



FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2019/2020 ACADEMIC SESSION

COURSE: MCE 517: MICRO-ELECTROMECHANICAL SYSTEMS

TIME ALLOWED: 2 HOURS

CREDIT UNIT: 2

LEVEL: 500

Instruction: Answer two Questions from each section.

All questions carry equal mark.

SECTION A

QUESTION ONE

- Whats are Micro-ElectroMechanical Systems, (MEMS)?[3marks]
- As a student of Mechatronics Engineering department who has been introduced to a course titled Micro-Electromechanical Systems, kindly state some major challenges facing the MEMS industries, also MEMS categories and its areas of application. [6 marks]
- Why is Silicon the most widely used substrate material for Micro-systems and MEMS productions. [6 marks]

QUESTION TWO

- Discuss the Bulk micro machining technique in the details with suitable examples and illustration of diagram.[6 marks]
- Highlights the benefits of using Micro-Electromechanical systems.[2 marks]
- Which problems do you see when removing the sacrificial layers, and how can the problems be avoided? [2 marks]
- What is Chemical Vapour Deposition, (CVD)? What are the parameters that significantly influence the rate of CVD.[5 marks]

QUESTION THREE

- Discuss the surface micro-machining technique in details with illustration of diagram.[6 marks]
- Explain the basic fabrication process used in MEMS industry.[4 marks]
- Highlight five (5) comparison of microelectronics and micro-systems.[3 marks]
- What are the different wafer bonding techniques.[2 marks]

SECTION B

QUESTION FOUR [15 marks]

- a) State the most critical factor of the successful commercialization of micro scale products. **[1 mark]**
- b) List the processes involved in packaging of micro-systems. **[3 marks]**
- c) Describe the term Micro-assembly and list 4 major reasons for high cost of micro-assembly. **[4marks]**
- d) Mention the different sealing techniques available for MEMS and micro-systems. **[4 marks]**
- e) Enumerate between isomorphic scaling and allometric scaling. **[3 marks]**

QUESTION FIVE [15 marks]

- a. List the different micro-manufacturing techniques you know. **[3 marks]**
- b. Differentiate between wet and dry etching and mention two substrates that can be etched during bulk manufacturing. **[4 marks]**
- c. Compare wet etching to dry etching using parameters such as: Operational parameters, environmental impact, production automation, Materials to be etched and equipment cost. **[4 marks]**
- d. What do you think is the major factor behind miniaturization of machines and devices over time and what must an engineer first pay attention to in the design of MEMS and micro-systems? **[4 marks]**