10.12.18(M)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 384 **IC**

Unique Paper Code : 32177901

Name of the Paper : NOVEL INORGANIC SOLIDS

Name of the Course : **B.Sc. (H) Chemistry/B.Sc. (Prog.) : DSE – 2A**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.

1. (a) Select the suitable option of various methods of synthesis and modification of inorganic solids in the following statements. The options are: Ceramic/ Coprecipitation/ Intercalation/ Hydrothermal/ Sol-Gel

(i) In which method, Aluminium butoxide is the suitable source reagent of Al_2O_3.

(ii) In which method, diffusion is the limiting factor.

P.T.O.

(iii) Which method is best suitable for the synthesis of synthetic emeralds?

(iv) Which method involves insertion of neutral molecules between weakly bonded layers?

(v) Which method involves use of stoichiometric mixture of soluble salts of the metal as starting materials?

(b) What is a topotactic reaction? Justify that intercalation is a topotactic reaction.

(c) Match the origin of color in the following inorganic solids. The options are: d-d transition/ charge transfer/ radical anion / intervalence charge transfer/ luminiscence. (The option may be repeated).

(i) CdSe

(ii) $[Fe^{III}]_4[Fe^{II}(CN)_6]_3$

(iii) $CoAl_2O_4$

(iv) $Cr_2O_3.nH_2O$

(v) $Na_8[SiAlO_4]_6.(S_3)_2$ (5,5,5)

2. (a) What are Solid Electrolytes? Why solid anionic electrolytes are rarer as compared to cationic electrolytes? What are the conducting ions in Ag_2HgI_4 and YSZ?

(b) Why TiO_2 and Carbon black pigments appear as white and black respectively? Why black pigments sometimes heat up on exposure to sunlight?

(c) At T=0, no one dimensional solid is a metal. What is the reason of Peierls distortion? How this distortion results in a metal semiconductor or insulator? (5,5,5)

3. (a) What are the properties of nanoparticles which make them different from bulk materials? How Quantum confinement bestows unique properties on semiconductor nanocrystals compared to the bulk semiconductor?

(b) Explain the difference between the top-down and bottom-up methods of fabrication of materials. Give one example of each synthesis method.

(c) Explain morphosynthesis and its significance in control of nanoarchitecture. (5,5,5)

4. (a) What are molecular magnets. Describe the slow relaxation process of molecular magnets.

(b) Explain conduction mechanism of polypyrrole as conducting polymer.

(c) What are Carbon nanotubes? Describe Chemical vapour deposition technique to synthesize carbon nanotubes. What is its advantage over other methods? (5,5,5)

P.T.O.

5. (a) Give the classification of matrix used in composites. What are the properties of matrix which influence its performance?

(b) What are refractories? How are they classified on the basis of chemical composition?

(c) What are core sheath wires? How can these be prepared? (5,5,5)

6. (a) Describe the relevance of self-assembly to the fabrication of nanomaterials.

(b) Explain hydrothermal Synthesis of inorganic solids. Give schematic representation of hydrothermal bomb used for Crystal growth.

(c) Discuss environmental effects on composites. (5,5,5)

7. Write short notes on any **three** of the following :

(a) Inorganic Liquid crystals

(b) Surface Plasmon Resonance (SPR)

(c) Ion exchange resins

(d) Solid Oxide fuel Cells (5,5,5)