

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600086
(For candidates admitted from the academic year 2023-24 & thereafter)

M.Sc. DEGREE EXAMINATION, APRIL 2026
BRANCH IV – CHEMISTRY
FOURTH SEMESTER

COURSE : **ELECTIVE**
PAPER : **NANOCHEMISTRY**
SUBJECT CODE : **23CH/PE/NC15**
TIME : **3 HOURS**

MAX. MARKS: 100

Q. No.	SECTION A	CO	KL
	Choose the correct answer. (10 x 1 = 10 marks)		
1.	Quantum dots are _____ dimensional nanomaterials. (a) zero (b) 1 (c) 2 (d) 3	1	1
2.	70 micron is equal to (a) 70×10^9 nm (b) 70×10^{-9} nm (c) 7000 nm (d) 70000 nm	1	1
3.	_____ is transparent at the nanoscale and thus used in sunscreens (a) Zinc oxide (b) Gold thiol (c) Silver sulphide (d) Cadmium sulphide	1	1
4.	The technique in which a high voltage power supply is used to prepare nano fibers from solution is _____ (a) Lithography (b) PVD (c) Electrospinning (d) High energy ball milling	1	1
5.	Identify the material where an electron is confined in two dimensions (a) Graphene sheets (b) Carbon nanotubes (c) Quantum dots (d) ZnO nanoparticles	1	1
6.	STM tips are usually made from _____ metal. (a) Tungsten (b) Palladium (c) Copper (d) Zinc	1	1
7.	Which of the following is wet chemical method of synthesising nanomaterials? (a) Solgel method (b) Chemical Vapour Deposition (c) Sputtering (d) Atomic Layer Deposition	1	1
8.	Nano clays are layered mineral of (a) Sulphides (b) Sulphates (c) Silicates (d) Sulphites	1	1

9.	Which of the following is a bottom-up approach? (a) Ball milling (b) Lithography (c) Chemical reduction (d) Etching	1	1
10.	The increase in surface area to volume ratio at the nanoscale leads to_____ (a) Decrease in reactivity (b) Increase in reactivity (c) No change (d) Loss of stability	1	1
Q. No.	SECTION B Answer ALL the questions. (10 x 1 = 10 marks)	CO	KL
	Fill in the blanks.		
11.	In soft lithography the stamps are made of_____	2	2
12.	Photo lithography is _____ approach of nano particle synthesis.	2	2
13.	The degree of crystallinity _____ with increase in clay content in polyethylene-based nanocomposites.	2	2
14.	A cold finger in an inert gas condensation method of synthesis contains _____ gas.	2	2
15.	The band gap increases in semiconductor nanoparticles due to ____	2	2
	Answer in a line or two.		
16.	Give two important factors that control the size of nanoparticles during synthesis.	2	2
17.	What are Nanoshells?	2	2
18.	What are Dendrimers?	2	2
19.	Why Au is considered a suitable substrate for thiol SAMs than other metals?	2	2
20.	What are quantum wells?	2	2
Q. No.	SECTION C Answer any FOUR questions. (4 x 6 = 24 marks)	CO	KL
21.	Describe how you would prepare a self-assembled monolayer (SAM) on a gold surface and demonstrate two practical applications based on its properties.	3	3
22.	Illustrate the preparation of a bionanocomposite using a natural polymer and nanofiller, and apply it to one suitable real-life application.	3	3

23.	Outline the procedure you would follow to synthesize pure gold nanoparticles using any two suitable methods.	3	3
24.	Relate the concept of quantum confinement to the changes observed in optical and electrical properties of semiconductor nanoparticles.	3	3
25.	Discuss how nanobots could be utilized in medical treatment with reference to one specific therapeutic or diagnostic application.	3	3
Q. No.	SECTION D Answer any FOUR questions. (4 x 8 = 32 marks)	CO	KL
26.	Analyze the phenomenon of Surface Plasmon Resonance (SPR) in gold nanoparticles and examine the factors influencing the intensity and wavelength of the SPR peak.	4	4
27.	Examine the structural features of fullerenes and analyze how their synthesis methods influence their properties and applications.	4	4
28.	Interpret how wide-angle X-ray diffraction data can be used to characterize the structural features of nanocomposites.	4	4
29.	Differentiate the various classifications of nanocomposites and analyze how their structural variations affect their properties.	4	4
30.	Compare and contrast Chemical Vapour Deposition (CVD) and Physical Vapour Deposition (PVD) techniques and analyze their suitability for nanoparticle synthesis.	4	4
Q. No.	SECTION E Answer the following questions. (2 x 12 = 24 marks)	CO	KL
31.	(i) Evaluate the effectiveness of the electrodeposition method for synthesizing nanophase materials, highlighting its advantages, limitations, and critical process parameters. (8) (ii) Discuss the advantages and limitations of soft lithography in the synthesis of nanomaterials and justify whether it is suitable for large-scale production. (4)	5	5
	(OR)		
32.	(i) Discuss the impact of nanomaterials on human health and the environment (8) (ii) Explain the preparation of aerogels and xerogels by the sol-gel method (4)		

33.	(i) Discuss the applications of nanomaterials in electronics and sensors (8) (ii) Justify the following statements with suitable scientific reasoning. (4) (a) Graphene has high thermal conductivity (b) Electrons in nanomaterial have higher energy than bulk materials. (OR)	5	5
34.	(i) Explain the characterization of nano composites using TEM and SEM. (8) (ii) Give any two important applications of nano particles in the field of sports. (4)		
