

Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year (New format)	AY2026-2027
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1 Semester 2
Course Author * Faculty proposing/revising the course	Ho Shen Yong
Course Author Email	hosy@ntu.edu.sg
Course Title	Making and Tinkering (Lite 1)
Course Code	PS5886
Academic Units	1
Contact Hours	24
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

The course aims to equip you with basic technological awareness, particularly computer- controlled electronics and 3D printing, and hands-on skills required for building basic equipment and products related to Science and Technology. Through this course, you will develop creativity as you are encouraged to explore different approaches to a given problem, and resilience when facing the need to acquire new technological skills in a limited time in order to solve a given problem.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	solve a given simple problem by applying the knowledge and skills associated with a. basic electrical works, b. computer-controlled electronics and c. 3D printing
ILO 2	use programming logic to control basic electronic components;
ILO 3	use a 3D drawing software to create 3d objects made up of two or more distinct parts and to create assemblies of well-tolerant 3d components;
ILO 4	operate a 3D printer, do a simple 3D print job and perform basic trouble shooting;
ILO 5	apply the design-thinking framework, together with the skills acquired to create a simple functional prototype.

Course Content

Electrical Workshop (EW)

Workshop Safety

Soldering and Basic circuit design

Computer Controlled Electronics

Micro-controller basics

Introduction to Arduinos and Arduinos programming

Introduction to other computer-controlled electronics systems

Digital Input / Output

Analog Input

Analog to digital conversion

Pulse Width Modulation

Types of motors, LED and sensors

Arduino Shields

3D Printing (3DP)

Theory and History of 3D Printing

3D printing technology

Sketching using 3D design software

Post processing techniques

Project (PROJ)

Project that involves building a physical object or solving a problem using 3D printing and computer-controlled electronics. Instructor will help suggest possible topics.

Reading and References (if applicable)

1. Autodesk Fusion 360: <http://www.autodesk.com/products/fusion-360>
2. Arduino IDE - <https://www.arduino.cc/en/Guide/Environment>
3. Arduino tutorial for beginners - <http://forefront.io/a/beginners-guide-to-arduino/>

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Introduction and Safety; Design-thinking workshop	1 - 5	In-person	Briefing, Simple Quiz and Demonstrations	
2	Safety and Basic Electronics Batch 1	1 - 2	In-person	Lesson, Hands-on for basic electrical works including soldering	
3	Safety and Basic Electronics Batch 2	1-2	In-person	Lesson, Hands-on for basic electrical works including soldering	
4	Basic 3D printing	3 - 4	In-person	Lesson, Use a 3D drawing software to create 3d objects, 3D printing	
5	Basic Computer-controlled Electronics	1, 2	In-person	Lesson, Basic programming for controlling electronic components	
6	Advance options: Either Advance 3D printing or Advance Computer-controlled Electronics	1 - 4	In-person	Lesson, Managing complex geometries and designing multi-part 3D projects or Sensors; controlling systems with different types of inputs	
7	Hands-on project 1	All	In-person	Create Functional Prototype using acquired skills	
8	Hands-on project 2 and Presentation (Course will end on week 8)	All	In-person	Create Functional Prototype using acquired skills; short presentation of project	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Master-Apprentice	Develop competence in 3D printing, computer-controlled electronics and basic electrical works. The instructor will provide feedback to you on their work each session. This will also help develop perseverance and resilience as you will have to improve continually until the desired quality of work is achieved.
Pair Work (Hands-on)	Develop communication skills while doing collaborative learning. You also have an opportunity to work as a team and do group presentation.
Project	Develop physical intuition and competence in solving scientific / technological problems. The designing of a solution to an open-ended problem also allow you to be creative.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Others(Continuous Assessment)	All		100	In the rubrics above, there is a list of tasks that the students will be have to demonstrate competency. Students will be assessed on the quality of the the completed task.	Individual	Analytic	Extended Abstract

Description of Assessment Components (if applicable)

In the rubrics above, there is a list of tasks that the students will be have to demonstrate competency. Students will be assessed on the quality of the the completed task.

Formative Feedback

At the end of teaching each topic / skill, the students will be given time to complete a given task. After that, the instructor will assess students on your understanding and feedback to the quality of your work. You will have to make improvements until satisfaction before the instructor will sign on the checklist for you. (See Appendix 01C)

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Project Management	Intermediate
Critical Thinking	Intermediate
Design Thinking	Intermediate
Systems Thinking	Intermediate
Embrace Challenge	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

NIL

Policy (Absenteeism)

Absence Due to Medical or Other Reasons

If you are sick and unable to attend your class, you have to:

1. Send an email to the instructor regarding the absence and request for a replacement class.
2. Submit the original Medical Certificate* to administrator.
3. Attend the assigned replacement class (subject to availability).

* The medical certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email)

about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

Appendix 1

Name: _____

Sample Learning Outcome Checklist page 1 (Items will vary according to the hardware used)

		Rating*	Sign / Date
	3D Printing [Individual]	1 2 3 4 5	
1 .	Basic overall knowledge about 3D printing and applications (Quiz)		
2 .	Able to use a 3D drawing software:		
	to sketch, scale, position basic 2d sketches		
	to sketch, scale, position basic geometrical 3d objects		
	to combine 2 or more geometrical 3d objects into complex objects		
	to create assemblies of well-tolerant 3d components		
3 .	Basic understanding of settings/parameters for 3d printing:		
	Layer Height and Resolution		
	Optimizing Orientation and Strength		
	Overhangs and Supports		
	Generation of 3D Print File from STL File		
4 .	Post processing		
	Combining separate parts into single piece		
	Surface finishing techniques		
	Paint or colour application		
	Part duplication		
5 .	Basic troubleshooting skills		
	Adjustments to increase load strength		
	Adjustments to improve print quality		
	Adjustments to reduce print time		

	Computer Controlled Electronics [Individual / Pair]		
1	Arduino programming language		
	if/then/else, while/for, setup/loop		
	DigitalWrite, AnalogWrite, DigitalRead, AnalogRead, delay		
	Debugging using Serial I/O		
2	Digital input/output		
	Able to control LED lights (turn on/off, to blink, to light up in a certain sequence)		
3	Analog input		
	Measure distance with ultrasonic sensor		
4	Pulse Width Modulation (PWM)		
	Working with photoresistor and control LED brightness		
	Control speed of motor		

* 5 – Done perfectly; 4 – Done a very good job but still have some room for improvement; 3 – Completed the job but some improvements can be made; 2 – Completed the job but some major improvements can be made; 1 – Unsatisfactory;

Name: _____

Learning Outcome Checklist page 2

		Rating*	Sign / Date
		1 2 3 4 5	
	Electronics Workshop [Individual]		
1	Demonstrate understanding and awareness of safety in an electronics workshop.		
2	To be able to assembly electrical components.		
3	To be able to test and trouble system of assembled components.		
4	Demonstrate understanding of the functionalities of circuit design and simulation software.		
5	Demonstrate understanding of the functionalities and basic operational principles of PCB machine.		
	Project		
	Project Presentation		

* 5 – Done perfectly; 4 – Done a very good job but still have some room for improvement; 3 – Completed the job but some improvements can be made; 2 – Completed the job but some major improvements can be made; 1 – Unsatisfactory;