

## **COURSE MODULES**

### **LEVEL 1.1**

#### **Engineering Sciences for Design 1**

This module pertains to the study of fundamentals of mechanics and applications in product design. The syllabus covers external forces in two dimensions and their effects on particles and rigid bodies at rest.

Students will learn to analyse forces acting on rigid bodies by drawing free-body diagrams and applying the conditions of static equilibrium. Topics include forces and resultants, moments and couples, equilibrium, plane friction, kinematics, and kinetics of linear motions. Applications of mechanics in product design are learnt through case studies and assignments.

#### **History & Principles of Design**

The module provides students with a historical perspective of design against the backdrop of developments in culture, art and technology. Students will learn about design movements and iconic design works. The module also covers elements and principles of design such as points, lines, planes, textures and space and the concepts of balance, proportion, symmetry and contrast. The basic product form and aesthetics are then learnt through assignments and discussions.

#### **Manufacturing Processes**

The module provides students with an understanding of common manufacturing processes. Through hands-on practice and integrated projects, students acquire knowledge of turning, milling, grinding, assembly, dimensional tolerances, joining processes, surface texture and so on. Students will take on projects involving producing parts according to design drawings and specifications given, as well as designing and producing simple products with suitable manufacturing processes. Shop floor safety is emphasised.

#### **Model Making**

In this module, students will learn about the various processes, techniques and materials used in model making. Students will apply their knowledge and improve their hands-on skills by making 3D models using materials such as foam, acrylic, paper board and wood in the workshop. Students will also pick up techniques in model finishing.

#### **Visual Thinking & Design Sketching**

The module equips students with important skills in visual thinking, design visualisation, freehand design sketching and rendering for product design. The emphasis on hands-on practice enhances students' creative thinking abilities from basic lines and two-dimensional (2D) sketches to thumbnails and three-dimensional (3D) perspective sketches. The module also provides students with an understanding of the generic product design process as well as the related tasks and attributes involved. The module also sets the context of the course by providing an overview of the curriculum.

### **LEVEL 1.2**

#### **Career & Professional Preparation I**

This module gives students a foundational introduction to their three-year diploma course curriculum and how it prepares them for industry. It will help them to embark on their three-year course with the end in mind, through guided reflection of their personal characteristics, and producing an overall game plan for their future education and career goals. The module aims to deepen students' commitment to the sector that the course prepares them for.

#### **Computer Aided Design 1**

The module equips students with the knowledge and skills in using a computer-aided design (CAD) tool to produce 3D solid and surface models as well as 2D detail and assembly drawings. Students will also learn the fundamentals, conventions and practices of engineering drawing based on the International

Standards Organisation (ISO) and Singapore Standards (SS) guidelines. Topics include 3D CAD modelling, 2D CAD drawings, orthographic projection, sectioning, dimensioning, conventional representations, assembly drawing, bill of materials and blueprint reading.

### Conceptual Design

In this module, students will apply their creativity to the first two phases of the design cycle — writing design briefs and design specifications as well as generating design concepts. They will learn to identify target user groups, define user needs, identify product markets, conduct basic market studies, generate creative design concepts, as well as evaluate and refine design concepts. They will then hone their design sketching skills and generate ideas in accordance to the design specification.

### Design Presentation & Methods

This module focuses on the presentation of design concepts and relevant details in digital media. It includes an introduction to visual communication design. Students will learn, in a practice-oriented manner, the commonly-used software programmes for visual communication design. These include image editing as well as text and graphic creation functions for logo, packaging, poster and product design presentation via digital means. Students will also deepen their understanding of the design presentation methods, principles and techniques through project work.

### Materials & Design Applications 1

The module covers the characteristics and properties of commonly used materials for products, including metals, plastics, rubber, ceramic, wood and composites. The module also includes the applications and criteria for selection and design considerations for common materials. Students acquire the knowledge and skills through lectures, discussions, case studies and projects.

## COURSE CURRICULUM

Module Name	Credit Units
<b>YEAR 1</b>	
<b>Level 1.1 (28 hours per week)</b>	
Engineering Sciences for Design 1	3
History & Principles of Design	4
Manufacturing Processes	5
Model Making	4
Visual Thinking & Design Sketching	6
Innovation Toolkit ^	4
Sports & Wellness ^	2
<b>Level 1.2 (25.5 hours per week)</b>	
Career & Professional Preparation I	1.5
Computer Aided Design 1	5
Conceptual Design	5
Design Presentation & Methods	6
Materials & Design Applications 1	4
Communication & Contemporary Issues ^	4

### Notes:

^ 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.

## **COURSE MODULES**

### **LEVEL 2.1**

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

This module equips students with skills necessary to seek and secure work. They will also be equipped to communicate their personal brand in a positive way. As students sharpen their communication skills, they will also learn how to market themselves effectively.

#### **Computer Aided Design 2**

In this follow-on module of Computer Aided Design 1, students are required to apply their knowledge and skills of computer-aided design for the design of relatively more complex parts and assemblies. Through these assignments, students acquire more advanced techniques in 3D modelling and production drawings. Topics include advanced 3D modelling, assembly analysis, limits and fits, and application of linear and geometric tolerances in CAD and drawings.

#### **Materials & Design Applications 2**

This module is a follow-on module of Materials & Design Applications 1, focusing on the selection of plastic materials and design of plastic parts for given design requirements. It also covers knowledge of the characteristics and design considerations for parts made of other materials with emphasis on their properties and applications. The module includes the topic on the principles and applications of Geometric Tolerance and Dimensioning. Students learn through projects, assignments, lectures and discussions.

#### **Product Design Studio 1**

This studio project module requires students to integrate and apply the knowledge and skills they have learnt from the various modules so far, in a design project based on a given design brief. Students are required to carry out design research, prepare design specifications, generate ideas and concepts, make mock-up models, and communicate their final design with a portfolio and presentation. There will be short lectures, case studies and assignments on topics including design research, mood board preparation, intellectual property search and studies on contemporary styles.

#### **Product Aesthetics & Ergonomics 1**

This focuses on the study of the relationships between form and function. Topics include principles and applications of aesthetics in product design, product semantics, colour theory and their applications.

Students also learn the use of computer-aided industrial design software tools and design rendering for presentations using markers. The module requires students to carry out product form and basic ergonomics studies using model making assignments.

### **LEVEL 2.2**

#### **Business & Project Management**

This module provides an overview of business organisation, functions and general management, leading to a detailed treatment of the organizational and operational aspects of project management in the context of product design and development. Topics include introduction to business organisation and management, organisation of projects, roles of the project manager, project planning, scheduling and controlling using network analysis such as Critical Path Method (CPM), Gantt Charts, and Programme Evaluation and Review Technique (PERT). The importance of concurrent or simultaneous product design and development in order to achieve short time-to-market is also emphasised.

#### **Component Design & Development**

This module covers the understanding of how the components or parts of a product influence its overall design, with studies on the layout, functions and design requirements of standard and non-standard components. Students learn the purposes, characteristics and applications of common standard components including motor, bearings, electronic circuit boards, gears and shafts; as well as how these are linked and assembled with non-standard parts such as housings, etc. Projects are used to reinforce learning along with assignments and case studies on existing products. Students also learn to prepare parts lists or bill of materials, CAD 3D and 2D detailed drawings, which are an important process in product design and development.

### Engineering Sciences for Design 2

This is a follow-on module of Engineering Sciences for Design 1 (ESD1). While ESD1 focuses on the fundamentals and design applications of mechanics, ESD2 covers the essentials of thermodynamics, fluids, mechanics and strength of materials and basics of electrical and electronic technology. These topics are discussed and analysed within the context of the basic principles and applications of product design and development, using practice-oriented learning methods.

### Furniture & Lifestyle Product Design

This module provides students with the valuable insights into designing furniture that is both aesthetically pleasing and functional for both domestic and commercial settings. Topics include trends, technologies, materials and production processes in the furniture industry. Students will learn through lectures and projects that require students to design and make furniture in the workshop. Designing of lifestyle products such as lighting, bathroom products and accessories will also be covered in this module.

### Product Aesthetics & Ergonomics 2

This module covers the principles of ergonomics (or human factors) and user-centred design, their applications in product design, the influence of these design factors in users' preference for a particular product or system, as well as codes and standards governing product safety. It also covers anthropometrics, user-centred design principles and approaches and environmental factors in the application of products. The emphasis is on research and a good understanding of the target users' needs, requirements, limitations and application in product design. The module project requires students to carry out tasks in product design, emphasising human factors and usercentred design.

### Product Design Studio 2

This is the second studio project module that requires students to integrate and apply the knowledge and skills they have learnt from the various modules so far, in a design project based on a given design brief. Students are required to carry out design research, prepare design specifications, generate ideas and concepts, make mockup models, perform detailed design with 3D CAD models and detailed drawings, and communicate the final design via a design portfolio and presentation. There will be short lectures, case studies and assignments and topics including product market segmentation and positioning, cultural and social impacts related to design, and sustainable design.

## COURSE CURRICULUM

Module Name	Credit Units
<b>YEAR 2</b>	
<b>Level 2.1 (27 hours per week)</b>	
Career & Professional Preparation II	2
Computer Aided Design 2	6
Materials & Design Application 2	4
Product Design Studio 1	6
Product Aesthetics & Ergonomics 1	7
Interdisciplinary Studies (IS) elective ^	2
<b>Level 2.2 (28 hours per week)</b>	
Business & Project Management	3
Component Design & Development	5

Engineering Sciences for Design 2	4
Furniture & Lifestyle Product Design	4
Product Aesthetics & Ergonomics 2	4
Product Design Studio 2	6
Interdisciplinary Studies (IS) elective ^	2

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**COURSE MODULES**

**LEVEL 3.1**

**Design for Manufacturability**

The module covers the principles of Concurrent Engineering, with a focus on Design for Manufacturability (DFM) and Design for Assembly (DFA). It includes the concepts and applications of the DFM and DFA methods, and also includes topics on Value Analysis, Quality Function Deployment, Failure Mode Effects and Analysis, Computer Aided Engineering and Rapid Prototyping in the context of product design and development. Students gain an appreciation of the importance of these methods in reducing manufacturing costs, enhancing product quality, reducing product development cycle time and enhancing innovation. Case studies, assignments and projects are used to enhance learning.

**Entrepreneurship & Business Plan**

This module provides students with an understanding of the nature and attributes of entrepreneurship and business planning. Through case studies, lectures, tutorials and discussions, students learn the general process and factors of how to start a business and develop it into a successful enterprise. The contents of a good business plan for starting a new business or for the expansion of an existing enterprise are learnt through case studies and assignments. Students will be required to write a feasibility plan for a product design and development project that they undertake in another module.

**Product Design Studio 3**

In this studio project module, students undertake a major individual project in designing a revolutionary product that considers future trends, avant-garde design features and application of factors in product design. Students are required to complete the product design process from the conceptualisation of the product idea to the product design, with a 3D CAD model, and drawings and documentation for production purposes. There will be guest lectures by practising designers, case studies, discussions and exercises on contemporary design topics, product innovation topics and emerging design trends.

**LEVEL 3.2**

**3-Month Internship**

The internship exposes students to the work environment as well as practices related to product design. It offers them the opportunity to apply the knowledge and skills acquired in the classroom to the real-world in areas of problem

solving, communication and interpersonal skills. The internship allows students to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work, based on the relevant code of practice.

### Capstone Project

This is a major project module in the PDI curriculum. It provides students with the opportunity to apply the knowledge and skills learnt to complete a major project. In this 12-week full-time project module, students undertake a major individual project, completing the life-cycle product design and development process that involves various phases from the conceptualisation of a product idea to product design, prototype making and testing, and finally preparation of drawings and documentation for production purposes.

## COURSE CURRICULUM

Module Name	Credit Units
<b>YEAR 3</b>	
<b>Level 3.1 (20 hours per week)</b>	
Design for Manufacturability	4
Entrepreneurship & Business Plan	3
Product Design Studio 3	9
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
<b>Level 3.2 (22 hours per week)</b>	
3-Month Internship	12
Capstone Project	10

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