's leading companies including Air New Zealand, Fonterra, Meridian Energy, Navman, Orion, goverment organisations such as NIWA and Transpower, and engineering consultancy firms such as Beca and Maunsell. Many graduates are also employed in the USA, UK and Europe.

As a graduate, you might be employed in a challenging and exciting position within the engineering, industrial, medical, service or business sector, that involves:

- modelling an optimal production process for a large manufacturer
- using your advanced programming skills as a software designer
- using your logical thinking and communications skills in a management position

Graduates who would like to undertake further study can apply to pursue postgraduate diplomas, masters and doctoral degrees at The Univeristy of Auckland.

When Maury Leyland (BE, Engineering Science) graduated, her first job was in Team New Zealand's design team during the 1995 America's Cup campaign. She moved to The Boston Consulting Group, working as a management consultant on projects ranging from airlines to pulp and paper mills. Now, she is Associate Director of Strategy and Growth at Fonterra.

Jarrad Wallace (BE, ME, Engineering Science) joined Southern Spars after graduating, and while working took on a Masters of Engineering project to create a computer model that optimizes the design of yacht rigs. Still with Southern Spars, he is now a Design Engineer, responsible for the development of rig design software.

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THE UNIVERSITY OF AUCKLAND
FACULTY OF ENGINEERING
Department of Engineering Science

Engineering Science

a Bachelor of Engineering specialisation

About the degree

The Bachelor of Engineering in Engineering Science is a four year degree with subspecialisatons in Operations Research and Continuum Mechanics.

Class sizes are small and students work closely with enthusiastic lecturers who are actively involved in the practice of Engineering Science. Classes are encouraged to develop a team spirit and to work together to enhance their learning. The teaching is mostly project based and practical.

- Part I is common to all Engineering specialisations.
- Part II lays the foundations of Engineering Science with courses in mathematical modelling, electronics, mechanics, materials, operations research, and computer programming.
- Parts III and IV are more specialised. You will be able to choose a number of courses in areas that interest you most. Using the knowledge and skills you have gained, you will also carry out your own research project based on problems relevant to industry.

Above: Josie McVitty and other students in the Part IV Project room.

Front cover: Nathan Moore, with his Part IV Project on optimizing the route of Woolworths/ Foodtown home deliveries.

Operations Research

Operations Research and Industrial Engineering are about helping make good decisions in industry and business. Operations Research focuses on building mathematical models for decision making. Industrial Engineering focuses more on processes, but the overlap is substantial given that many processes are controlled by models that have been implemented using mathematical software.

Operations Research

Operations Research (OR) has been called the "science of better." It is a scientific approach to making good decisions. If anything needs to be made shorter, faster, cheaper, safer, more reliable, or more profitable then OR is usually involved.

OR experts build computer models of often complicated problems and situations and then apply advanced optimization algorithms to guide them in making the best decisions.

Engineering science students who specialise in OR are usually good at mathematics, computing and statistics. They enjoy solving mathematical puzzles and finding optimal solutions to difficult practical problems.

Industrial Engineering

Industrial Engineering (IE) deals with the improvement of industrial processes to increase profits, with a focus on the implementation of production and processing systems. It is possible in an Engineering Science degree to give your programme an IE flavour by taking elective courses in manufacturing in Mechanical Engineering and operations management in the School of Business.

Students who specialise in IE are usually good at mathematics and computing, and enjoy the challenge of making a process more efficient by reorganising staff and/or resources.

James Allard (BE, Engineering Science) became an OR Analyst at Air New Zealand, designing and maintaining software which optimizes crew staffing and rostering. As Air New Zealand's crew salary bill is several hundred million dollars, the resulting savings are substantial.

Continuum Mechanics

Continuum Mechanics is the study of what happens when forces are applied to all kinds of materials. As well as high-tech engineering such as designing a spacecraft, it is involved in our everyday activities such as pouring a cup of coffee and biting an apple. The study of Continuum Mechanics involves courses in Solid Mechanics and Fluid Dynamics.

Solid Mechanics

Solid Mechanics investigates how solid materials behave under different conditions, for example when they are subjected to a mild wind, or a massive explosion. Solid materials include just about everything - concrete, foam, steel, tissue, plastics, gels, glass and wood.

The practical applications of this discipline are easy to imagine. A Solid Mechanics specialist might investigate how much damage is inflicted on a car when it crashes; how metal can be cut in an efficient way; or what happens to the muscles of an athlete when they get injured.

Engineering Science students who specialise in Solid Mechanics usually enjoy calculus, physics and computers and are interested in the practical applications of mathematical techniques.

Fluid Dynamics

Fluid Dynamics is concerned with the motion of liquid and gases. Some Fluid Dynamics specialists are interested in predicting and managing natural systems - for example petroleum reservoirs and groundwater pollution. Others take a sophisticated approach to design problems where fluids come in to play, such as aeronautics and yachting.

Fluid Dynamics is important in all sorts of industries. A specialist in this area could predict air flow over aircraft wings, or model blood flow in the human body, or investigate how to create the perfect wave for surfing.

Students who specialise in Fluid Dynamics will solve problems using mathematical equations. These equations are often large and complex and so must be solved using the power of computers.

Karen Willcox (BE, Engineering Science) focused on Fluid Dynamics, and went on to do a doctorate at MIT, USA. She then joined the Blended-Wing-Body team at Boeing Phantom Works. She now works at MIT, and has research projects which include collaborations with Boeing, Pratt and Whitney, and NASA.