

3.2.2.1 Overview

Chemical engineering (ChE) and chemical engineers are essential for many industries such as oil and gas, petroleum refining, petrochemicals, pharmaceuticals, biologics, chemicals, semiconductor/electronic, food, polymers etc. Besides these, chemical engineers find satisfying and rewarding careers in engineering design and consultancy, research institutes, government, educational institutions and finance. All these sectors have been growing and contributing significantly to the manufacturing output in Singapore.

The four-year BEng (Chemical Engineering) programme at NUS educates budding engineers to design, develop, and operate chemical processes by which chemicals, petroleum products, food, pharmaceuticals and consumer goods can be produced economically and safely with minimal environmental impact. In addition, Chemical Engineering students acquire the necessary background and skills to design and develop functional products that benefit society in many ways. Chemical processes involve reactions, heat transfer, separations and biological phenomena to produce useful and valuable products. Accordingly, they study changes in the composition, energy content and/or state of aggregation of materials, taking into consideration the nature of matter and its properties (chemistry), the forces that act on matter (physics), similar aspects of biological materials (biology), and the relationships between them (mathematics). Chemical engineering differs from chemistry and applied chemistry programmes, with its emphasis on industrial applications of chemical reactions, separations and techniques for designing and operating economical, safe and environmentally benign processes.

Programme educational objectives (PEOs) of BEng (Chemical Engineering): Considering expectations of all our stakeholders, Chemical Engineering programme at NUS prepares students with technical expertise, experiences, critical and creative thinking skills, communication skills and other professional attributes. Accordingly, *our graduates are expected to succeed in the following within several years after graduation:*

- (1) Excel in careers in the chemical, petroleum, petrochemical, pharmaceutical, food, biotechnology, microelectronics, energy, materials processing or other related industries/organisations;
- (2) Pursue advanced degrees and/or certifications for a career in engineering, academia, business, law, medicine, or research and development;
- (3) Display leadership, and also contemporary and global outlook; and
- (4) Demonstrate high-level of professionalism, ethical and social responsibility, independent learning, and desire for life-long learning.

To achieve the above PEO, the four-year undergraduate Chemical Engineering programme has been designed to provide a complete learning experience by incorporating the three essential components of the university's curriculum structure, namely, University Level Requirements (ULRs, to provide broad-based education), Programme Requirements (to provide strong background in the discipline) and

Unrestricted Elective Modules (UEMs, to give flexibility to students to meet their own aspirations).

The requirements for the BEng (Chemical Engineering) degree programme ensure a balanced exposure to science, engineering principles and contemporary technology. Besides education in science and technology, students broaden intellectual horizons by taking supporting modules that constitute the ULR and the Faculty Requirements of the Programme Requirements. Building upon many core modules in the first five semesters, technical electives and a research project (dissertation) in the subsequent semesters provide an opportunity to specialize in the student's area of interest. Students have complete freedom to use UEM to take modules that complement individual career plans or to simply pursue personal curiosity and interest. All Chemical Engineering students are exposed to industrial practice through internship, site visits and/or lectures by practising engineers. They are also provided with networking, globalisation and technical/business leadership opportunities through student exchange, overseas colleges, entrepreneurship and minor programmes for broader education.

The student learning outcomes (SLOs) of BEng (Chemical Engineering) programme are as follows. Graduates of this programme should be able to:

- a) apply knowledge of mathematics, science and engineering to the solution of complex engineering problems;
- b) design and conduct experiments, analyse, interpret data and synthesise valid conclusions;
- c) design a system, component, or process, and synthesise solutions to achieve desired needs;
- d) identify, formulate, research through relevant literature review, and solve engineering problems reaching substantiated conclusions;
- e) use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints;
- f) communicate effectively;
- g) recognise the need for, and have the ability to engage in life-long learning;
- h) understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development;
- i) function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management;
- j) understand professional, ethical and moral responsibility; and
- k) apply critical thinking through independent thought and informed judgement, and develop creative and innovative solutions.

The BEng (ChE) programme at NUS is accredited by the Engineering Accreditation Board (EAB) of Singapore. EAB is the Singapore signatory of the Washington Accord, and all signatories of this Accord recognise the substantial equivalence of programmes accredited by one of them, in satisfying the academic requirements for the practice of engineering at the professional level. This means ChE graduates from NUS are accepted for engineering practice in the countries that are part of the

Washington Accord. Besides Singapore, signatories in the Washington Accord include Canada, USA, UK, Hong Kong, New Zealand and Australia.