RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (Special) Degree in Chemistry
Forth Year – Semester II Examination –June/July 2018

CHE 4206 – NANOCHEMISTRY

Answer ALL questions   Time: Two (2) hours

The use of a non-programmable calculator is permitted

1.

(a) Using suitable diagrams and chemical reactions, describe the main processes in dye sensitized solar cells

(b) TiO_2 and ZnO_2 are potential semiconductor nanoparticles showing good antimicrobial properties in textiles. Draw a schematic diagram to indicate the mechanism of formation of reactive species responsible for the antimicrobial action. Giving reasons, select the most efficient antimicrobial agent from the above two materials. (Note: both TiO_2 and ZnO_2 are same in size and shape).

2.

(a) What are the basic steps of photolithography technique?

(b) Describe the contact, proximity and projection printing processes. Discuss their advantages and drawbacks.

(c) Draw a labeled schematic diagram showing the pattern creation on positive and negative resist materials used in photolithography. List out the performance factors of photoresist.

3.

(a) What are the two basic mechanisms for the stabilization of nanocolloidal dispersions? Explain them.

(b) Briefly explain the three possible mechanisms for the growth of homogenous nucleation of spherical nanoparticles.

The interfacial energy for calcium carbonate nanocrystals in saturated solution is 0.12×10^{-3} J/ m^2. If the critical radius is 40 pm, calculate the value of the Gibbs free energy barrier.

4.

(a) Given the XRD pattern below for a crystalline material, calculate the mean crystallite size of the crystalline material

(b) Briefly discuss about the working principle of AFM

(c) What are the three main working modes of the AFM technique?