

Elective Pathways

SCIENCE

These pathways have been created to provide guidance for **Bachelor of Engineering (Honours)** students wishing to specialise in a study area with their elective courses. Each course has been selected to complement the content of the Bachelor of Engineering (Honours) degrees with consideration of pre-requisites.

Please note that these pathways are suggestions only and will not be noted formally on the final degree certificate.

Students are welcome to enrol in any elective provided that they satisfy the pre-requisites. For a full list of UON courses, [visit the course handbook](#).

Aquatic Environments

85% of the population in NSW live on or near the water and 80% of Australians live within 50km of the coast. Students completing the Aquatic Environments pathway would be well placed for employment opportunities as water is a key social and economic component of our everyday lives. Students with an Aquatic Environments pathway would have knowledge of this important ecosystem and the services it provides (clean water, aesthetic value, harvesting, nutrient recycling, recreational activities). B Engineering (Hons) (Environmental) is the key program for the Aquatic Environments, however, the pathway is relevant to all programs based on the importance of aquatic environments.

Compulsory courses:

- [ENVS1001](#) Environmental Science: Concepts and Methods
- [MARI1000](#) Issues in the Marine Environment

20 units from:

- [ENVS2009](#) Catchments and Water Resource Management
- [MARI2410](#) Coral Reef Experiences
- [ENVS3002](#) Applied Environmental Science

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level courses

Pathway available in the following degrees:

- ✓ Environmental

Biochemistry

Cellular processes are increasingly being harnessed for manufacturing biomaterials.

Compulsory courses:

BIOL1001	Molecules, Cells and Organisms
BIOL1002	Organisms to Ecosystems
BIOL2010	Biochemistry
BIOL2050	Molecular Genetics

Pathway available in the following degrees:

- ✓ Chemical
- ✓ Civil

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level courses

Earth Science/Geology

An understanding and knowledge of Earth Sciences and more specifically geology would greatly benefit students and is relevant to the chosen programs.

Compulsory courses:

GEOS1040	Earth's Dynamic Systems
GEOS1050	Earth Processes and Products

10 units from:

GEOS2080	Earth Science Field Course
GEOS2161	GIS and Remote Sensing

10 units from:

GEOS3170	Resource and Exploration Geology
GEOS3220	Coastal Environments and Processes
GEOS3250	Geographic Information Systems

Pathway available in the following degrees:

- ✓ Civil
- ✓ Environmental

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level courses

Environmental Chemistry

Chemistry underpins all of the science and technology associated with the environment. Designed to complement the Environmental Engineering program, with the Environmental Chemistry pathway the student has the opportunity to gain a greater understanding of Chemistry to enhance their understanding of environmental processes. The focus of the pathway is to build knowledge and skills in chemical analysis, chemistry of metals and colloidal materials. These will add value to a range of environmental engineering topics including sampling, remediation and water treatment.

Compulsory courses:

CHEM2110	Analytical Chemistry
CHEM2210	Inorganic Chemistry
CHEM3110	Instrumental Methods of Analysis
CHEM3580	Polymers and Colloids

Pathway available in the following degrees:

- ✓ Environmental

Assumed knowledge:

- *CHEM1010 Introductory Chemistry 1*
- *CHEM1020 Introductory Chemistry 2*
- *CHEM2610 Environmental Chemistry 1*
- *MATH1110 Mathematics 1*
- *MATH1120 Mathematics 2*

Food Science

This pathway will offer the opportunity to acquire a background in key aspects of the Food Industry, a significant potential employer of Chemical Engineering Graduates. In fact, food and beverage manufacturing is the largest sub sector of manufacturing on the NSW Central Coast, and is valued at \$275 million to the local economy. Food and beverage companies employ 2614 people locally. Currently the B Engineering (Hons) (Chemical), offers no such opportunities to gain early experience of the Food Industry, and thus enhance employment prospects in the Industry. The pathway will help graduates foster skills and capabilities relevant to large-scale production of food.

Compulsory courses:

FSHN1010	Food and Nutrients I
FSHN2040	Animal Food Products
FSHN2050	Plant Food Products
FSHN3010	Food Processing and Quality Management

Pathway available in the following degrees:

- ✓ Chemical

Assumed knowledge:

- *2000/3000 level courses require completion of the 1000 level course*

Inorganic Chemistry

Chemistry is the science underpinning many of the industrial operations in which Chemical Engineers will ultimately find employment. As such, with the Chemistry pathway the student has the opportunity to gain additional chemical experience with examples of reactions, systems and processes that may be found in a broad range of industrial operations. The four streams (Physical, Inorganic, Organic and Pharmaceutical Chemistry), provide context and applications for students interested in the following areas: coal or minerals processing, fine chemicals, petrochemicals, pharmaceuticals, polymers, consumer products or formulation science.

Compulsory courses:

CHEM2210	Inorganic Chemistry
CHEM2410	Physical Chemistry
CHEM3410	Energy and Structure
CHEM3560	Materials Chemistry

Pathway available in the following degrees:

- ✓ Chemical

Assumed knowledge:

- *CHEM1010 Introductory Chemistry 1*
- *CHEM1020 Introductory Chemistry 2*
- *MATH1110 Mathematics 1*
- *MATH1120 Mathematics 2*

Marine and Freshwater

Compulsory courses:

ENVS1001	Environmental Science Concepts and Methods
ENVS2009	Catchment and Water Resource Management
MARI2320	Marine Ecology
MARI3300	Estuarine Ecology

Pathway available in the following degrees:

- ✓ Chemical
- ✓ Environmental

Materials Chemistry

Chemistry underpins all of the science and technology associated with developing, optimising and deploying new materials. Designed to complement the Mechanical Engineering program, particularly the Materials Science and Engineering courses MECH 2250 and 3400, with the Materials Chemistry pathway the student has the opportunity to gain a greater understanding of Chemistry to enhance their understanding of materials science and engineering. The focus of the pathway is to build knowledge and skills in materials chemistry, inorganic chemistry, physical chemistry, soft matter and the computational modelling of material structure. These will add value to a range of materials and mechanical engineering topics including energy storage technologies, corrosion, advanced manufacturing, tribology and engineering materials.

Compulsory courses:

[CHEM1020](#) Introductory Chemistry II
[CHEM2210](#) CHEM2210 Inorganic Chemistry

20 units from:

Material and Interfacial Structure Stream

[CHEM2410](#) Physical Chemistry
[CHEM3560](#) Materials Chemistry

Physical Chemistry of Materials Stream

[CHEM2410](#) Physical Chemistry
[CHEM3410](#) Energy and Structure

Macromolecular and Colloidal Materials Stream

[CHEM2310](#) Organic Chemistry
[CHEM3580](#) Polymers and Colloids

Assumed knowledge:

- *MATH1110 Mathematics 1*
- *MATH1120 Mathematics 2*

Pathway available in the following degrees:

- ✓ Mechanical

Microbiology

Fermentation technology requires an understanding of microbes and how they grow in different systems (e.g. closed vs continuous). Microbes can also protect structures from erosion which has ramifications for some Civil and Environmental engineering projects.

Compulsory courses:

BIOL1001	Molecules, Cells and Organisms
BIOL1002	Organisms to Ecosystems
BIOL2090	Microbial Biology
BIOL3100	Microbiology

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level course

Pathway available in the following degrees:

- ✓ Chemical
- ✓ Civil
- ✓ Environmental
- ✓ Mechanical
- ✓ Surveying

Molecular Biology

Gene technology is a tool of increasing use, and is combined with large-scale fermentation in the biotechnology industry. The big data generated by molecular biology is best handled by bioinformatics.

Compulsory courses:

BIOL1001	Molecules, Cells and Organisms
BIOL1002	Organisms to Ecosystems
BIOL2050	Molecular Genetics

10 units from:

BIOL3090	Molecular Biology
BIOL3310	Plant Cell and Molecular Biology
BIOL3100	Microbiology

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level course

Pathway available in the following degrees:

- ✓ Chemical
- ✓ Computer Systems
- ✓ Environmental

Organic Chemistry

Chemistry is the science underpinning many of the industrial operations in which Chemical Engineers will ultimately find employment. As such, with the Chemistry pathway the student has the opportunity to gain additional chemical experience with examples of reactions, systems and processes that may be found in a broad range of industrial operations. The four streams (Physical, Inorganic, Organic and Pharmaceutical Chemistry), provide context and applications for students interested in the following areas: coal or minerals processing, fine chemicals, petrochemicals, pharmaceuticals, polymers, consumer products or formulation science.

Compulsory courses:

CHEM2310	Organic Chemistry
CHEM2210	Inorganic Chemistry
CHEM3310	Molecular Organic Synthesis
CHEM3580	Polymers and Colloids

Pathway available in the following degrees:

- ✓ Chemical

Assumed knowledge:

- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1
- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1

Pharmaceutical Chemistry

Chemistry is the science underpinning many of the industrial operations in which Chemical Engineers will ultimately find employment. As such, with the Chemistry pathway the student has the opportunity to gain additional chemical experience with examples of reactions, systems and processes that may be found in a broad range of industrial operations. The four streams (Physical, Inorganic, Organic and Pharmaceutical Chemistry), provide context and applications for students interested in the following areas: coal or minerals processing, fine chemicals, petrochemicals, pharmaceuticals, polymers, consumer products or formulation science.

Compulsory courses:

CHEM2201	Analytical and Medicinal Chemistry
CHEM2310	Organic Chemistry
CHEM3550	Medicinal and Biological Chemistry
CHEM3110	Instrumental Chemical Analysis

Pathway available in the following degrees:

- ✓ Chemical

Assumed knowledge:

- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1
- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1

Physical Chemistry

Chemistry is the science underpinning many of the industrial operations in which Chemical Engineers will ultimately find employment. As such, with the Chemistry pathway the student has the opportunity to gain additional chemical experience with examples of reactions, systems and processes that may be found in a broad range of industrial operations. The four streams (Physical, Inorganic, Organic and Pharmaceutical Chemistry), provide context and applications for students interested in the following areas: coal or minerals processing, fine chemicals, petrochemicals, pharmaceuticals, polymers, consumer products or formulation science.

Compulsory courses:

CHEM2410	Physical Chemistry
CHEM3410	Energy and Structure
CHEM3560	Materials Chemistry
CHEM3580	Polymers and Colloids

Pathway available in the following degrees:

- ✓ Chemical

Assumed knowledge:

- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1
- CHEM1010 Introductory Chemistry 1
- MATH1110 Mathematics 1

Plant Biology

Plants provide the entry point of all energy and nutrients into terrestrial ecosystems. A comprehensive investigation of coordinated plant development is critical for broad scale environmental understanding.

Compulsory courses:

BIOL1001	Molecules, Cells and Organisms
BIOL1002	Organisms to Ecosystems
BIOL2220	Plant Cell Development

10 units from:

BIOL3330	Plant Physiology and Development
BIOL3310	Plant Cell and Molecular Biology

Pathway available in the following degrees:

- ✓ Environmental

Assumed knowledge:

- 2000/3000 level courses require completion of the 1000 level course

Sustainability

Finding sustainable solutions for complex environmental issues is more than a technological matter. The best solutions take into account the social, political and economic context in which the responses are deployed. This pathway introduces students to this context and deepens their understanding of how environmental engineering solutions are interlinked with the social, political and economic world. The sustainability pathway is designed for those students who want their solutions to have maximum effect and public benefit.

40 units from:

ENVS1003	Environmental Values and Ethics
ENVS1004	Social Development and the Environment
ENVS2008	The Sustainable Society
ENVS3001	Integrated Impact Assessment
ENVS3006	Sustainability: Theory and Practice

Pathway available in the following degrees:

✓ Chemical

Assumed knowledge:

- *ENVS2008 requires ENVS1004*
- *ENVS3001 requires ENVS2002*
- *ENVS3006 requires ENVS1004, ENVS2008*