Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	MICROFABRICATION
COURSE CODE	:	BEJ43203
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) A crucial step in the micro and nanofabrication process is photolithography.

(i) Give a brief definition of "photolithography." Provide support for your answer with a suitable diagram.

(6 marks)

(ii) State **TWO (2)** main photolithography equipment and explain their role in photolithography process.

(6 marks)

(iii) Photolithography process relies significantly on the performance of the photoresist in transferring the pattern from the mask onto the wafer substrate. Identify **THREE (3)** main photoresist performance factors.

(3 marks)

(b) Chemical Vapour Deposition (CVD) is one of the techniques for thin film deposition process.

(i) Determine the advantages and disadvantages of CVD. Summarize your answer in table.

(4 marks)

(ii) With the aid of relevant diagram, outline the aluminium sputtering deposition process.

(6 marks)

Q2 Doping is a process where an exact amount of impurities/dopant atoms is introduced into the semiconductor material under specific process conditions.

(a) Differentiate between doping techniques namely, ion implantation and diffusion process. Support your answers with aid of diagram.

(7 marks)

(b) Explain the mechanism of the diffusion technique using an appropriate diagram.

(6 marks)

(c) As a researcher, you must create an experimental process with the aim to fabricate an n-tub in a CMOS device.

(i) Propose the best method to accomplish your goal in **Q2(c)** and illustrate the doping profile for the method you choose.

(7 marks)

(ii) Analyze **TWO (2)** limitations of your chosen method in **Q2(c)(i)**.

(5 marks)

Q3 In microfabrication, one of the primary methods for realizing the design from mask onto silicon wafers is etching. Etching is a process that removes materials from the wafer surface to achieve the design requirement.

(a) Name **TWO (2)** etching process types.

(3 marks)

(b) Distinguish the concepts of selectivity, isotropic etch and anisotropic etch.

(6 marks)

(c) Describe how the etching rate is calculated.

(3 marks)

(d) Polysilicon was etched at a rate of 0.5 nm/s in chlorine plasma. If the polysilicon's initial thickness was 500 nm, examine its thickness following etching, considering that the etching procedure took only a minute to complete.

(6 marks)

(e) Copper (I) Oxide (Cu_2O) thin film was fabricated using electrodeposition method with initial thickness of 500 nm. After one minute etch, the thickness was reduced to 200 nm. Analyze the etch rate of the Cu_2O thin film.

(7 marks)

Q4 (a) "Metallization" is a process of adding layers of metal on the surface of wafers.

(i) Determine **THREE (3)** metal characteristics for the metallization process. Give a brief explanation.

(6 marks)

(ii) List **TWO (2)** types of metals that are good conductors.

(3 marks)

(iii) Your supervisor gave you the assignment to deposit a metal electrode. Choose the finest metal to use as your electrode. Create an instrument diagram that corresponds to your experimental process and use it to explain the step-by-step of experimental procedure.

(6 marks)

(b) Your final year project assignment requires you to investigate the topological characteristics of your sample.

(i) Propose **ONE (1)** method to quantify the samples's surface roughness.
(2 marks)

(ii) Predict the possible outcome of the measurement in **Q4(b)(i).**
(2 marks)

(iii) Give a brief explanation of the method suggested in part **Q4(b)(i)** with the aid of diagram.
(6 marks)

- END OF QUESTIONS -