The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

00034

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	:	2023/24
Date	:	19th March 2025
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.

01	i	a) What do you understand by MEMS?	*03 marks*
		b) Give examples of commonly used MEMS devices in smart mobile.	*03 marks*
	ii	What is the main limitation to successful application of MEMS?	*03 marks*
	iii	Differentiate between the bulk and surface micromachining.	*03 marks*
	iv	A slender silicon beam is under longitudinal tensile stress. The force is **1mN**, and the cross-sectional area is **20µm** by **1µm**.The Young's modulus in the longitudinal direction is **120 GPa**. a) Find the relative elongation of the beam (percentage). b) What is the force necessary to fracture the beam if the fracture strain of silicon is **0.3%?**	*08 marks*
02	i	Microelectronic devices may be subjected to hostile environments, such as high temperature, humidity, and vibration, as well as physical abuse, such as being dropped onto a hard surface. Describe your thoughts on how you would go about testing these devices for their endurance under these conditions.	*06 marks*
	ii	Explain the role of microfabrication in MEMS technology.	*04 marks*
	iii	Why is MEMS technology important in biomedical devices?	*05 marks*
	iv	Describe how a MEMS pressure sensor works.	*05 marks*
03	i	(a) State the types of NEMS based materials.	*04 marks*
		(b) Identify the significance of NEMS based materials.	*03 marks*
	ii	Briefly explain the Sol-Gel deposition process in NEMS fabrication.	*05 marks*
	iii	(a) What are the types of actuation methods of NEMS systems?	*03 marks*
		(b) Briefly explain two of them.	*05 marks*
04		Write short notes on the following based on NEMS Materials. (a) Carbon Nanotubes (b) Fullerenes (c) Quantum Dots, Films (d) Nanowires	*4 x 05 marks*
05	i	Explain the two types of vapor deposition techniques.	*05 marks*
	ii	What is self-assembly in nanofabrication?	*03 marks*
	iii	Briefly explain the Free-Space optic techniques.	*04 marks*
	iv	Describe the three key issues when evaluating the effectiveness of a NEMS based electromechanical transducer.	*03 marks* *05 marks*

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