R8399

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Nanoscience and Technology

SYNTHESIS OF NANOMATERIALS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1. What is the other term of Laser ablation?

   (a) Laser blasting

   (b) Photoablation

   (c) Laser deposition

   (d) All of the above

2. Select the Correct statement related to sputtering method

   (a) Sputtering is a ballistic process in which the target remains hot

   (b) Cathode sputtering is more frequently used in thin film technology

   (c) Sputtering is not a physical process

   (d) Sputtering is not used in the semiconductor industry

3. The sot-gel is a ——————— of solid particle.

   (a) Sublimation

   (b) Melting

   (c) Colloidal suspension

   (d) Cool down

4. Select the nanomaterial that is used in Theranostics

   (a) Semiconductor   (b) Nanorods

   (c) Thin film   (d) Ball milling

5. The building block of Carbon nano tube (CNT) is ————

   (a) Mini tubes   (b) Lattice

   (c) Unit cell   (d) Graphene

6. Select the example for zero dimensional nanostructure

   (a) Nanotube

   (b) Graphene quantum dots (GQDs)

   (c) Nanowire

   (d) None of the above

7. The use of Severe Plastic deformation (SPD) is

   (a) Produce ultra-fine grind materials (UFG)

   (b) Remove rust

   (c) Freeze the high temperature structure

   (d) Oxidize the surface of the component

8. Select the CORRECT Statement related to Ball milling

   (a) It is not a suitable mechanical method

   (b) It is not used for grind material

   (c) It is used to grind and blend bulk material into QDs.

   (d) None of the above

R8399

9. DNA self-assembled nanostructures with sticky ends to form 2D arrays are called

   (a) DNA array

   (b) DNA tiles

   (c) DNA architecture

   (d) DNA self-assembly

10. Nanomaterials that are synthesized using the living systems are called

   (a) Chemical method

   (b) Physical method

   (c) Biological method

   (d) Physico chemical method

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Discuss the Principles of Inert-Gas Condensation.

Or

   (b) Write the advantages of thermal evaporation method compared to sputtering method

12. (a) Outline the advantages and disadvantages of photochemical synthesis.

Or

   (b) Write a short note on solid state sintering.

13. (a) Give all account of the properties and applications of Nano rings.

Or

   (b) Write the applications of 3D Nanostructures with suitable example

3   **R8399**

14. (a) Write about the factors influencing the size of the product in ball milling process.

Or

(b) Describe the significance of Severe Plastic deformation (SLD).

15. (a) Give an account of the synthesis and application of fungal mediated nanoparticles.

Or

(b) How will you explain protein based nanostructure with example?

Part C (5 × 8 = 40)

Answer any **five** questions.

16. Explain in detail about the Radio Frequency (RF) sputtering and its merits.

17. Illustrate the method of the Electrochemical synthesis with an example and write its applications in energy sector.

18. Explain the principle and synthesis of Inorganic nanotube and its applications.

19. Explain the synthesis of Nanomaterials by High Energy Ball Milling with diagram.

20. Explain the significance of biologically synthesized Nanoparticles compared to other methods.

21. Explain the principle and procedure of arc discharge method through an example.

22. Explain about DNA based Nanostructure formation with any two examples.

23. Explain the suitable method to synthesis 1 D nano structure and 3D nanostructures.

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4

R8399

R8400

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Nanoscience and Technology

CHARACTERIZATION OF NANOMATERIALS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1.   Select the correct measurement method for the Minerals hardness test

   (a)   Indentation hardness

   (b)   Rebound hardness

   (c)   Scratch hardness

   (d)   All of the above

2.   The nanoceramics are discovered in the year of ————

   (a)   The early 1980s   (b)   The early 1960s

   (c)   The early 1970s   (d)   The early 1990s

3.   Select the correct material that is having a low resistivity

   (a)   Manganese   (b)   Tungsten

   (c)   Magnesium   (d)   Silver

4. The energy required by a reacting molecule to get converted in to a product is called

(a) Activation energy (b) Absorbance

(c) Rate constant (d) Thermodynamics

5. Select the correct wavelength range for UV spectrum light

(a) 100-500nm (b) 10nm-400nm

(c) 200-800nm (d) 10-100nm

6. Select the most commonly used mode in the Atomic Force Microscopy

(a) Non-contact (b) Tapping

(c) Contact (d) All of the above

7. Select the soft magnet material from the following

(a) Nickel-iron alloy (b) Steel

(c) Sodium (d) Titanium

8. Point out the other term of the Electron spin resonance

(a) Electron paramagnetic resonance

(b) Electron diamagnetic resonance

(c) Electron paramagnetic reoccurrence

(d) None of the above

9. Which of the equation is used to estimate the effective radius of a diffusing particle

(a) Stokes- Einstein equation

(b) Beer Lamberts law

(c) Enzyme reaction

(d) All the above

R8400

10. The electrochemical technique that is used to measure the kinetics of chemical reactions and adsorption is

(a) Chronoamperometry

(b) Chromatography

(c) CFM

(d) None of the above

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Give an account of the plastic the deformation of nanomaterials.

Or

(b) Discuss about the adhesion and friction of Nanoparticles.

12. (a) Write a short note on the relaxation times of dipoles.

Or

(b) Briefly write about the DC electrical conductivity as a function of temperature.

13. (a) Write the working principle of Photoluminescence (PL).

Or

(b) Outline the principle and application of X-ray diffraction.

14. (a) Write the principle of NMR spectroscopy.

Or

(b) Write a short note on Hysteresis loop with diagram.

3   R8400

15. (a) Write the significance of electro analytical techniques.

Or

(b) Discuss about the ion-ion interaction in detail.

Part C (5 × 8 = 40)

Answer any **five** questions.

16. Explain about the fatigue, failure stress and strain toughness of nanomaterials.

17. Explain the types of Hall effect and its application.

18. Elucidate on Scanning Electron microscopy and give a note on its merits and demerits.

19. Describe the concept of dia-para, ferro and ferri magnetism with diagrammatic representation.

20. Explain the principle and application of Electrochemical impedance spectroscopy

21. Write a short note on the following:

(a) Nanomembranes

(b) Electrochemical cell

22. Explain working principle and applications of High resolution of Transmission electron microscopy (HR-TEM).

23. Explain the applications of Vibrating Sample Magnetometer (VSM).

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R8400

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Nanoscience and Technology

APPLICATIONS OF NANOMATERIALS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1.   ————————— is the process through which one can make microfluidic chips.

   (a)   Carbon balls   (b)   Hollow tube

   (c)   Photolithography   (d)   None of the above

2.   Light emitting diodes emits light when it is in

   (a)   Zero biasing   (b)   Reverse biased

   (c)   Forward biased   (d)   Infinite biasing

3.   Which of the following memory is volatile in computer memory chip?

   (a)   Read-only memory (ROM)

   (b)   Random-access memory (RAM)

   (c)   Erasable   Programmable   Read-only   Memory (EPROM)

   (d)   Programmable Read-only Memory (PROM)

4. What type of gel is used as an electrolyte in the Lithium ion battery?

   (a) Silicon   (b) Sodium

   (c) Lithium   (d) Copper

5. Select the biomaterial that can be used in ceramic valves

   (a) ZnO   (b) Zirconia

   (c) Zinc   (d) Starch

6. The process of applying a surface layer that repels dry particles, water and oil is called

   (a) Nano ceramic coating

   (b) Computing

   (c) Doping

   (d) Lithography

7. Select the Photo catalyst material that can be used in dye degradation

   (a) Implant   (b) Titanium dioxide

   (c) Chromium   (d) All the above

8. Nano bioremediation means

   (a) Checking BOD level

   (b) Desalination

   (c) Removal of Pollutants using Nanoparticles

   (d) Removal of Pollutants using Microbes

9. An artificial replacement in the body part such as limb or palate is called as

   (a) Prosthesis   (b) Valve

   (c) Angiogenesis   (d) Progenesis

R8401

10. In tissue engineering ——————— is needed for the structural support for cell attachment and subsequent tissue development.

(a) Bone morphogenetic protein

(b) Mineral

(c) Cell

(d) Scaffolds

Part B   (5 × 5 = 25)

Answer **all** questions, choosing either (a) or (b).

11. (a) Outline the differences between MEMS and NEMS.

Or

(b) Give an account of Nano transistors and its application.

12. (a) Describe high power magnets and its bio applications.

Or

(b) Write short note on salient features of high energy density batteries.

13. (a) Discuss about membrane technology in water treatment.

Or

(b) Write a short note on Nanocomposites used in orthopaedic applications.

14. (a) How will you explain the role of Nanomaterials in organic dye degradation?

Or

(b) Discuss about the significant of water resistant composite and its application.

3   R8401

15. (a) Write a detailed note on artificial nanostructure with an example.

Or

(b) Give an account of new generations of medical implants with example.

Part C (5 × 8 = 40)

Answer any **five** questions.

16. Elaborate the lithography technique and add a note on the types of photoresist used in photolithography with diagram.

17. Write a short note on the following : (4 × 2 = 8)

(a) Hard magnets

(b) Soft magnets

18. Explain the importance of hydroxyapatite in biomedical applications with reference to bone and dentistry.

19. Describe the implementation of nanotechnology in Textile and leather industry.

20. Discuss about the biofunctionalized CNT and its biological application.

21. Write a detailed note on the following : (4 × 2 = 8)

(a) Nano biosensor

(b) Neural implants.

22. Discuss about the nanomaterial that enhance the characteristics of Aerospace components.

23. Explain the nanomaterial that is used for detoxification of organic/inorganic pollutants through an example.

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R8401

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Nanoscience and Technology

INFORMATION STORAGE MATERIALS AND DEVICES

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** the questions.

1. ———— is any storage type in which data is written and read with a laser.

    (a) Optical storage

    (b) Solid State Memory

    (c) Magnetic Memory

    (d) Data Storage

2. The principle of magnetic recording was first demonstrated by the Danish engineer Valdemar Poulsen in ————

    (a) 1990   (b) 1900

    (c) 1903   (d) 1909

3. The laser spot diameter can be varied and is limited only by the power ———— required.

    (a) laser power   (b) density

    (c) both (a) and (b) (d) none of these

4. ————— is the process of moving or copying data from one place to another or storing data simultaneously in more than one location.

   (a) Signal Modulation

   (b) Data replication

   (c) Both (a) and (b)

   (d) None of these

5. ————— is a coupling between nearest neighboring cations without involving any intermediary anion.

   (a) Spin

   (b) Exchange Coupling

   (c) Magnetic Moment

   (d) None of these

6. A ————— is a region within a magnetic material in which the magnetization is in a uniform direction.

   (a) Spin

   (b) Coupling

   (c) Magnetic Moment

   (d) Magnetic domain

7. A ————— is a device, consisting of two or more conducting magnetic materials.

   (a) Spin

   (b) Spin valve

   (c) Magnetic Moment

   (d) Magnetic Anisotropy

R8402

8. ———— technologies are processes for depositing and processing thin layers from a few microns thick down to individual atomic layers.

   (a) Thin film   (b) Sensor

   (c) Media Noice   (d) None of these

9. CRAM full form ————

   (a) Compressed Memory

   (b) Compressed Random Access Memory

   (c) Compressed Replicate Memory

   (d) None of these

10. ReRAM full form ————

    (a) Random-access memory

    (b) Replicate Memory

    (c) Resistive Random Access Memory

    (d) None of these

Part B (5 × 5 = 25)

Answer **all** questions by choosing either (a) or (b).

11. (a) Briefly note on Solid State Memory.

    Or

    (b) Write short notes on Magnetic Recording.

12. (a) Write about the principle of Magnetooptic Disks.

    Or

    (b) Write a short note on Disk Format.

13. (a) Discuss about the Super paramagnetism.

    Or

    (b) Write about the Magnetic Field.

3   **R8402**

14. (a) Give the notes on AMR head.

Or

(b) Explain the Media Noise.

15. (a) Write the difference between DRAM and SRAM.

Or

(b) Explain the Quantum Information Storage.

Part C $(5 \times 8 = 40)$

Answer any **five** questions.

16. What is Information Storage Materials? Write about the different types of Information Storage Materials.

17. Give short notes on Diffraction-limited Laser Spot.

18. Give the accounts on :

(a) Ferromagnetic

(b) Anti-Ferromagnetic Materials.

19. Write the details about Inductive Read and Write Head.

20. Write about the short notes on Probe Storage.

21. Write short notes on Optical Pickup Heads.

22. List and Explain the Thin Film Technology.

23. Differentiate Molecular Memory and Atomic Memory.

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R8402