M. Sc. (Chemistry) Examination, 2022

(4th Semester, CBCS)

Analytical Chemistry Special

Paper – XVI-A

Time : Two hours Full Marks : 40

Use a separate answer script for each Unit.

UNIT: A-4161 (a & b)

1. a) What are functionalized metal nanoparticles? Explain the sensing properties of Au-nanoparticles for heavy metals ions.

   b) Electrochemical sensors exhibit good sensitivity for the detection of different biological fluids in recent years. Explain.

   c) In between wet and dry methods for designing of nanosystems, which one is feasible for a simple lab? What is the reason for shifting of XRD peaks of Pd doped TiO_2 nanocrystals with respect to pure TiO_2?

   d) Define Janus particle. How do core-shell nano-particles differ from an ordinary system?

   e) What are some of the most interesting nanoparticles found in nature (not manufactured in the lab)?

   2+2+2+2+2=10

2. a) Resolution power of an electron microscope (EM) is higher than that of a light microscope (LM): Justify.

b) Write the full forms of FESEM & DLS technique. When and where can they be utilized for material characterization?

c) Explain the different modes of AFM technique with schematic diagram for material characterization. Choosing of AFM tip is very important — Justify.

d) What is the use of FT-IR studies for biosynthesized nanoparticles?

e) What is "electron-beam" damage? Why are Au or Pt coatings necessary for biological samples during SEM studies?

f) What are the different pattrns of TEM studies and how does it help to understand the crystallinity of the samples? 1+2+2+1+2+2=10

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Answer ***any four*** questions.

3. For a reaction kinetics $-d[C]_t/dt = k[C]^{-1}$, show that the $[C]_t$ versus t plot at the initial times is linear. What does it signify? ($[C]_t$ is the concentration of the reagent at any time during the reaction). 5

4. Complementary redox reactions are normally faster than non-complementary redox ones. Discuss with one example for each. 5

5. How could you kinetically estimate iodide in a given sample using Ce^{4+}/As^{3+} redox reaction? 5

6. Discuss Single Point Method for the determination of components of a binary mixture which are closely related by any kinetic method. 5

7. With a suitable enzymatic scheme discuss any acceptable (least error) procedure for the determination of Michaelis Menten constant. Explain why the method has least error for the determination using any proper differential equation. 5

8. Discuss the principle of analysing the analytical region for the determination of substrate for an enzyme-substrate reaction. 5