

**NANYANG TECHNOLOGICAL UNIVERSITY****SEMESTER 2 EXAMINATION 2023-2024****MA6502 – FUNDAMENTALS & ADVANCES IN ADDITIVE MANUFACTURING**

April/May 2024

Time Allowed: 3 hours

**INSTRUCTIONS**

1. This paper contains **FOUR (4)** questions and comprises **TWO (2)** pages.
  2. **COMPULSORY** to answer **ALL** questions.
  3. Marks for each question are as indicated.
  4. This is a **CLOSED-BOOK** examination.
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1. (a) Discuss **THREE (3)** key advantages how 3D printing enables agility in manufacturing. (6 marks)
- (b) A medical company decided to use Electron Beam Melting (EBM) to fabricate metal implants. Explain what is the main motivation of selecting EBM for implant manufacturing over other 3D printing technologies. (5 marks)
- (c) Discuss **TWO (2)** limitations of Electron Beam Melting (EBM) process. (4 marks)
- (d) Explain the Selective Laser Melting (SLM) process. Include a figure to aid your explanation. (10 marks)
2. (a) Name **THREE (3)** factors that influence the flowability of powder in powder-bed fusion processes. Explain how each factor influences powder flowability. (6 marks)
- (b) Explain the process of powder-based Laser Metal Deposition (LMD) technology. Include a figure to aid your explanation. (10 marks)
- (c) Name **THREE (3)** unique advantages of Direct Energy Deposition (DED) techniques compared to Powder-Bed Fusion (PBF) techniques. (9 marks)

3. (a) STL file encodes the surface geometry of an object using “tessellation.” Explain what is chord height. (4 marks)
- (b) State the relationship between chord height and smoothness of surface. Include a figure to aid your explanation. (5 marks)
- (c) What are the advantages of Selective Deposition Lamination (**SDL**)? Discuss THREE (3) advantages. (6 marks)
- (d) Explain the process of printing a metal part using Binder Jet Printing technique. Use a figure to aid your explanation. (10 marks)
4. (a) You are tasked to produce a prototype of biomedical model which contains multi-colours, multi-materials and transparent design feature. Recommend a suitable 3D printing process and explain this fabrication process. Include a figure of this process. (9 marks)
- (b) Name TWO (2) limitations of this process. (4 marks)
- (c) Briefly explain the process of 3D printing of concrete using robotic arm printing. (6 marks)
- (d) Write THREE (3) advantages of concrete printing. (6 marks)

END OF PAPER



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Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.