

COURSE OUTLINE

Academic Year	AY2022	Semester	Summer
Course Coordinator	Professor Yeong Wai Yee		
Course Code	MA5031		
Course Title	3D Printing and Additive Manufacturing: Principles and Applications		
Pre-requisites	-		
No of AUs	3		
Contact Hours	Lectures: 39 hours		
Proposal Date	Summer 2023		

Course Aims

This course aims to provide a general understanding of Additive Manufacturing or 3D Printing as it is more commonly known. It starts with an introduction and the importance of 3D Printing and describes the process chain.

The course will equip you with all the 3D printing systems and technologies, their pros and cons. It will also cover the file format used in 3D printers. More importantly, a comprehensive range of applications and case studies will be covered. Finally, benchmarking, growth and trends will be described. You will go through a lab session to see 3D printer systems and understand the working principles as well as applications of these systems.

Intended Learning Outcomes (ILO)

Upon the successful completion of the course, you would be able to:

- 1) Summarize and describe the motivation behind 3D Printing or Additive Manufacturing, basic concepts and process chain.
- 2) Describe and illustrate key 3D printing processes
- 3) Identify, compare and evaluate the strengths and limitations of the various techniques of 3DP or AM.
- 4) Classify the file format, and describe the basics and trends of file format in 3D Printing.
- 5) Identify the applications in Design, Engineering and Manufacturing
- 6) Examine real case studies in aerospace, automotive, fashion, weapon, food, biomedical, movie, building and construction.
- 7) Discuss and analyse benchmarking, growth and trends of 3DP/AM.

Course Content

	Topic	Hours
1.	Introduction The historical development, advantages and fundamentals of 3D Printing	2
2.	Process Chain	2

	Fundamental automated processes, 3D modelling, data conversion and transmission, building and postprocessing	
3.	Liquid Based 3D Printing Systems Systems covered include Stereolithography Apparatus, Polyjet, DLP, Bioprinting	5
4.	Solid Based 3D Printing Systems Systems covered include Fused Deposition Modelling, Selective Deposition Lamination and Laminated Object Manufacturing	5
5.	Powder Based 3D Printing Systems Systems covered include Selective Laser Sintering, Electron Beam Melting and Selective Laser Melting	5
6.	STL File Format Description, Problems and Solutions of Additive Manufacturing Data Formats	2
7.	Applications and Case Studies Applications and case studies relevant to industries such as: - Automotive and aerospace - Weapons and construction - Bioengineering and Medicine	3
8.	Benchmarking, Growth and Trends Benchmarking and growth, and future development trends	3
9.	Lab exercises Computer exercises to recap understanding on 3D printing	4
10.	Workshop Demonstration and workshop for 5 different 3D printing equipment	5

**Assessments (Quiz & Presentation) will be conducted over 3 lecture hours.*

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Continuous Assessment 1: Quiz	1-3	a, b, c, d, e,	25%	Individual	
2. Continuous Assessment 2: Presentation	4-7	b, c, e, f, i, j, l	25%	Individual	
3. Final Examination (Closed Book; 2 hrs)	1-7	a, b, c, d, e, f, j, l	50%	Individual	
Total			100%		

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Course Instructors

Instructor	Office Location	Phone	Email
Prof Yeong Wai Yee			WYYeong@ntu.edu.sg

Planned Weekly Schedule – Special Term II

Week	Topic	Course ILO	Readings/ Activities
1	Introduction and process chain of 3D Printing	1,2,5	Lecture, Lab tour
2	liquid-based process Solid-based and powder-based processes	2,3,	Lecture , CA 1
3	Lab session and 3d Printing workshop, benchmarking of 3D Printing	1-4, 7	Lab session and workshop
4	Data format, applications and future trends of 3D Printing	4,5,6,7	Lectures , CA 2