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B.Sc.-M.Sc. Integrated Program, Chemistry/Semester-V Examination-2023
Paper Title: Novel Inorganic Solids
Paper Code: BCH-DSE3 TH

Time: 3 hours

Maximum Marks: 75

Note: This paper has three sections A, B, and C, Attempt all the three sections

Section A: Answer all the questions; Section B: Answer any 3 out of 5; Section C: Answer all the questions, each question has an internal choice.

Abbreviations Used

CLO- Course Outcome, PLO- Program Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create

Section A

Very Short Type Questions ((attempt all)

(10x2= 20 marks)

Q. No.	Question	BTL	CLO	PLO
A1.	Give full form of 'LSGM' Fast Ion Conductor. Which ion is the charge carrier in it?	1	1	2
A2.	What are desirable characteristics of the matrix materials?	4	4	3
A3.	Give potential applications for core-shell nanoparticles.	3	3	3
A4.	What is the difference in electronic energy levels of a semiconductor and quantum dot?	3	5	4
A5.	In a solid state reaction, mixing MgO and Al ₂ O ₃ grains easily creates the first few atomic layers nuclei of product MgAl ₂ O ₄ , but further growth becomes problematic. Give two ways to accelerate the reaction.	4	4	4
A6.	How DNA condensation can be carried out in-vitro?	3	3	3
A7.	CdS is yellow and CdSe is red though transition in both occurs from chalcogenide p orbitals to Cd orbitals. Give reason.	5	5	4
A8.	When a biomolecule binds to a gold nanoparticle's surface, what happens to the signal produced by the particle's Surface plasmon Resonance?	6	5	4
A9.	Metals contribute extra features to liquid crystals. Comment.	6	6	3
A10.	The arrangement of individual atoms is more precisely governed by bottom-up nanofabrication techniques. Justify.	5	5	4

SECTION B

Long type Questions (Attempt any two out of four)

(2x10=20 marks)

Q. No.	Question	BTL	CLO	PLO
B1.	What is the basic structure of an ion exchange resin? How does it work?	4	4	3
B2.	Explain the effect of doping on electrical conductivity of trans-polyacetylene.	4	4	3
B3.	Discuss the roles of matrix and reinforcement in composite materials.	5	5	4
B4.	Suggest the procedure for synthesis of Ag nanoparticles using tea leaves as green source. Why green-based synthesis fits the criteria of the best approach for producing nanoparticles for biological purposes than a conventional method.	6	6	4

SECTION C

Short-type Questions. (Attempt all questions)

(7x5=35 marks)

Q. No.	Question	BTL	CLO	PLO
C1.	How solution of $K_2Pt(CN)_4 \cdot 3H_2O$, a semiconductor, turns to a one dimension metal on treatment with bromine?	3	3	4
	OR Describe the slow relaxation process of molecular magnets.			
C2.	Give an example of a bionanomaterial and its application in nanotechnology.	6	6	4
	OR What is the relevance of self-assembly to the fabrication of nanomaterials? What role will it play in nanotechnology?			
C3.	What is 'yttrium stabilized zirconia' (YSZ)? Suggest its synthesis using Sol-Gel Method?	2	2	3
	OR Discuss the working of Solid oxide fuel cells (SOFCs).			
C4.	Describe biomimetics with respect to how artificial fossilization is used to create titania paper.	2	2	3
	OR Distinguish natural and artificial nanomaterials with examples.			

- C5. Why graphite is suitable material to form intercalation compounds? Discuss the synthesis of any graphite intercalated compound. 6 6 4

OR

Discuss the principle and procedure for ion-exchange method of synthesis with appropriate example.

- C6. What is the difference between: 4 4 4
(a) direct indirect band gap in semiconductors?
(b) intraband and interband transition?

OR

In solid cationic electrolytes, will the ionic conductivity be more or less in the low-temperature as compared to higher temperatures form? Justify your choice.

- C7. How carbon nano-tubes can be synthesized by chemical vapour deposition process? What can be the advantages of this method compared to other methods? 3 3 4

OR

Suggest a method to synthesize single walled carbon nano-tubes. Comment on their electrical properties with the rotation of a graphene sheet.

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