

CONFIDENTIAL



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

- COURSE NAME : NANOSTRUCTURED MATERIALS
- COURSE CODE : BWC 30903
- PROGRAMME CODE : BWC
- EXAMINATION DATE : JULY / AUGUST 2023
- DURATION : 3 HOURS
- INSTRUCTION :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - 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 **THREE (3)** PAGES

TERBUKA

CONFIDENTIAL

- Q1** (a) Differentiate between elastic and inelastic scattering. (4 marks)
- (b) Explain how the elastic and inelastic scattering is applied in the electron microscopic system. (4 marks)
- (c) (i) Discuss the uniqueness of carbon element in the field of nanotechnology. (5 marks)
- (ii) Differentiate Carbon Nanotube and Fullerene. (6 marks)
- (iii) List out the application of graphite and graphene in the current industries. (6 marks)
- Q2** (a) Briefly explain the phenomena of electron tunnelling process in Tunneling Electron Microscope (TEM). (5 marks)
- (b) Discuss the potential applications of Atomic Force Microscopy (AFM) in nanotechnology, such as in the development of nanoscale electronic devices or in the investigation of biological systems at the nanoscale level. (7 marks)
- (c) (i) Describe the role of Scanning Electron Microscopy (SEM) in the investigation of nanomaterials in various fields such as electronics, medicine, and energy. (8 Marks)
- (ii) Explain the principle of Energy-Dispersive X-ray (EDX) measurements in nanomaterials. (5 Marks)
- Q3** Among the optical properties of nanostructures in the application of imaging and sensing is the surface plasmon resonance (SPR) and quantum confinement.
- (a) (i) Explain the phenomenon of surface plasmon resonance (SPR). (4 marks)
- (ii) Discuss the different types of metallic nanostructures that can be applied for SPR sensing, including their shapes, sizes, and materials. Include any illustrations to support. (6 marks)

- (b) (i) Describe the basic principles of quantum confinement. (4 marks)
- (ii) Analyze the various factors that can influence the size and shape of quantum confinement regions, and evaluate their relative importance in determining the properties of nanostructures. (8 marks)
- (iii) Give **THREE (3)** examples for specific application of quantum confinement in the field of optoelectronics. (3 marks)
- Q4** (a) (i) Differentiate bulk nanostructure materials from conventional materials. (4 marks)
- (ii) Explain **TWO (2)** factors that can affect the properties of bulk nanostructured materials, and suggest how these factors can be controlled. (8 marks)
- (b) (i) Define a superhydrophobic surface and draw a surface that is considered as superhydrophobic. (3 marks)
- (ii) Discuss **TWO (2)** strategies for optimizing superhydrophobic properties including the method for fabrication and the structural morphology. (10 marks)

-END OF QUESTIONS -