



Study Programme	: Bachelor of Science Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: DMX6306 Micro/ Nano Electromechanical Systems
Academic Year	: 2024/25
Date	: 12 th March 2026
Time	: 0930 hours -1230 hours
Duration	: 3 hours

General instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **Five (05)** questions and answers all questions.
 3. The answer to each question should commence from a new page.
 4. This is a Closed Book Test (**CBT**).
 5. Answers should be in clear handwriting.
 6. Do not use Red colour pen.
 7. Write the name of the question paper with the course code on the first page of the answer book.
 8. Write your index number (not the registration number) on every page of your answer book.
 9. Write at the bottom of the first page of your answer book clearly the question numbers you answered.
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| 01 | i | Briefly explain the photolithography process including its basic steps, different types, and resolution characteristics. | 06 marks |
| | ii | Differentiate the isotropic and anisotropic wet etching of silicon materials. | 04 marks |
| | iii | a) Explain the different types of Chemical Vapor Deposition (CVD) processes used in microfabrication. | 05 marks |
| | | b) Discuss the temperature requirements, advantages, and typical applications in CVD. | 05 marks |
| 02 | i | a) Describe the Deep Reactive Ion Etching (DRIE) process and its importance in silicon micromachining. | 05 marks |
| | | b) Compare the two major DRIE approaches. | 04 marks |
| | ii | a) Briefly explain the polysilicon surface micromachining process, including its advantages and challenges. | 04 marks |
| | | b) How does polysilicon surface micromachining differ from bulk micromachining? | 03 marks |
| | iii | Describe the Physical Vapor Deposition (PVD) techniques used in microfabrication. | 04 marks |
| 03 | i | a) Differentiate between PMMA and SU-8 as thick-film photoresists used in microfabrication. | 04 marks |
| | | b) Discuss the advantages and limitations of each material. | 06 marks |
| | ii | Provide a comparison of injection molding and hot embossing as replication methods for polymeric microdevices. | 05 marks |
| | iii | Explain the soft lithography technique, with particular emphasis on PDMS as the elastomeric material. | 05 marks |
| 04 | i | Discuss the applications of PDMS materials in microfluidic device prototyping. | 04 marks |
| | ii | a) Explain polymeric surface micromachining as a micro fabrication technique. | 04 marks |
| | | b) What are the different types of materials used in structural layers in micro fabrication techniques? | 03 marks |
| | iii | a) Briefly explain the importance of packaging in MEMS devices. | 04 marks |
| | | b) Discuss the unique challenges that differentiate MEMS packaging from traditional IC packaging. | 05 marks |
| 05 | i | Briefly explain the working mechanism of photothermal actuators. | 05 marks |
| | ii | Compare electrostatic actuation approaches used in MEMS and NEMS devices with highlighting the scaling challenges. | 06 marks |
| | iii | a) Explain the working principles of piezoelectric actuation in NEMS. | 04 marks |
| | | b) Why is the d_{31} coupling mode is commonly used in piezoelectric actuation? | 05 marks |

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