Ever thought of driving in the rain without the need for wipers? How about harnessing solar energy from your shirt to charge a mobile phone? These are the wonders that nanotechnology and materials science can create.

This course adopts a multidisciplinary curriculum that combines applied sciences and engineering. You will learn how to use nanotechnology to deliver cheaper, smaller, better, faster and stronger products using advanced materials such as polymers, ceramics and composites.

Our strong industry links with nanotechnology and advanced materials companies and institutions will further provide you with ample opportunities to work on live industry projects. This will prepare you for a wide range of careers in the materials science and nanotechnology sectors.
WHY THIS DIPLOMA?
• Get wide exposure to engineering and science.
• Enjoy good opportunities for R&D in academia or research institutions.
• Be part of an exciting new trend in technology.
• Gain international exposure and experience through our Overseas Internship Programme in countries such as Australia, Canada, France, the UK and Japan.

IT WILL ENABLE YOU TO...
• Gain a broad-based foundation in the sciences behind advanced materials like polymers and ceramics.
• Improve products in the electronics, consumer, medical and pharmaceutical, chemical, and renewable clean energy industries.
• Deliver improved products that have new and far greater functionalities at a lower cost.
• Design and develop advanced and innovative materials.

DURATION
Three academic years on a full-time basis.

FURTHER EDUCATION
Receive advanced standing or module exemptions for relevant or equivalent degrees and programmes at many universities in Singapore and overseas, such as the University of New South Wales, University of Sydney, University of Western Australia, University of South Australia, University of Southern Queensland, Queen Mary University of London, Newcastle University, University of Sheffield and Cranfield University.

CAREER PROSPECTS
Look forward to rewarding and challenging careers in:

Materials development and processes – Your strong knowledge in chemistry and materials science will be needed as a materials technologist and development engineer. You can also become a materials process engineer with your competencies in various materials process technologies.

Materials characterisation and analysis – You can take up positions as a quality control engineer and laboratory/research technologist in advanced materials analysis laboratories for both industry and research institutions. This is because you have practical training in operating and handling specialised equipment, instruments and tools for the characterisation and analysis (including failure analysis) of advanced materials, in support of the complete product development cycle.

Nanotechnology – You can take on a number of roles that support the design and development of nanotechnology products in nanotechnology and nanoscience laboratories using smart, nano-structured devices and nanomaterials.

ENTRY REQUIREMENTS
You must have obtained the following minimum GCE ‘O’ Level results:
• English Language (EL1) Grade 1–7
• Elementary/Additonal Mathematics Grade 1–6
• A relevant Science subject Grade 1–6

^ Please refer to the section on entry requirements for diploma courses for more details.
COURSE STRUCTURE

YEAR 1 – SEMESTERS 1 & 2
Core Modules
EGJ101 Mathematics 1A
EGJ103 Electrical Principles & Circuits
EGJ104 3D Modelling
EGJ105 Communication Skills
EGJ106 Physics
EGJ107 Mathematics 1B
EGJ108 Inorganic & Physical Chemistry
EGJ109 Mechanics
EGJ110 Materials Science
EGJ111 Computer Programming
EGJ112 Good Laboratory Practices
EGJ113 Introduction to Engineering

General Studies*

YEAR 2 – SEMESTERS 1 & 2
Core Modules
EGJ201 Mathematics 2A
EGJ202 Thermodynamics
EGJ203 Polymers & Composites
EGJ204 Organic Chemistry
EGJ205 Materials Analysis & Nanocharacterisation
EGJ206 Materials & Nanotechnology Project 1
EGJ207 Mathematics 2B
EGJ208 Advanced Materials Science
EGJ209 Mechanics of Materials
EGJ210 Metrology & Quality Control
EGJ211 Micro & Nanotechnology
EGJ212 Materials & Nanotechnology Project 2

General Studies*

YEAR 3 – SEMESTERS 1 & 2
Elective Programmes (Select one)

Materials For Sustainable Technology
Core Modules
EGJ303 Nanomaterials & Commerce
EGJ304 Professional & Interpersonal Communication Skills
EGJ311 Energy Harvesting & Storage
EGJ312 Sustainable Materials & Technology
EGJ324 Full-Time Semestral Project**

General Studies*

Internship#

Elective Modules (Choose two)
EGJ302 Semiconductor Technology
EGJ306 Electronic Materials
EGJ313 Nanomaterials & Safety

Functional & Structured Materials
Core Modules
EGJ301 Nanomaterials Science
EGJ303 Nanomaterials & Commerce
EGJ304 Professional & Interpersonal Communication Skills
EGJ308 Advanced Crystalline Solids
EGJ324 Full-Time Semestral Project**

General Studies*

Internship#

Elective Modules (Choose two)
EGJ305 Wafer Fabrication Processes
EGJ306 Electronic Materials
EGJ311 Energy Harvesting & Storage

For detailed module synopses, please refer to the online Prospectus at www.nyp.edu.sg/prospectus

* To complete 60 hours for General Studies Modules with the aim of promoting a holistic education and learning experience. Choose modules from clusters that include foreign languages, communication and interpersonal skills, leadership and teamwork, values and society, general knowledge and interests, and healthy and active lifestyle.

** Students taking EGJ325 or EGJ326 would not need to do EGJ324.

# Internship (Choose one)
EGJ323 Internship Programme (12 weeks)
EGJ325 Internship Programme (24 weeks)
EGJ326 Overseas Internship Programme
EGJ101
Mathematics 1A [60 hours]
This module provides students with the basic mathematical principles and tools necessary to underpin their education in the engineering discipline. It will enable them to apply mathematical methods, tools and notations proficiently in the analysis and solution of engineering problems. Topics covered include engineering functions, trigonometry, complex numbers, determinants, matrices and vectors. At the end of this module, students will be able to demonstrate understanding of and competence in the basic mathematics of engineering, such as vectors, matrices, exponential and logarithmic functions, and complex numbers.

EGJ103
Electrical Principles & Circuits [60 hours]
This module provides students with the fundamentals of DC and AC electrical circuits. They will be learning the relevant electrical principles, electrical safety rules and how to measure the AC and DC basic electrical quantities. Topics covered include principles of electricity, resistive circuits, electromagnetism, inductive and capacitive circuits, DC transient circuits, AC circuits and DC sources. Skills acquired serve as a foundation for advanced modules in the areas of Biomedical Instrumentation & Control and Nanotechnology Engineering.

EGJ104
3D Modelling [45 hours]
This module provides students the fundamental knowledge of basic 3D modelling and 2D drafting skills. Topics covered include Solid Modelling and Drafting and Documentation to equip the students with the necessary skills in communicating design ideas and concepts. The module equipped students with knowledge of the universal graphic language and documentation standards essential for engineering components and systems design in the diploma and the engineering industry.

EGJ105
Communication Skills [30 hours]
This module gives students a broad understanding of the communication process and interpersonal communication skills to interact effectively with others. The module will also cover the various forms of writing skills – technical, proposal and report – required in an engineering environment. In addition to interacting more effectively with others, their oral presentation skills will also be honed so that they become effective presenters.

EGJ106
Physics [60 hours]
This module provides students with fundamental basic concepts of physics and also covers how to apply physics in technology development such as biomedical and material science applications. The module covers measurement, kinematics, dynamics, energy, thermal physics, wave theory, solid state devices and electromagnetism. By the end of this module, students will have a good grasp of basic physics knowledge. Knowledge acquired also serves as a foundation for advanced modules in the field of biomedical engineering and material science.

EGJ107
Mathematics 1B [60 hours]
This module provides students with the essential knowledge in calculus and analytical skills for solving engineering problems encountered in their course of study. It also serves as a foundation for advanced topics in the second year. Topics include concept of limits; derivatives of polynomial, trigonometric, inverse trigonometric, exponential and logarithmic functions; indefinite and definite integrals of common engineering functions; and differentiation and integration with engineering applications.
EGJ108

*Inorganic & Physical Chemistry [75 hours]*

The module provides students with essential knowledge that covers the general chemistry involving ideal gas laws, thermochemistry, phase diagrams, the principles of physical chemistry and the reactions and properties of inorganic compounds. Also included in the module are atomic structure and trends, chemical bonding, chemical equilibrium, kinetics, electrochemistry and reactions, and chemistry of solutions including acids and bases. By the end of this module, students should have a firm understanding of the atomic structure and bonding of inorganic matter, the physical chemistry and reactions of inorganic compounds. The knowledge acquired serves as foundation for other advanced modules in nanotechnology, materials synthesis, advanced materials science and engineering.

EGJ109

*Mechanics [60 hours]*

This module provides students with the fundamentals of engineering mechanics. The module covers topics like principles of mechanics, forces, statics in 2D, stress and strain, moment of inertial of areas, beams and bending theory. Knowledge acquired serves as foundation for advanced modules in the field of mechanical design and engineering.

EGJ110

*Materials Science [60 hours]*

This module introduces the principles of materials science to first year students. The topics covered include atomic structure, types of bonds, inter and intra molecular bonding, basic crystallography, imperfection in solids, crystal defects, non-crystalline and crystalline materials, diffusion and diffusion controlled process, as well as processing-structure-property relationships. By the end of the module, students will have a firm grasp on the fundamental knowledge of materials science. Skills acquired serve as a foundation for advanced modules in Advanced Materials Science, Mechanics of Materials and Electronic Materials.

EGJ111

*Computer Programming [60 hours]*

This module focuses on giving students a firm grasp of the fundamental programming skills. It teaches skills in designing algorithms/flowcharts, variables and data types, data processing, structured programming and software testing/debugging in C language. It provides the necessary knowledge to develop complete programs according to design requirements. The module serves as a foundation in areas of electronics & image processing.

EGJ112

*Good Laboratory Practices [30 hours]*

This module provides students with fundamental knowledge in basic laboratory management and effective laboratory practices. Topics to be covered include basic laboratory operations, laboratory safety and guidelines, laboratory data management, applications of proper laboratory techniques and international laboratory quality standards. This module will have practical sessions for students to apply their GLP knowledge in testing instrumentation, laboratory operations and services. The focus is on how knowledge and techniques in laboratory practices can be applied in the various laboratory setting.

EGJ113

*Introduction to Engineering [60 hours]*

This module develops students' interest in engineering and stimulates them by providing a platform for them to have their first hands-on experience in building practical projects in various engineering disciplines and applying and integrating the knowledge from different engineering modules in the semester. Students will first conceptualise, design, implement and finally operate on interesting and practical projects. Through this platform, students will be able to hone their creative thinking and problem-solving skills, build synergistic teamwork and enhance their communication skills. Students will also be able to understand the importance of material selection and its applications.
EGJ201
Mathematics 2A [60 hours]
This module provides students with the basic theory of ordinary differential equations and Laplace transform. The module focuses on differential equations that arise in practice and the emphasis will be on solving these equations and understanding the possible behaviours of solutions. Topics covered include partial derivatives, first and second order differential equation and their applications, numerical approximation to solutions of differential equations, Laplace transform and applications. At the end of the module, students will be able to demonstrate a sound knowledge of a range of techniques for solving linear ordinary differential equations and apply them to solve real-life problems in engineering.

EGJ202
Thermodynamics [60 hours]
The module covers the fundamental concepts and applications of thermodynamics. Different forms of energy and types of process are introduced here. Internal energy and enthalpy are discussed in connection with the first law of thermodynamics, and entropy with the second law. Tables of thermodynamics properties, heat transfer, steady state flow processes, ideal systems, mixtures, psychrometry, and combustion reactions are also covered. Students will be able to apply fundamental thermodynamics concepts and solve various thermodynamics problems.

EGJ203
Polymers & Composites [60 hours]
Students will gain a foundation in the chemistry, physics and materials properties of polymer and composite materials. Students will be able to describe the fundamental science behind the properties these materials display. Topics will also include the classification, processing and commercial significance of these materials. Students will be able to measure, design and predict the material properties of composite materials and apply this to their use as modern advanced materials.

EGJ204
Organic Chemistry [60 hours]
Students of this module will gain fundamental knowledge of organic chemistry. By understanding the bonding and geometry of the main functional chemical groups students will be able to predict reactions and specify reaction mechanisms. Laboratory classes will further enhance the key concepts and students will develop practical chemical skills. This module prepares students to apply chemical knowledge to biological and environmental systems and industry practices.

EGJ205
Materials Analysis & Nanocharacterisation [60 hours]
This module provides students with a practical understanding of the techniques essential for the analysis and characterisation of nano-materials. Students are introduced to basic measurement terminologies and roles of nanocharacterisation first. Subsequently, they learn the fundamental theory, instrumentation, interpretation of results, and applications of nanomaterials analysis techniques, including optical microscope, scanning electron microscope, scanning probe microscope, ultra-violet and visible spectroscopy, Fourier transform infrared spectroscopy, and x-ray diffraction. The module will enable students to apply these techniques for nano-materials characterisation.

EGJ206
Materials & Nanotechnology Project 1 [30 hours]
This module covers a series of structured project assignments in the area of materials and nanotechnology. Students work in teams and are expected to apply the techniques and skills learnt throughout the first year of the diploma in projects that may include materials characterisation and analysis-related assignments. Through this platform, students will be able to hone their creative thinking and problem-solving skills, build synergistic teamwork and enhance their communication skills.
EGJ207
Mathematics 2B [60 hours]
This module provides students with the necessary mathematical training that will assist and expand their experiences within their discipline of study. The module contains two parts. The first part focuses on Fourier analysis and discusses how periodic signals in the time domain can be represented in the frequency domain. The aim of the second part is to give students a working knowledge of statistical concepts so that statistical reasoning can be correctly applied to experimental results and their statistical significance discussed. Topics include Fourier series, probability concepts, probability distribution (Binomial, Poisson and Normal), sampling distributions, estimation and linear regression. At the end of the module, students will be able to demonstrate a sound knowledge of the mathematical training and apply them to solve real-life problems in engineering.

EGJ208
Advanced Materials Science [60 hours]
This module provides students with the principles and practice related to processing, structure and properties of engineering materials. This module covers basic knowledge of interpretation of phase diagrams including quantitative prediction of microstructure, the kinetics of phase transformations, thermal processing of metal, structures, properties of ceramics and polymers and corrosion of materials. The emphasis is on understanding the importance of process control to achieve desired properties through the formation of correct microstructural features. Knowledge acquired also serves as a foundation for advanced modules in the field of materials science and engineering.

EGJ209
Mechanics of Materials [60 hours]
This module provides students with fundamental knowledge and understanding of how materials in their applications as load-bearing structures and components will behave when subject to different types of mechanical loading. Topics covered include mechanical properties, materials test standards and testing methods, deformation in solids, types of fracture, fatigue and creep. Methods to alter the mechanical properties of engineering materials, in particular metals, such as, heat treatment and strengthening mechanisms are also included. Common causes of failure in materials and the effects of material defects such as cracks, on stress concentration in materials are discussed. Knowledge acquired from this module will be essential for prospective engineers when dealing with the testing and application of materials in the design and development of load-bearing components and structures in mechanical systems.

EGJ210
Metrology & Quality Control [60 hours]
This module equips students with the fundamental principle of metrology, statistical quality control and ISO standards. Topics covered include basic concept of quality control, selection and correct use of measuring tools and equipment, statistical process control (SPC) and ISO standards. Hands-on practice is an integral part of the course to apply, enhance and acquire skills in the proper handling and techniques of using precision measuring tools, as well as, SPC software for process quality monitoring and improvement. At the end of the module, the students will be able to ensure fitness for use of parts in a manufacturing environment.

EGJ211
Micro & Nanotechnology [60 hours]
This module introduces the basic principles and concepts of micro and nanotechnology. The topics covered include scaling laws of miniaturisation science, application of micro and nano devices, design principles of miniaturised devices, micro and nanofabrication processes. By the end of the module, students should have a firm grasp on the fundamental of micro and nanotechnology. Knowledge acquired can be applied in the areas of biomedical, cosmetic, consumer electronics, alternative energy, aerospace and textiles.
EGJ212
Materials & Nanotechnology Project 2 [30 hours]
This module continues along the lines of Materials and Nanotechnology Project 1. It provides students to further develop techniques and skills with emphasis on nanomaterials synthesis and characterisation project. Students are expected to work in groups. Knowledge acquired from this module will be benefit for students’ innovation in materials and nanotechnology design and development.

EGJ301
Nanomaterials Science [60 hours]
This module provides students with the fundamental knowledge of materials at the nanoscale. Students are introduced to the physics of nanotechnology. Topic covers include concepts of surface area, surface energy and structures, as well as the effects on material properties.

Common techniques to fabricate and characterize nanomaterials. Applications of important nanomaterials and their environmental impact will be discussed. Knowledge acquired will be useful in the materials industry as well as in research lab.

EGJ302
Semiconductor Technology [60 hours]
The students should have some knowledge of basic engineering sciences, mathematics, electrical principles, electronics and electronic devices. Major topics covered include classification of cleanrooms, a study of major IC devices, parametric testing, failure analysis and reliability engineering. Practical skills pertaining to these topics will be realized in laboratory to enhance the understanding of semiconductor technologies in a real manufacturing environment. At the end of the module, students will be able to apply the knowledge that they have gained to real-life engineering problems involving parametric testing, failure analysis and reliability engineering.

EGJ303
Nanomaterials & Commerce [60 hours]
This module is designed to develop the skills and knowledge in the various aspects of technopreneurship, where students are expected to complete an assignment, with special emphasis on materials & nanotechnology applications. Students will research on project engineering including emphasis on information gathering, usability, robustness of design, costing analysis, business entity and structure, business plan and its various components, and intellectual property protection. The focus is on applying the technopreneurship skills into the creation process for materials & nanotechnology related industry. The student will be able to write a business plan and design an innovative product.

EGJ304
Professional & Interpersonal Communication Skills [30 hours]
This module helps students understand and acquire communication skills for entry into the job market as working professionals. It focuses on job searching skills and includes resume and cover letter writing, as well as interviewing skills. Students will gain insights into change management, organisational structure and corporate culture, enabling them to fit in better at their workplace. They will also learn about business correspondence.

EGJ305
Wafer Fabrication Processes [60 hours]
This module provides students with essential knowledge of wafer fabrication processes for integrated circuit chips in the semiconductor manufacturing industry. Major topics covered include oxidation, diffusion, photolithography, etching, ion implantation, thin film deposition, chemical mechanical polishing, wafer cleaning, and process integration. Practical skills pertaining to these technologies will be emphasised in laboratory to enhance the understanding of wafer fabrication in a semiconductor-manufacturing environment. In all, students will appreciate the fundamental wafer fabrication processes used in the semiconductor manufacturing industry.
EGJ306
Electronic Materials  [60 hours]
This module provides students with the essential knowledge and concepts of materials used in electronic applications. Students are introduced to the physical principles of electronic conduction in materials, influences of composition and microstructure on electronic properties of materials, and applications of materials in electronic, magnetic and optical devices. Practical sessions in the laboratory will be conducted to enhance the understanding of the electronic materials and working principles of electronic devices. By the end of this module, students will be able to analyse the electronic property of materials, describe the working principles and the structure of electronic devices such as diodes, light emitting diodes (LED), solar cells and transistors.

EGJ308
Advanced Crystalline Solids  [60 hours]
This module provides students with further knowledge of metals and ceramics. This module will cover advanced topics of important engineering families of metals and ceramics. The structure and properties of these materials will be treated in greater detail. Applications of these materials in biomedical, electronic and structural applications will be discussed. With this knowledge, the students will be able to choose relevant metallic or ceramic materials for different applications in the industry.

EGJ309
Smart Materials  [60 hours]
Students will gain an understanding of the physical and chemical science behind smart materials and learn how they can be employed in the materials of the future. The module will provide an overview of smart materials focusing on the functionality and applications of the materials. Topics will include: shape memory alloys; piezoelectrics and ferroelectrics and smart polymers. Students will learn how to design and control the properties of the materials to tailor them for a particular application.

EGJ311
Energy Harvesting & Storage  [60 hours]
This module provides students with an understanding of the fundamental principles and terminology, as well as an application knowledge of materials related to energy harvesting and storage technologies. Students will be able to understand and assess the different types of materials and key properties, and to apply processing principles relevant to energy harvesting and storage devices.

EGJ312
Sustainable Materials & Technology  [60 hours]
Sustainable materials and technology has been gaining importance to address the earth’s depleted resources and worsened environmental pollution. This module will provide students with an understanding of the design and applications of sustainable materials and the efficient use of renewable materials in manufacturing. The pollution prevention technology will focus on water treatment technology for industrial and municipal wastewater treatment using conventional membranes and emerging technologies in water reclamation and water recycling.

EGJ313
Nanomaterials and Safety  [60 hours]
In this module students will be able to understand the environmental impact of nanomaterials. As the adoption of products containing nanomaterials increases there is a growing need for the evaluation of their safety. With this module, students will understand the complexity of assessing toxicity and have the skills to evaluate human and environmental risks of nanomaterials. Students will also be able to understand and follow regulatory structures. Case studies of specific nanomaterials such as nanosilver and CNTs will be used.
EGJ323
Internship Programme  [12 weeks]
This module enables students to enhance their learning by relating and applying their knowledge and skills to practise in real-life work environments. This will allow students to gain work-centred knowledge and skills, and work-related experiences. In addition, they will acquire important work values which include being responsible and positive, and exercising integrity, work ethics and interpersonal communication skills. Through this work-based experiential programme, they will be better prepared for entry into the workforce.

EGJ324
Full-Time Semestral Project  [12 weeks]
This module enables students to put into practice the knowledge and skills they have acquired from the course to develop solutions for real-life applications. Projects will be assigned to students who will work under staff supervision to develop and produce the desired project deliverables. In addition to equipping the students with technical and soft skills for project development, this module will enable students to develop problem-solving skills and instil the habit of lifelong learning to prepare them for entry into the workforce.

EGJ325
Internship Programme  [24 weeks]
This module enables students to put into practice the knowledge and skills that they have acquired from the course in real-life work environments. The students will be assigned work tasks or projects, with clear learning outcomes that are relevant to their courses and intended job roles, during the internship. The students will be guided by mentors from the industry and NYP to help them perform on the job and to achieve the learning outcomes. This will allow students to gain work-centred knowledge and skills, and work-related experiences. In addition, they will acquire important work values and ethics which include being responsible and positive, as well as taking initiative and exercising integrity. Through this work-based experiential programme, students will be better prepared for work and life.

EGJ326
Overseas Internship Programme  [24 weeks]
This module enables students to put into practice the knowledge and skills they have acquired from the course to develop solutions for real-life applications. Projects and/or jobs will be assigned to students who will work under the mentorship and supervision of experienced staff at the company premises to develop and produce the desired job and project deliverables. In addition to equipping the students with technical and soft skills for project development, this module will enable students to develop problem-solving skills, instil the habit of lifelong learning and develop a global mindset to prepare them for entry into the workforce.