UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	NANOSTRUCTURED MATERIALS
COURSE CODE	:	BWC 30903
PROGRAMME CODE	:	BWC
EXAMINATION DATE	:	JULY 2022
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

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

Q1 (a) Explain the importance of nanotechnology in the development of materials.

(6 marks)

(b) Briefly differentiate between top-down and bottom-up methods for synthesizing nanostructures.

(4 marks)

(c) List **FIVE (5)** characterization methods used to analyze nanostructured materials.

(5 marks)

(d) **Figure 1(d)** shows the X-ray Diffraction (XRD) patterns for composite polystyrene materials with 0,4 and 8% of Sn nanoparticles respectively for spectra a,b,c. Based on the results obtained, outline the possible findings.

(10 marks)

Q2 Carbon-based nanomaterials are produced and used in many industrial sectors. These materials include carbon nanotubes (CNTs), fullerenes, carbon nanofibers, carbon black, and carbon-onions.

(a) Describe the uniqueness of carbon-based nanomaterials as compared to other nanomaterials.

(5 marks)

(b) Elaborate **ONE (1)** sample preparation technique to synthesize carbon-based nanomaterials.

(8 marks)

(c) **Figure Q2 (c)** shows images of the surface of carbon nanotubes using two different microscopy techniques, the Field-Emission Scanning Electron Microscope (FE-SEM) and the Atomic Force Microscope (AFM). Distinguish the advantages and disadvantages of these two microscopy techniques in analyzing nanostructured materials.

(12 marks)

Q3 (a) Define bulk nanostructured materials.

(2 marks)

(b) Outline the methods used to produce bulk nanostructured materials.

(7 marks)

(c) Explain the strengthening mechanism involved in nanostructured steel. Use suitable sketches to support the explanation.

(8 marks)

(d) Sketch and label the cross-section of **FOUR (4)** different types of nano-composite structure.

(8 marks)

2

Q4   (a)   Differentiate the optical properties of a metal nanoparticles as compared to semiconductor nanoparticles.

(6 marks)

(b)   Explain the quantum size effect in the optical properties of semiconductor nanomaterials. Use suitable sketches to support the explanation.

(9 marks)

(c)   Outline the advantages of using nanostructures in the fabrication process of devices.

(4 marks)

(d)   Describe the advantages of using nanostructures in electronic applications.

(6 marks)

–   END OF QUESTIONS   –

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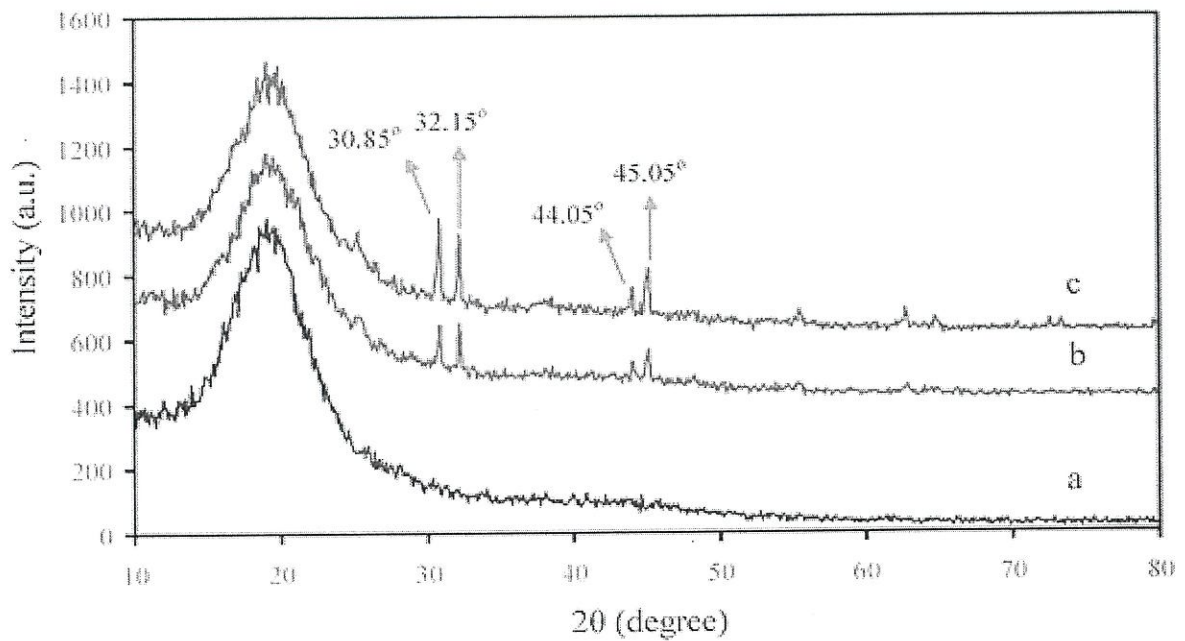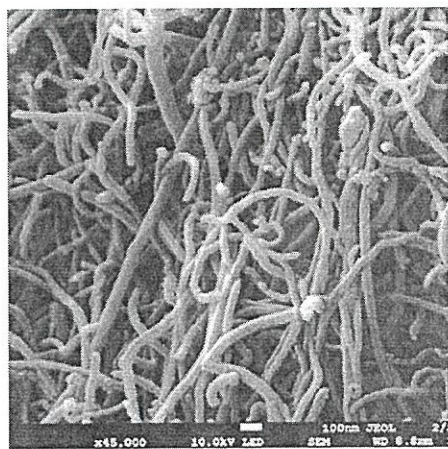
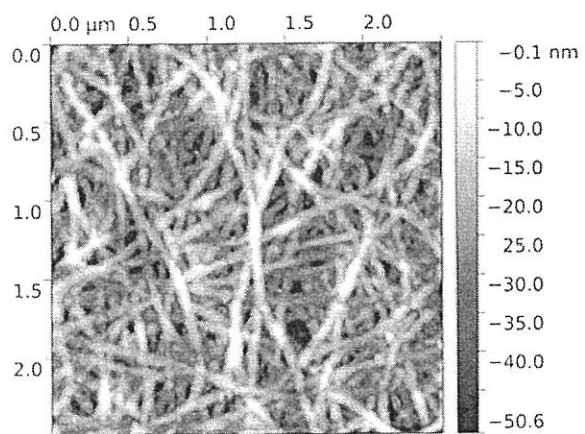Figure Q1 (d)

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FE-SEM

AFM

Figure Q3 (c)

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