Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	MATERIAL CHARACTERIZATION
COURSE CODE	:	BEJ 43603
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

Q1 (a) A research student wants to investigate the chemical and structural properties of a fabricated sample with an instrument that would not defect with his sample. Propose a technique that is useful to characterize the chemical and structural information of a multilayer of thin-film sample using the vibrational energy level.

(2 marks)

(b) Based on your answer in part **Q1(a)**, briefly explain the technique operation with the help of aid diagram and label clearly.

(6 marks)

(c) Analyze the information that can be obtained from the expected result of the multilayer thin film sample. Support your answer with the aid of diagram.

(12 marks)

(d) Suggest **TWO (2)** conditions that can utilize this type of characterization technique.

(5 marks)

Q2 (a) A batch of electronic circuitry was patterned on 4-inch silicon (Si) wafer using a photolithography process to produce hundreds of integrated chips (IC). The student was given a task to examine the final details of that IC's condition.

(i) Recommend **ONE (1)** technique that can be used to investigate the chemical and physical properties of the internal IC's structure such as quality, shape and quantum densities.

(2 marks)

(ii) Explain in detail **THREE (3)** common sequences of sample or specimen preparation prior to the characterization technique that recommended in part **Q2(a)(i).**

(10 marks)

(b) Determine a technique that can give microscopic information over entire semiconductors.

(2 marks)

(c) Explain **TWO (2)** conditions from the results that can be produced using the technique answered in part **Q2(b)**.

(6 marks)

(d) Name **ONE (1)** real application of characterization technique that can measure the emitted radiation. Explain briefly.

(5 marks)

Q3 (a) Discuss and explain the mechanism that is most efficient to estimate the life of product.

(6 marks)

(b) Based on the answer in part **Q3(a)**, relate the required qualification and give **ONE (1)** example for a long-term reliability test for faster feedback.

(6 marks)

(c) The most important part of Metal Oxide Semiconductor (MOS) device is its gate oxide structure. Classify **THREE (3)** distinct regions of oxide breakdown with a graph, oxide electric field versus the number of failures.

(7 marks)

(d) Further failure analysis of a device was examined using Gallium (Ga) ions, Ga^{+} with a final focus tip probe less than 10nm diameter, as shown in **Figure Q3(d)**. Outline **THREE (3)** common procedures from the given image.

(6 marks)

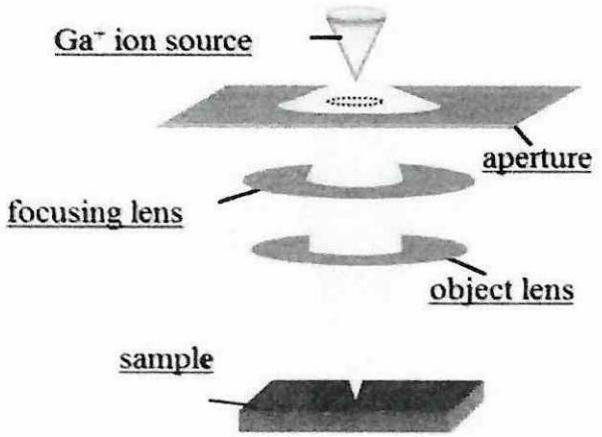

Figure Q3(d)

Q4 (a) **Figure Q4(a)** shows a result of thin film obtained from the testing method. As a research student, analyze **THREE (3)** important points from the image given.

(7 marks)

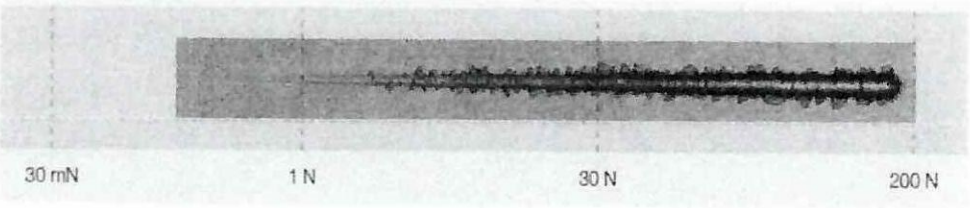

Figure Q4(a)

(b) From your opinion, evaluate why test in part **Q4(a)** must be carried out.

(6 marks)

(c) Identify **THREE (3)** principles source of electrostatic charging and discharging.

(3 marks)

(d) From answer in part **Q4(c)**, analyze and explain **TWO (2)** related conditions.

(4 marks)

(e) Illustrate the equivalent LCR circuitry of electrostatic discharge from modelling human body and machine waveform.

(5 marks)

- END OF QUESTIONS -