PG Even Semester (CBCS) Exam., May—2017

CHEMISTRY

(4th Semester)

Course No. : CH–402 (C)

(Chemistry of Advanced Materials)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* What are nanoscience and nanotechnology? How do they differ from each other? 2+2=4

(b) Explain the metallic properties of 3 nm diameter Ag nanoparticle with the help of quantum confinement effect. 3

(c) Explain the electronic band theory of metallic lithium. Draw the density of states profile for bulk and nanocrystals. 2+2=4

(d) What makes nanostructures unique compared to bulk materials? 4

2. *(a)* Describe in brief the 'top-down' lithography method for the fabrication of nanostructure on a silicon substrate. Give the limitation of 'top-down' approaches. 3+2=5

(b) Discuss the construction of (5, 3) SWNT from a graphene sheet. Calculate the diameter and chiral angle of the above nanotube. 5

(c) Write a note on the synthesis of nanomaterials using the following (any *one*) : 3

(i) Sol-gel method

(ii) Chemical vapour deposition

(d) Mention different characterization techniques of nanomaterials. 2

UNIT—II

3. *(a)* How does the surface plasmon resonance (SPR) band of gold nanosphere vary with particle size? Explain. 4

(b) Illustrate the application of gold nanorods in photodynamic therapy of cancerous cells. 8

(c) How could nanotechnology be utilized to meet the clean energy demand in the modern world? 3

4. (a) Schematically show how the band gap engineering of semiconducting nanoparticles could be exploited in photocatalytic water splitting. 7

(b) Describe in brief the operation principle of a bulk heterojunction solar cell. 6

(c) Comment on the biosensing application of gold nanoparticles. 2

UNIT—III

5. (a) What do you mean by liquid crystals? Mention the distinguishing characteristics of the liquid crystalline state. 2+2=4

(b) Furnish the structures of lyotropic mesophases and explain. 4

(c) How does lyotropic mesogen resemble with biological membrane? 4

(d) Discuss the optical anisotropy in liquid crystals. 3

6. (a) Define director and order parameter in liquid crystals. 2+2=4

(b) Write a brief account on the orientational order parameter in nematic mesophase. 5

(c) What is thermotropic liquid crystal? How does it differ from lyotropic liquid crystals? 1+2=3

(d) Explain why iridescent colours are displayed by beetle. 3

UNIT—IV

7. (a) What is pharmacophore? Illustrate with an example. 1+3=4

(b) Write in detail the pharmacokinetic ADME properties related to drug action. 1½×4=6

(c) Write short notes on : 2½×2=5

(i) Nanomedicine

(ii) Design of combinatorial synthesis

8. (a) What are prodrugs? Give two examples of prodrug development. 2+4=6

(b) What do you mean by QSAR? Explain the utility of log P in drug design. 4

(c) Write a short note on nanodrug carrier. 5

UNIT—V

9. *(a)* Explain by taking suitable example for each of the following supramolecular properties : 2×3=6

(i) Catch objects

(ii) Move

(iii) Rotate

(b) How could supramolecular fluorescent sensor be used in citrate anion detection? 4

(c) Write a brief account on photoinduced energy transfer in electric device by taking suitable example. 5

10. *(a)* Discuss the application of supramolecular chemistry in the field of pharmaceutical research. 6

(b) Write a short note on molecular AND and XOR switch. 5

(c) Write short notes on the following : 2×2=4

(i) MRI contrast agent

(ii) Molecular tweezers

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