UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	MICROFABRICATION
COURSE CODE	:	BED 40603
PROGRAMME	:	BEJ
EXAMINATION DATE	:	DECEMBER 2018/ JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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Q1 (a) (i) List **SIX (6)** basic process and functions involved in fabricating Intergrated circuit (IC) using planar technology.

(6 marks)

(ii) Identify the steps used in the preparation of siliconwafers.

(5 marks)

(b) (i) Discuss the advantages of epitaxial layer.

(2 marks)

(ii) Show the basic chemical reaction in the epitaxial growth process of pure silicon.

(6 marks)

(iii) Sketch a simple chemical vapour deposition reactor that used for epitaxy layer.

(6 marks)

Q2 (a) (i) Define thermal oxidation process.

(2 marks)

(ii) Wet oxidation is faster than dry oxidation. Discuss the outcome from both processes.

(4 marks)

(iii) Analyse the suitable oxidationprocessfor field oxide formation.

(4 marks)

(b) (i) Based on **Figure Q2(b)**, calculate the final thickness of the silicon dioxide on a wafer that initially has 0.2µm after an additional 3 hour of 1000°C dry oxidation.
(A=0.165µm and B=0.0117 µm²/h at 1000 °C dry oxidation)
Assume that the oxide thickness is T_{limit} at time=0 and that the oxide thickness is given by

$$T_{ox}^2 + AT_{ox} = B(t + \tau),$$

where $\tau = (T_{init}^2 + AT_{init})/B$.

(4 marks)

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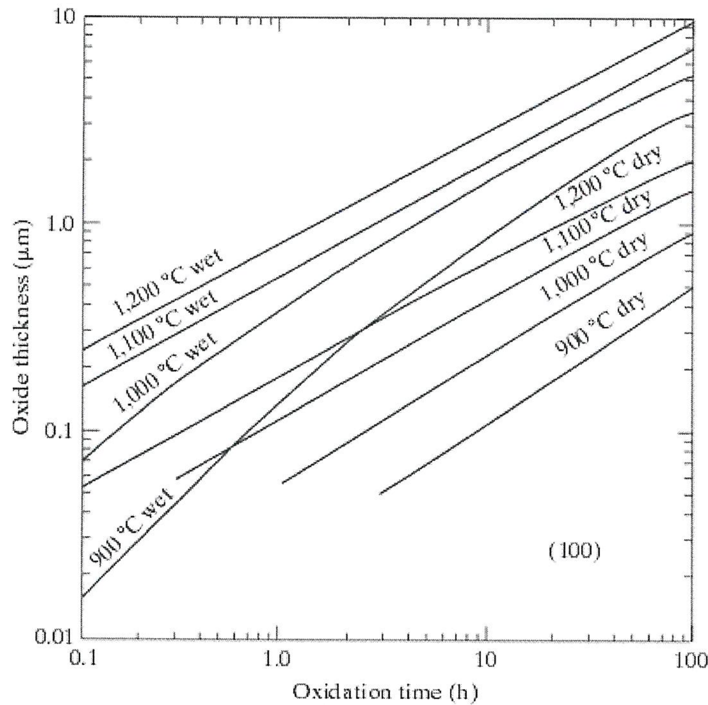

Figure Q2(b)

(ii) Based on Figure **Q2(b)**, calculate the time it takes to grow an additional 0.2µm of oxide at 900 °C in a wet ambient so that the total oxide thickness is 0.4µm.

(7 marks)

(iii) Compare between wet oxidation and dry oxidation. Summarize in table.

(4 marks)

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

(2 marks)

(ii) List **TWO (2)**types of photoresist.

(2 marks)

(iii) Discuss **TWO(2)** basic components in photoresist.

(4 marks)

(iv) Analyse **TWO (2)** elements that can contribute to the photoresist thickness during the coating process as shown in **Figure Q3(a)**.

(4 marks)

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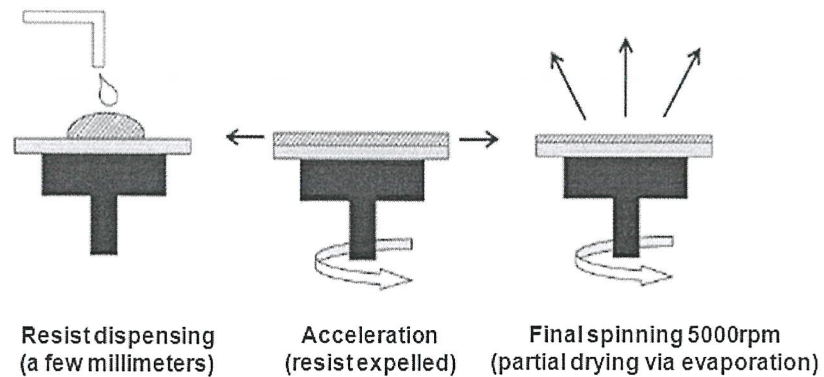

Figure Q3(a)

(b) As a postgraduate student, you have to design a sputtering system for metallization process. Sketch your design apparatus and explain the mechanism briefly.

(7 marks)

(c) As a researcher, you have to choose the laboratory equipment to investigate the topological properties of your thin film. Determine the equipment needed and explain the device requirement.

(6 marks)

Q4 (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)

(b) Polysilicon etched depth in chlorine plasma is given in the **Table 1**. Predict the etch rate based on the data given.

(9 marks)

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Table 1: Etching depth as a function of time

Time (s)	Depth (nm)
10	20
30	50
50	100
70	130

- END OFQUESTIONS -