

## **CHEMICAL & BIOMOLECULAR ENGINEERING COURSE MODULES (YEAR 2)**

As the only course in Singapore that integrates biological and chemical sciences with engineering concepts, the Diploma in Chemical & Biomolecular Engineering [CBE] will train you to be very versatile to tap myriad career opportunities. The broad-based curriculum covers chemical processing, pharmaceuticals, environment science, engineering and life sciences.

In your first year, you will be equipped with a solid foundation for chemical engineering, with modules such as chemistry, biology, physics, and mathematics. You will also be introduced to how the basic concepts in science are used in engineering through the Introduction to Chemical and Biochemical Engineering module.

In your second year, you will explore the application of scientific concepts in the operation of common engineering systems and equipment. These include an in-depth study of biopharmaceutical technology, chemical engineering transfer technologies, analytical chemistry, engineering materials and reaction engineering.

In your final year, you will deepen your knowledge with one of two exciting specialisation options. Both options provide insights into the operations of integrated operating facilities through modules such as process engineering design, process instrumentation and control as well as unit operations. You will also get to explore a virtual chemical plant and train on computer simulations which will hone your communication and troubleshooting skills through simulated process setups. In addition, a six-month internship is provided to give you an opportunity to put your learning into practice. You can opt for either an Industry Internship with companies such as Chevron Oronite, ExxonMobil, Shell Petrochemicals and GlaxoSmithKline or a Research Internship in a local or an overseas research facility.

### **SPECIALISATION OPTIONS**

#### **General Chemical Engineering**

This option provides students with the critical skills for analysing chemical processes specific to the petrochemical and specialty chemical industries.

#### **Pharma & Biopharmaceuticals**

This option provides students with knowledge of the different chemical processes, quality assessments, and the regulatory environment specific to the pharmaceutical and biopharmaceutical manufacturing industries.

### **LEVEL 2.1**

#### **Analytical Chemistry**

This module teaches students some common separation and characterisation instruments and instrumental techniques used in the laboratory, as well as providing hands-on opportunity for them. These techniques include UV-visible spectrophotometry (UV-Vis), gas liquid chromatography (GLC), high performance liquid chromatography (HPLC) and Atomic Absorption Spectroscopy (AAS).

#### **Biopharmaceutical Production**

This module provides students with a working knowledge of all aspects of the manufacturing of biologics products. This module will cover various aspects of upstream and downstream manufacturing including media and buffer batching, cell banking, microbial and animal cell culture, bioreactor technology cell harvesting, chromatography, and fill and finish processes.

#### **Career & Professional Preparation II**

This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their further career and/or education. In this module, students will explore basic job search strategies, practise writing effective resumes and cover letters, and learn interview skills. Students will also learn professional and intercultural communication skills to prepare them for a dynamic and diverse workplace.

### **Chemical Engineering Laboratory 2.1**

This module integrates the practical aspects of Reaction Engineering and Transfer Processes - Fluid Flow modules. In addition, students will also explore basic electrical concepts for the determination of efficiency of common chemical engineering equipment, such as pumps and compressors.

### **Engineering Mathematics 3**

Building upon the materials covered in the earlier two modules on engineering mathematics, this module provides students with an adequate knowledge of mathematics to solve problems encountered in their future work. Topics include vector algebra, first and second order differential equations and their applications, Laplace transform technique and its applications, and regression analysis. Students will also use a mathematical software package to solve these problems.

### **Reaction Engineering**

This module focuses on reactor design principles. Topics include reactor kinetics, analysis of batch reactors, continuous stirred tank reactors and plug flow reactors. It also covers topics in material balance calculations as well as aspects of the design, construction and operation of chemical and biological reactors. Examples from the petrochemical, chemical, environmental and biotechnology industries are used to reinforce lecture materials.

### **Transfer Processes - Fluid Flow**

In this module, students are introduced to fluid dynamics. Topics include energies of liquids in motion, flow in pipes, general principles of pumps and system characteristics compressors, and flow measurement.

## **LEVEL 2.2**

### **Analysis of Chemical Engineering Processes**

In this module, students will study the fundamental principles of flow diagram analysis, including both mass and energy balances, and the use of a process flow- sheeting package.

### **Chemical Engineering Laboratory 2.2**

This module integrates the practical aspects of Environmental Technology and Transfer Processes - Heat and Mass modules.

### **Engineering Materials**

In this module, students will study the properties of materials commonly used in industries and gain an understanding of the basic requirements to carry out the proper selection of materials. Topics include the classification of materials, properties of materials, metals, alloy and polymeric materials, corrosion and degradation of materials.

### **Environmental Technology**

This module introduces students to environmental problems and their impact. Students will study the various methods, applications and equipment in solving and preventing environmental problems, specifically in the areas of air and water pollution, and the management of industrial wastes.

### **Occupational Health & Safety**

This module provides an understanding of biological, chemical and physical hazards, ergonomics, radiation, and management of dangerous and toxic goods. It also includes an overview of occupational health and safety legislation as part of a basic knowledge of industrial safety.

### **Transfer Processes - Heat & Mass**

This module explores the mechanisms of heat transfer (conduction, convection and radiation), and introduces the importance of heat exchangers in chemical engineering processes. The fundamentals of mass transfer are also covered, giving a deeper understanding of key chemical engineering processes such as evaporation and condensation, distillation, and other extraction and separation techniques.

### World Issues: A Singapore Perspective<sup>^</sup>

This module develops a student's ability to think critically on world issues. Students will discuss a wide range of social, political and cultural issues from the Singapore perspective. It also looks at how city-state Singapore defied the odds and witnessed close to half a century of rapid economic growth, strong political ties and social harmony.

### COURSE CURRICULUM (YEAR 2)

Module Name	Credit Units
<b>YEAR 2</b>	
<b>Level 2.1 (26 hours per week)</b>	
Analytical Chemistry	3
Biopharmaceutical Production	5
Career and Professional Preparation II	2
Chemical Engineering Laboratory 2.1	3
Engineering Mathematics 3	4
Reaction Engineering	4
Transfer Processes – Fluid Flow	3
Interdisciplinary Studies (IS) elective <sup>^</sup>	2
<b>Level 2.2 (23.5 hours per week)</b>	
Analysis of Chemical Engineering Processes	6.5
Chemical Engineering Laboratory 2.2	3
Engineering Materials	2
Environmental Technology	4
Occupational Health & Safety	2
Transfer Processes – Heat & Mass	4
World Issues: A Singapore Perspective <sup>^</sup>	2
At the end of their second year, students will select <u>one</u> of two specialisation options: <b>General Chemical Engineering</b> or <b>Pharma &amp; Biopharmaceuticals</b> .	

#### Notes:

<sup>^</sup> For more details on Interdisciplinary Studies (IS) electives, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

#### IS Modules

The School of Interdisciplinary Studies (IS) delivers a broad-based curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge economy. IS offers both prescribed modules and electives to challenge boundaries. Prescribed modules develop students' competencies in core areas such as Communication, Innovation and Enterprise, Culture and Communication, and Personal Mastery and Development, while elective modules provide insights into Arts and Humanities, Business, Design, and Science and Technology.