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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : MATERIAL CHARACTERIZATION
COURSE CODE : BED 41303
PROGRAMME : BEJ
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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- Q1**
- (a) (i) Select the equipment used to determine the particular defect etches such as defect size, type and density in semiconductor device during during and/or fabrication processes. The equipment must be simple and easy to use. Analyse the features of the equipment. (4 marks)
- (ii) List **ONE (1)** each the strength and weakness of the equipment in part **Q1(a)(i)**. Summarize your answer in a table. (4 marks)
- (b) (i) Explain Raman Spectroscopy technique. (2 marks)
- (ii) As a research student, analyse and explain the results that could be obtained from Raman measurement. Support your answer with the aid of a diagram and clearly labeled it. (Hint: Intensity vs. Raman shift) (11 marks)
- (c) Zinc Oxide (ZnO) have a bandgap energy of 3.3 eV. Estimate the wavelength of light that absorb by ZnO. (4 marks)
- Q2**
- (a) As a final year project student, you need to observe and taking an image of the top view and cross-sectional Cuprous Oxide (Cu_2O) thin film, which exhibit typical triangular and pyramidal shape.
- (i) Propose suitable equipment for the characterization technique. (3 marks)
- (ii) Explain **THREE (3)** principles of the apparatus and identify the advantages. (6 marks)
- (iii) Sketch and label clearly the top view and cross-sectional image that can be produced. (4 marks)
- (b) (i) List **THREE (3)** main principal of ion beam techniques. (3 marks)
- (ii) Analyse suitable ion beam method to characterize the doping profiling and surface metal contaminants. Briefly explain the feature, weakness and strength of the method. (9 marks)

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- Q3** (a) The gate oxide of an MOS device is one of the most important MOS device parameter.
- (i) List **TWO (2)** common problems of the gate oxide. (2 marks)
 - (ii) Propose **TWO (2)** type of stress test to characterise the life time and integrity of gate oxide. (4 marks)
- (b) (i) List **THREE (3)** stages of failure in bathtub curve. (3 marks)
- (ii) Based on answer **Q3(b)(i)**, sketch, label and explain clearly the overall bathtub curve that contain failure rate versus time. (8 marks)
- (c) Oxide breakdown on MOS device can be categorized into **THREE (3)** modes or regions.
- (i) State **THREE (3)** distinct regions for oxide breakdown. (3 marks)
 - (ii) Choose **ONE (1)** of the three regions in **Q3(c)(i)** and analyse the oxide breakdown effect if occurred on the sample. (5 marks)
- Q4** (a) (i) The adhesion test is one of the methods to study the durability and performance of the thin film. The test can be divided into two categories. Identify the categories and explain clearly. (4 marks)
- (ii) List **TWO (2)** adhesion tests for each categories in **Q4(a)(i)**. (4 marks)
- (iii) As a student, you need to set-up a scratch test for your thin film sample. Sketch the diagram of your experiment apparatus and explain briefly. (10 marks)
- (b) (i) Explain X-Rays Fluorescence (XRF) technique and its feature. (3 marks)
- (ii) Analyse one situation which constituent of mixed conductor can be determined using XRF technique. (4 marks)

- END OF QUESTIONS-

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