



First Semester Examination
2022/2023 Academic Session

February 2023

EPE441 – Micro and Nano Manufacturing Engineering
(Kejuruteraan Pembuatan Mikro dan Nano)

Duration: 3 hours
(Masa: 3 Jam)

Please check that this examination paper consists of FOUR (4) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi EMPAT (4) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer ALL **FIVE (5)** questions.

Arahan: Jawab **LIMA (5)** soalan]

1. (a) State a difference between Science, Engineering and Technology at micro/nano scales. Give **ONE (1)** example for each of them.

(30 marks)

(b) In modeling atomic structures in Molecular Dynamics simulation, identifying potential between atoms, energy minimization and equilibrium processes are three important parameters or steps.

(i) Sketch and briefly describe a general pattern of Lennard-Jones Potential graph.

(20 marks)

(ii) Sketch and briefly explain a general energy minimization graph

(20 marks)

(iii) Sketch and briefly explain a general equilibrium graph for Conical Ensemble (NVT) and Isothermal- Isobaric Ensemble (NPT) simulations

(30 marks)

2. (a) Choose **ONE (1)** micro or nano-scale product and describe the complete fabrication process flow of the chosen product.

(70 marks)

(b) Describe **THREE (3)** differences between Liquid Crystal Display (LCD) and Light Emitting Diode (LED) Display.

(30 marks)

3. (a) A company that is specialized in biomedicine found out that a surface with certain topographic can repel virus adhesion. The company wants you to fabricate the hard mold (Figure Q3 [a]) that can be used to replicate the surface. Construct a complete fabrication process flow for producing this mold and the replication method using PDMS as elastomer.



Figure Q3 [a]

(60 marks)

(b) Explain a difference between bottom-up fabrication and top-down fabrication. Give **ONE (1)** example for each method.

(40 marks)

4. (a) Choose **ONE (1)** of the topics listed below and compose your thoughts about **TWO (2)** ethical issues and **TWO (2)** values in the selected topic.

- (i) Genetically Engineered (GE) or Genetically Modified (GM) Foods,
- (ii). Nanoparticles or
- (iii). Human Cloning

(40 marks)

(b) "Neuralink is Elon Musk's neural-interface-technology company. It's developing a device that would be embedded in a person's brain, where it would record brain activity and potentially stimulate it. The chip Neuralink is developing is about the size of a coin and would be embedded in a person's skull. From the chip, an array of tiny wires, each roughly 20 times thinner than a human hair, fan out into the patient's brain. Elon Musk has compared the technology to a "FitBit in your skull." (Notes: FitBit is a brand for smartwatches).

Figure Q4 (b) shows how the Neurolink chip will be embedded in the human brain. Please elaborate **THREE (3)** ethical issues that could be raised with the Neurolink device mentioned above.

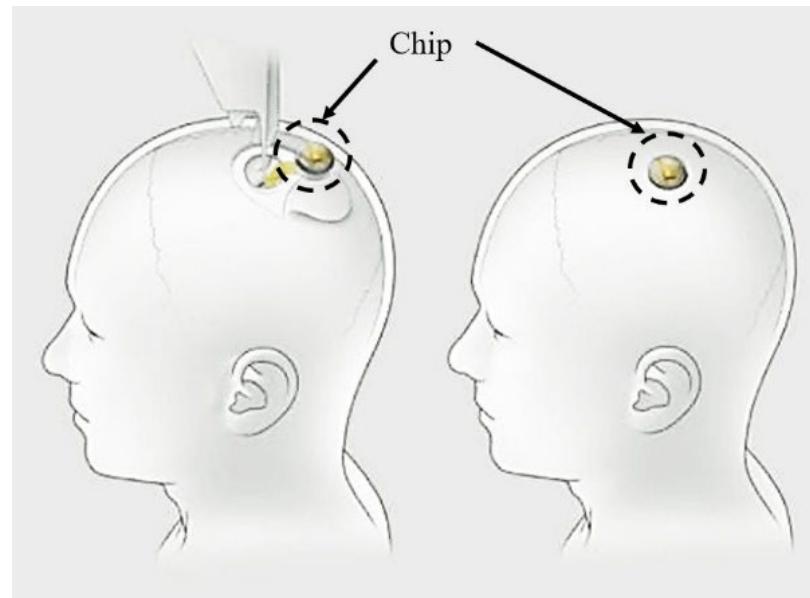


Figure Q4 (b)
(60 marks)

5. (a) Sales of semiconductor in second quarter of 2021 is increase by 29% and in third quarter of 2021, the sale is 28% higher than corresponding quarter in the year 2020. The recent COVID19 pandemic caused severe global chip shortage around the world. Suggest, **THREE (3)** methods on how Micro/Nanomanufacturing industries can increase their productivity in the future.

(60 marks)

(b) Explain **TWO (2)** roles of nanotechnology in future Green Technology. Give relevant examples in any industry.

(40 marks)

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