UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	MICROFABRICATION
COURSE CODE	:	BED 40603
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2019/ JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

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Q1 (a) (i) List the basic processes involved in fabricating ICs using planar technology.

(6 marks)

(ii) List the steps used in the preparation of Silicon to wafers.

(5 marks)

(b) (i) Explain the term epitaxy growth in IC fabrication.

(2 marks)

(ii) Describe 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) Describe thermal oxidation process.

(3 marks)

(ii) State **TWO (2)** important properties of SiO_2.

(2marks)

(iii) Analyse field-oxide formation and gate oxide formation, in term of oxidation process.

(5 marks)

(b) (i) A Si wafer has an unknown initial oxide thickness, $\boldsymbol{x_i}$. The wafer then goes through a particular oxidation process with a linear oxidation constant $B/A = 1.2\ \mu m\ /hour$ and a parabolic oxidation constant $B = 0.3 \mu m^2/hour$. After thermal oxidation for 1 hour, the total oxide thickness is measured to be $\boldsymbol{x}$ µm. With an ***additional*** 3 hours of oxidation, the total oxide thickness becomes $\boldsymbol{2x}$ µm. Find the numerical values of $\boldsymbol{x}$ and $\boldsymbol{x_i}$.
[Hint: The solution for the quadratic equation $ax^2 + bx + c = 0$].

(15 marks)

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Q3 (a) (i) Briefly explain photolithography process and type of photoresist.
(4 marks)

(ii) Discuss **TWO (2)** basic components in photoresist.
(4 marks)

(iii) Explain **TWO (2)** elements that can contribute to the photoresist thickness during the coating process as shown in **Figure Q3(a)(iii)**.
(4 marks)

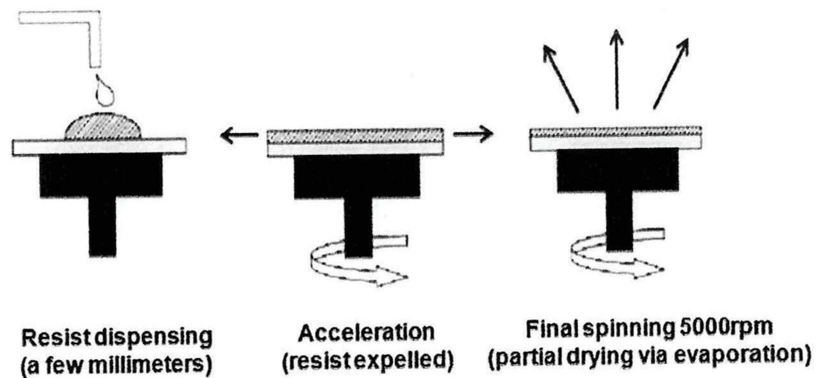

Figure Q3(a)(iii)

(b) As a postgraduate student, design a sputtering system for metallization process. Sketch the design apparatus and explain briefly the sputtering mechanism.
(7 marks)

(c) As a researcher, you have to decide the lab equipment to investigate the topological properties of your thin film. Analyse the equipment needed and their properties.
(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) Explain **TWO (2)** atomic diffusion mechanism in a two-dimensional lattice and explain clearly using approriate diagram.
(10 marks)

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(b) Copper is proposed as an interconnect material in newer generation of ICs because of its low electrical resistivity. There is no reliable process recipe to etch copper by RIE. Propose and a process flow to fabricate copper interconnects in a planarized multilevel metallization scheme for **Figure Q4 (b).**

Starting with a SiO2 layer on Si substrate, show all the step with process description and cross-sections.

(15 marks)

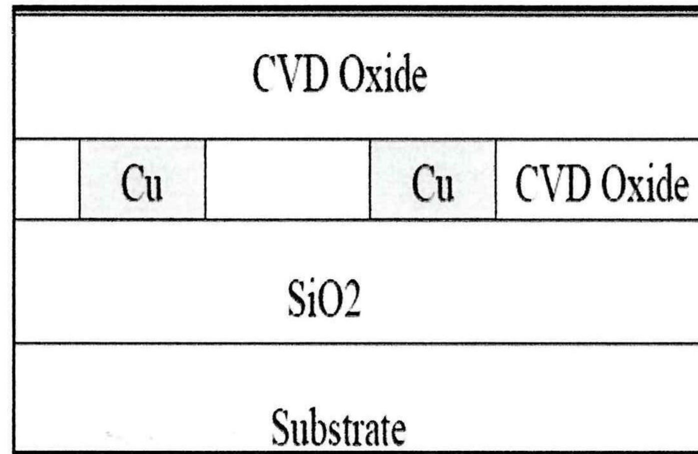

Figure Q4(b)

- END OF QUESTIONS -

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