

課程大綱Detailed Course Syllabus

課程說明(Course Description)

本課程主要以工業設計流程來進行運用工藝天然材質之產品開發，相較於傳統工藝內隱知識及創作面向，本課程將更注重研修者學習在設計構成的不同階段運用草圖、數位草模、3D列印草模等設計媒材來做為概念具體化之工具，並與決策者、製造協作者進行設計呈現與溝通。前述過程將透過一個以竹為主要材質的產品開發專題來實踐，選擇竹材之原因為結合全球SDGs永續趨勢、台灣竹種品質優勢與政府振興竹產業政策，以及竹材目前在減碳趨勢的討論中公認為具有消耗二氧化碳及零碳排等優點的天然材料。

本課程為探索竹材在現代生活運用的可能性與新價值，將安排一系列前置探索實驗，以重新熟悉竹材質以及與異材質物件結合的發想。此一前置實驗包括對竹體內在結構進行切削雕塑，以獲取新型態的竹元件與其物理表現，再以此階段獲取的竹元件與其他材質物件進行結合，包括五金零件、3D列印件兩類，目的在於突破竹本身材質之限制，並發揮組構作用。具體設計主題目前設定為單車、露營蔽體、傢俱、生活產品等四大方向。應用材料型態包括不同加工程度之竹筒、竹條、竹組織及竹集成材，最終設計以比例模型表現，模型材質為縮小比例之竹材或3D列印件。課程實作上與台灣工藝研究發展中心合作，在材料、數位加工、工藝技法上得到相關竹產業、竹藝師之資源。

教學方式(Teaching Method)

考量到主要研修對象為大一學生，課程中將配合前置探索階段，教同學使用入門程度的數位草圖繪製(Concept Apps)、數位建模(Rhino 3D)與 FDM 3D 列印技術操作，教師會實際操作示範，並指定練習或運用在探索過程中。

前置探索過程分為三階段，包括：

- 1.竹內在結構的雕塑和探索：透過規劃切削、銑床、研磨等加工程序去雕塑現有的竹材料中空結構，並形成特別的型態和物理屬性。考量同學操作加工機器能力之限制，本階段以數位模型模擬與3D列印模型替代。
- 2.探討竹與外在物件的結合：五金零件部分包括各類建築機械五金或現成物件，如螺絲、束帶、彈簧、鋼絲等等，思考竹材料如何透過五金零件達到組構之目的。3D列印件則提供同學更多自主設計發揮空間及自由度，如形成特殊結構或角度來固定竹管或竹材料。
- 3.發展具體產品設計：同學將運用前述摸索階段得到的零件或組構方式，運用在產品設計，主題為單車、露營蔽體、傢俱、生活產品等四大方向。

在各階段的課程中，將包括兩部分，1.講解相關案例以及 2.必要的設計輔助工具操作，同時同學需發表前一週課程中發展設計的過程或結果。

教學進度(Syllabus)

第1週 課程概述：竹材料在當前永續設計趨勢的角色、各地運用現況以及台灣竹材資源優勢。

竹內在結構的雕塑和探索案例介紹/草圖繪製工具教授

第2週 竹內在結構的雕塑和探索/Rhino 數位建模-形狀繪製、擠出實體、與竹體布林切削

第3週 竹內在結構的雕塑和探索/竹體設計提案/切片與FDM 3D 列印

- 第4週 竹內在結構的雕塑和探索/提出十種竹體雕塑，以3D列印呈現
- 第5週 竹與既有五金零件結合/案例介紹、五金零件收集、功能分析與可能應用
- 第6週 竹與既有五金零件結合/竹體與五金零件組合運用之設計，以數位模型呈現
- 第7週 竹與既有五金零件結合/3D列印竹體與五金零件組裝/提出十種組裝設計
- 第8週 竹與3D列印件結合/Rhino 數位建模進階-實體物件構成零件指令
- 第9週 竹與3D列印件結合/3D列印件設計/Rhino 數位建模進階-實體物件構成零件指令
- 第10週 竹與3D列印件結合/3D列印件設計
- 第11週 竹與3D列印件結合 /3D列印竹體與列印件組裝/提出十種組裝設計
- 第12週 竹產品設計開發-整合前置階段成果的草圖概念提出
- 第13週 竹產品設計開發-草圖概念細節與定案
- 第14週 竹產品設計開發-數位草模
- 第15週 設計討論與模型製作
- 第16週 模型製作
- 第17週 最終發表

以上階段以運用草圖、數位模型以及3D列印模型作為呈現過程之產出。

成績考核

本課程各週皆有作業進度，老師會運用FB社群管理，同學需開設自己的作業相本並上傳作業圖片、照片，90%的分數由各週作業來決定，10%為出席率，沒有期中期末考。

相關網頁

<https://www.pinterest.jp/jianyouli58/bamboo-structure/>

Detailed Course Syllabus

• Course Description

This course is developing product design with natural/crafts material through industrial design method. Comparing the tacit knowledge and inheritance of traditional crafts, this course will more focus on how the students can apply sketch, digital model and 3D printed model to express their concepts in the different stages of design development, and communicate with decision makers and collaborators. Above process will be operated under a design topic based on bamboo material. Bamboo matches the SDGs trend and current Taiwan government policy, and Taiwan bamboo species are famous by their quality.

For discovering the bamboo's new value and possible applications in the modern life, a series of material exploration are arranged for students to study the bamboo material and combination with other materials or objects. First exploration is applying cutting and milling bamboo to extract the internal structure, and create new form and mechanical property. Based on the previous stage, the second exploration is focus on the combination with other objects, include existing architectural/mechanical hardware and 3D printed components. Through applying these objects, bamboo can be assembled and comprised for archiving specific design purpose. In the last stage, students can applying their discoveries from structure engraving and combining with external objects to develop into a product, the product themes include bicycle, camping pavilion, furniture and life product. The product prototype in the final presentation is 1/4 or 1/5 scaled model made with bamboo or 3D printed parts. National Taiwan Crafts Research and Development Institute supports this course for bamboo offering and craft technique.

- Teaching Method

Considering the course is for freshman, some beginning design aid tools will taught, such as sketching Apps(Concepts on iPad), digital modeling software(Rhinoceros 3D) and FDM 3D printing, instructor will demonstrate these tools on the course for different requirements in the design process.

As the course description, the material exploration include 3 stages,

1. Sculpture of bamboo internal structure : Considering freshman's limited manufacturing skill, the design work in this stage will use digital/3D printed models for alternative media.
2. Combination with existing objects: The mentioned hardware include cable tie, screws, springs, wire, etc, the parts are low cost and available . 3D printed objects offer more design freedom, students can design new parts to fix bamboo tubes or pieces.
3. Product design: Based on the above object designs, student can develop designs of bicycle, camping pavilion, furniture and life product.

All classes are consist of two parts, related case introduction and design aid tool tutorial, and students need present the work of last week.

- Syllabus

1. Wk 01: 1. Course Overview : Bamboo in the sustainability design, Bamboo in Taiwan. 2. Sculpture of bamboo internal structure 3. Sketching Apps tutorial.
2. Wk 02: Sculpture of bamboo internal structure/Basic Rhino skills-shape drawing, extrude and boolean.
3. Wk 03: Sculpture of bamboo internal structure, ideas of bamboo sculpture/ FDM 3D printing and slicer software.
4. Wk 04: Sculpture of bamboo internal structure, present 3D printed bamboo sculptures.
5. Wk 05: Combination with existing hardware parts-cases study, hardwares intro, function analyze and shift.
6. Wk 06: Combination with existing hardware parts-Bamboo assembly design by digital modeling.
7. Wk 07: Combination with existing hardware parts-Bamboo assembly design by 3D printed models.
8. Wk 08: Combination with 3D printed parts- advanced Rhino skills by solid modeling.
9. Wk 09: Combination with 3D printed parts- advanced Rhino skills by solid modeling.
10. Wk 10: Combination with 3D printed parts- 3D printed part design by digital models.
11. Wk 11: Combination with 3D printed parts- 10 assembly designs of 3D printed part and bamboo.
12. Wk 12: Product design-Concept design based on material exploration.
13. Wk 13: Product design-Design concept details.
14. Wk 14: Product design-presentation by digital model.
15. Wk 15: Product design-design discussion and prototype making.
16. Wk 16: Product design-prototype making.
17. Wk 17: Final presentation.

- Evaluation

90% - weekly presentation, 10%-attendance.

- Referenced material

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