DIPLOMA IN CHEMICAL & BIOMOLECULAR ENGINEERING

A broad-based course that integrates biological and chemical sciences with engineering concepts, the Diploma in Chemical & Biomolecular Engineering (CBE) will open doors to a variety of careers. Learn how to apply principles of chemistry, physics, mathematics and biology to develop valuable products in an efficient and sustainable way.

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

In your final year, you will deepen your chemical engineering knowledge and acquire insights into the operations of integrated operating facilities through modules such as Sustainable Industry Processes, Separation Technology, as well as Process and Automation Laboratory.

You will also get to explore a virtual chemical plant and use computer simulations to hone your communication and troubleshooting skills. In addition, you can put your learning into practice in a six-month internship. 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 overseas research facility.

YEAR 1 COURSE MODULES

LEVEL 1.1

Career & Professional Preparation 1
This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their career and/or further education. In this first module, students will undergo personal discovery and exploration of industry and career prospects. Students will learn how to plan and set achievable goals in preparation for their future. Students will also learn the importance of passion and professionalism, along with basic teamwork and interpersonal skills.

Data Analytics and Engineering Drawing
The module provides an introduction to basic data analytics which includes data processing as well as data visualisation. Students will be trained in identifying the proper form of data representation in technical communication. In addition, the module also provides hands-on practice of AutoCAD in engineering drafting to allow students to appreciate the use of computer software in the engineering field.

Engineering Mathematics 1
The module provides students with an adequate foundation of Engineering Mathematics that will enable them to acquire specialist mathematical skills for their careers and/or further studies. Students will also use a mathematical software package to solve mathematical problems.

Inorganic & Physical Chemistry

This module covers the principles of physical chemistry as well as the reactions and properties of inorganic compounds. Students will study the structure of matter, chemical bonding, chemical calculations, electrochemistry and redox reaction, chemical equilibria, ionic equilibria, chemical kinetics, thermochemistry, transition metal chemistry and chemistry of solutions, including acids and bases.

Introduction to Engineering Principles

The module introduces students to basic chemical engineering concepts and applications, for example, units and dimensions, material balance calculations, reaction stoichiometry, reaction engineering, and fluid mechanics. Upon completion of this module, students will be able to undertake basic chemical engineering calculations.

LEVEL 1.1

Engineering Mathematics 1

A continuation of the Engineering Mathematics I module, this module provides students with an adequate foundation of Engineering Mathematics that will enable them to acquire specialist mathematical skills for their careers and/or further studies. Emphasis is placed on their applications in solving engineering related problems. Students will also use a mathematical software package to solve mathematical problems.

Organic & Biological Chemistry

This practical-oriented module is designed to give students an introduction to organic and biological chemistry.
Students will be introduced to the chemistry of hydrocarbons, alcohols, amines, carboxylic acids and their derivatives. The structure, function and chemical reactions of carbohydrates, lipids, proteins, nucleic acids, enzymes and coenzymes are also covered.

Thermodynamics

In this module, students will study the fundamental concepts of thermodynamics and fluid mechanics. Topics include the first and second laws of thermodynamics, properties of liquids and vapours, non-flow processes and steady flow processes with steam and perfect gases. The concepts of pressure, pressure head, and pressure measurement will also be discussed.

YEAR 1 COURSE CURRICULUM

Module Name	Credit Units
Level 1.1 (21 hours per week)	
Career & Professional Preparation 1	1
Data Analytics and Engineering Drawing	3
Engineering Mathematics 1	6
English Language Express*	NA
Innovation Made Possible^	3
Inorganic & Physical Chemistry	5
Introduction to Engineering Principles	3
Level 1.2 (20 hours per week)	
Communication Essentials^	3
Engineering Mathematics 2	6
Health & Wellness^	1
Organic & Biological Chemistry	5
Thermodynamics	5

Notes:
^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is/ * This module is only offered to students who are weaker in the English Language.

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.

YEAR 2 COURSE MODULES

LEVEL 2.1

Analytical Chemistry
This module teaches students some common separation and characterisation instruments and instrumental techniques used in the laboratory and provides hands-on learning opportunities. 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 a practical foundation of biological sciences in the context of industrial biotechnology. It further provides students with a working knowledge of important aspects in the upstream and downstream manufacturing processes of biologics products. These include microbial and animal cell culture, bioreactor technology, cell harvesting, purification and fill and finish processes.

Career & Professional Preparation 2
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, practice 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.

Reaction & Flow Laboratory
This module provides students with the opportunity to operate common chemical engineering equipment used in reaction engineering and fluid flow. These include the use of batch and continuous reactors, pumps, compressor, and friction measurement. Students will also practice the process of experiment designs and project management through a lab-based learning approach.

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
This module aims to provide fundamental principles of process flow diagram analysis, including both material and energy balances for single and multiple process units. Students will also acquire familiarity with data-sources, charts, handbooks and/or literature used in process flow diagram analysis.

Environment, Health & Safety
This module covers the role of the chemical engineer in solving and preventing environmental problems especially in the areas of air and water pollution. Students will explore common methods and processes that help to reduce or control pollution in the chemical industry. In addition, this module provides students sufficient knowledge of occupational, health and safety knowledge and practices in the workplace, including the statutory requirements for good and safe work practices.

Process Technology Operations
This module introduces practical aspects of controls, sensors, and instrumentation. It aims to equip students with a basic knowledge of how automated control systems are implemented in process control plants. Fundamental concepts of Process Quality Control as well as digital monitoring and simulation are also covered in the context of an integrated chemical system.

Transfer Process & Environmental Laboratory
This module aims to complement students' understanding of chemical engineering equipment in the field of heat and mass transfer, and environmental technology through the completion of relevant experiments. Students will also practice the process of experiment designs and project management through a lab-based learning approach in water analysis.

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.

YEAR 2 COURSE CURRICULUM

Module Name	Credit Units
Level 2.1 (20 hours per week)	
Analytical Chemistry	3
Biopharmaceutical Production	5
Career & Professional Preparation 2	2
Reaction & Flow Laboratory	3
Reaction Engineering	4
Transfer Processes: Fluid Flow	3
Level 2.2 (20 hours per week)	
Analysis of Chemical Engineering Processes	5
Environment, Health & Safety	4
Process Technology Operations	3
Transfer Process & Environmental Laboratory	3
Transfer Processes: Heat & Mass	3
World Issues: A Singapore Perspective^	2

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YEAR 3 COURSE MODULES

LEVEL 3.1

Current Good Manufacturing Practices

This module provides students with an understanding of current Good Manufacturing Practices (cGMP) regulations for biopharmaceutical, and pharmaceutical related products. Students will study and analyse scientific investigations and regulations.

Computer Aided Process Optimisation

In this module, students will learn to optimise a preliminary design of chemical process plant with the aid of AutoCAD and a commercial computational software. Students will get to practice design principles, including the necessary safety considerations, material selection, and cost feasibility.

Process & Automation Laboratory
This module provides students with the opportunity to apply their knowledge on transfer processes and unit operations in chemical and pharmaceutical engineering through hands-on experiences with both standalone units and an integrated chemical system. Students will also learn the concept of start-up, shutdown and troubleshooting with the use of a simulation software.

Separation Technology
This module provides the students with scope of unit operations in chemical engineering. Topics include evaporation, adsorption, distillation, liquid-liquid extraction, absorption, membrane separation processes and crystallisation.

Sustainable Industry Processes
This module contains multiple remote learning packages that provide an overview of sector specific processes and practices. Students can opt to complete one or multiple packages that suit their area of interests. The remote learning packages cover the renewable and sustainable technologies in the process and petrochemical industry.

LEVEL 3.2

INDUSTRY TRACK

Industrial Internship
Students will do an internship and project which gives them opportunities to apply the knowledge acquired in classrooms to real-world work situations. They will be attached to companies in various industries such as the petrochemicals, specialty chemicals, and pharma- or biopharmaceutical sectors.

RESEARCH TRACK

Research Internship
Students will be introduced to basic research skills, which include literature review, laboratory safety, project management, and statistical analysis of laboratory data, followed by opportunities to undertake a scientific research project. The projects will be carried out in-house or at external research institutions, which include overseas institutions.

YEAR 3 COURSE CURRICULUM

Module Name	Credit Units
Level 3.1 (19 hours per week)	
Current Good Manufacturing Practices	2
Computer Aided Process Optimisation	4
Process & Automation Laboratory	3
Separation Technology	4
Sustainable Industry Processes	2
Project ID: Connecting the Dots^	4
Level 3.2 (20 hours per week)	
Industry Track	
Industrial Internship	20
Research Track	
Research Internship	20

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