

University of Ruhuna- Faculty of Technology
Bachelor of Biosystems Technology Honours Degree
Level II (Semester II) End Semester Examination, December 2023
Academic year 2021/2022

Course Unit: BST 2242 Nanotechnology

Duration: 1 & 1/2 hours

Instructions to candidates:

Answer only **Three (3)** questions.

Each question should be started with a new page.

1. Carbon nanotubes (CNTs) are widely used in cancer cell diagnosis and treatments.
 - a. List down five (05) factors which should be considered in nanoparticle synthesis. (20 marks)
 - b. Explain briefly the chemical vapor deposition (CVD) method used in CNTs synthesis. (30 marks)
 - c. Cellular uptake of CNTs may affect cellular functions. Explain. (50 marks)

2. Answer all parts.
 - a. List down five (05) environmental applications of nanoparticles. (20 marks)
 - b. Nitrogen oxides (NO_x) are released into the air by fossil fuel combustion resulting acid rains. Briefly explain how you modify the exhaust (silencer) of a vehicle to minimize the NO_x release into the air. (30 marks)
 - c. Leather industry effluent is contaminated with Cr (VI), heavy metals (As), microorganisms, and some organic/inorganic contaminants, *etc.* Using your knowledge in nanotechnology, briefly explain how you would purify the effluent prior discharging to the environment. (50 marks)

3. Answer all parts.

a. List down three (03) factors that affect the bioavailability of minerals in nanocompounds.

(15 marks)

b. Calculate the specific surface area of ZnO nanoparticles (Density = 5.6 g/cm³, particle size = 25 nm) in m²/g.

(35 marks)

c. The most common type of anemia is caused by iron deficiency. Briefly discuss how nanoparticles can be used in food fortification to overcome the iron deficiency.

(50 marks)

4. Answer all parts.

a. Briefly discuss how you select the most appropriate characterization method to characterize nanoparticles.

(30 marks)

b. XRD analysis is used to measure the nanoparticles crystalline size of green synthesized Ni. The Debye Scherrer equation, $D = K\lambda / \beta \cos\theta$, is used to calculate the crystalline size of the nanoparticles, where D is the nanoparticles crystalline size, K represents the Scherrer constant (0.98), λ denotes the wavelength (0.154 nm), and β denotes the full width at half maximum (FWHM) in radians. Diffraction peaks (2θ) are 37.32°, 44.82°, and 47.92°. FWHM values for each peaks are 0.002 radian.

i. Calculate the nanoparticle size for each diffraction peak.

(50 marks)

ii. Calculate the average size of green -synthesized Ni nanoparticles.

(20 marks)

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