UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	MICROFABRICATION
COURSE CODE	:	BEJ 43203
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **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

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Q1 (a) (i) Define *photolithography*.

(2 marks)

(ii) Photolithography is a center element of the wafer fabrication process. As a research student list **FIVE (5)** basic steps of the lithography process.

(5 marks)

(b) (i) Identify **TWO (2)** types of photoresist used in photolithography process. State the differences between these two types of photoresists and summarize in table.

(5 marks)

(ii) As a student, you received a task to fabricate a pattern shown in **Figure Q1(b)(ii)**. Design a suitable mask by using one of the photoresists in part **Q1(b)(i)**.

(6 marks)

(iii) Discuss the reason for your mask design in **Q1(b)(ii)**.

(3 marks)

(c) Analyse **TWO (2)** parameters that affect the thickness during photolithography process.

(4 marks)

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

(i) Analyse **TWO (2)** atomic diffusion mechanism in a two-dimensional lattice and explain clearly using approriate diagram.

(8 marks)

(ii) Explain **TWO (2)** types of of boundary conditions for diffusion process with the aid of schematic diagram.

(8 marks)

(iii) Analyse **TWO (2)** factors that influence diffusion.

(4 marks)

(b) (i) Other than diffusion, give **ONE (1)** technique to execute the doping process.

(2 marks)

(ii) As a research student, examine **THREE (3)** methods that can minimize the ion channeling effect.

(3 marks)

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Q3 (a) (i) Briefly explain etching process.

(3 marks)

(ii) Identify and explain **TWO (2)** kind of etching processes.

(4 marks)

(iii) Analyse the differences between wet and dry etching.

(4 marks)

(b) For a 0.25 μm IC chip, the polysilicon film thickness before etch process is 3000 Å and after etching process, the thickness reduces to 2789Å. Calculate the etch rate for poly-silicon film if time taken to etch it about 30 sec.

(7 marks)

(c) Zinc Oxide (ZnO) was deposited on Si wafer. Calculate the selectivity if the etching rate of CuO and Si is 600 Å/min and 30 Å/min, respectively.

(7 marks)

Q4 (a) As your project task, you need to deposit Aluminium (Al) electrode on Si device. You need to consider several steps below:

(i) Propose an appropriate technique to deposit Aluminium.

(3 marks)

(ii) Explain step-by-step of the process flow with the aid of apparatus diagram.

(6 marks)

(iii) Analyse **TWO (2)** advantages of the selected method in **Q4(a)(i)** compared with the other techniques.

(6 marks)

(b) As a researcher, you need to measure the thickness of Silicon dioxide film.

(i) Propose **TWO (2)** methods to measure the thickness.

(4 marks)

(i) Analyse which one in part **Q4(b)(i)** used optical concept and briefly explain about the method properties.

(6 marks)

- END OF QUESTIONS -

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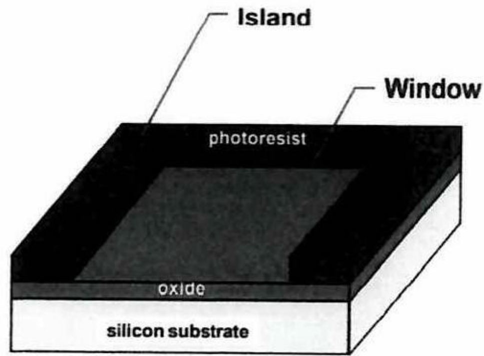

Figure Q1(b)(ii)

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