M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022.

First Semester

Nanoscience and Technology

INTRODUCTION TO QUANTUM PHYSICS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** questions.

1. The dimensions of a vector space is given by the minimum number of

    (a) Linearly dependent vectors

    (b) Linearly independent vectors

    (c) Both (a) and (b)

    (d) None of these

2. $\hat{A} \, \psi = \lambda$ is called ——————————.

    (a) Operator   (b) Eigen function

    (c) Eigen value   (d) Wave function

3. To solve Schrodinger equation we need potential and —————————.

    (a) Physical requirements of system

    (b) Boundary condition

    (c) None of these

    (d) Both (a) and (b)

4. Schrodinger equation is a _____.

   (a) 1ˢᵗ order differential equation

   (b) 2ⁿᵈ order differential equation

   (c) Both (a) and (b)

   (d) None of these

5. The transmission based on tunnel effect is that of a plane wave though a ─────────.

   (a) Circular Barrier

   (b) Opaque Object

   (c) Rectangular barrier

   (d) Infinitely small barrier

6. Tunnel effect is notably observed in the case of ─────.

   (a) X-ray's   (b) Gamma rays

   (c) Alpha particles (d) Beta particles

7. The absorbed wavelengths in atomic absorption spectrum appear as ──────────.

   (a) Dark background (b) Dark lines

   (c) Light background (d) Light lines

8. The lines which appear in absorption and emission spectrum are ──────────.

   (a) Same   (b) Different

   (c) Very different (d) Far apart

9. An electron in the conduction band _____.

   (a) Is always chargeless

   (b) Has tendency to leave the atom

   (c) Has lower energy than an electron in the valence band

   (d) Has higher energy than an electron in the valence band

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10. For elements having energy gap more than 5 eV, act as; _____.

   (a) Semiconductors   (b) Insulators

   (c) Superconductors   (d) Conductors

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

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

   Answer should not exceed one page or 250 words.

11. (a) What are Eigen functions and Eigen values?

   Or

   (b) Evaluate [Lx, Ly].

12. (a) State Heisenberg's uncertainity principle?

   Or

   (b) Write the time dependent Schrodinger's equation.

13. (a) How do you determine Bound state?

   Or

   (b) What exactly is a Bound state and why does it have negative energy?

14. (a) Define Optical properties.

   Or

   (b) Explain about Absorption and Emission in optical properties.

15. (a) Differentiate Fermi level and quasi Fermi level.

   Or

   (b) Describe Semiconductor Band-Gap Engineering.

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Part C (5 × 8 = 40)

Answer any **five** questions.

16. Solve for the Eigen values and the Eigen functions of L2 and Lz operator.

17. What are Einstein's A and B coefficients? Evaluate the Einstein coefficient for spontaneous emission.

18. Explain Electron wave propogation in devices.

19. Explain detailed accounts on Basic quantum mechanics for linear optical transitions.

20. Describe the notes on p-n junction and Schottky junction?

21. Briefly explain about Wave functions possess even or odd parity.

22. List and explain the configuration space rules for Feynman graphs.

23. Explain the de Broglie wavelength of an electron of energy MeV.

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M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Nanoscience and Technology

BASICS OF MATERIALS SCIENCE

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1.   Water is denser than ice due to ———————
     (a)   induced dipole induced dipole interactions
     (b)   dipole-induced dipole interactions
     (c)   dipole-dipole interactions
     (d)   hydrogen bonding interactions

2.   An alloy reacted with dilute hydrochloric acid to produce a gas which 'pops' a lighted splint. The residue reacted with dilute nitric acid to form a blue solution. Which one of the following pairs of metals is present in the alloy?
     (a)   Copper and lead
     (b)   Lead and magnesium
     (c)   Lead and zinc
     (d)   Copper and magnesium

3.   The process in which a carbonate ore is heated strongly in the absence of air to convert it into metal oxide is called ———————
     (a)   Roasting   (b)   Calcination
     (c)   Reduction   (d)   Smelting

4. How many unit cells are divided equally in a face-centered cubic lattice?

   (a) 2   (b) 4

   (c) 6   (d) 8

5. Each of the following solids shows the Frenkel defect except

   (a) ZnS   (b) AgBr

   (c) KCl   (d) Agl

6. How can a dielectric be converted to a conductor?

   (a) Compression   (b) Heating

   (c) Expanding   (d) Freezing

7. Dielectric materials are basically ———————

   (a) Insulators   (b) Semiconductors

   (c) Superconductors (d) Conductors

8. Nylon threads are made of _____

   (a) Polyester polymer

   (b) Polyamide polymer

   (c) Polyethylene polymer

   (d) Polyvinyl polymer

9. Which of the following is a branched polymer?

   (a) Low density polymer

   (b) Polyester

   (c) high density polymer

   (d) nylon

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10. What are the conditions for gas like Carbon monoxide to obey the ideal gas laws?

   (a) Low temperature and low pressure

   (b) Low temperature and high pressure

   (c) High temperature and low pressure

   (d) High temperature and high pressure

Part B (5 × 5 = 25)

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

Answer should not exceed one page or 250 words.

11. (a) Explain briefly on Growth and form of crystal.

   Or

   (b) Explain details about (i) Schottky defects (ii) Frenkel defects?

12. (a) Write about Crystalline and Noncrystalline states.

   Or

   (b) Write a short note on Classification of Solids.

13. (a) Explain Semiconductors and its Types.

   Or

   (b) Write short notes on Atomic Structure and its physical properties.

14. (a) Write about the Classification of Polymers.

   Or

   (b) Explain the Deformation of Semi crystalline polymers.

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15. (a) Explain the Nanocrystals and Nanostructure.

Or

(b) What are the defects of nanocrystal in the microscope?

Part C (5 × 8 = 40)

Answer any **five** questions.

16. Explain the Schottky and Frenkel defects.

17. Write brief notes on Crystalline and Noncrystalline states.

18. Explain the detailed accounts on Thermal conductivity and Electrical conductivity.

19. Describe about Polymeric Materials and the Electrical properties of Polymers.

20. Describe the Crystallinity of long chain polymers and structure of long chain polymers.

21. Write short notes on

(a) Semiconductor devices?

(b) Dielectric materials?

22. Define Properties of solids? Write about Energy bonding structures in solids.

23. What is nanotechnology? Explain detailed accounts on Deformation in FEE and HCP Nanostructures.

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M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Nanoscience and Technology

BASIC BIOTECHNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1. Restriction enzymes were discovered by_____

   (a) Smith and Nathans

   (b) Alexander Fleming

   (c) Berg

   (d) None

2. ELISA is ——————————

   (a) Using radiolabeled second antibody

   (b) Usage of RBCs

   (c) Using complement-mediated cell lysis

   (d) Addition of substrate that is convened into a coloured end product

3. The human genome project was launched in the year

   (a) 1980   (b) 1973

   (c) 1990   (d) 1989

4. Which bacterium is used in the production of insulin by genetic engineering?

    (a) *Saccharomyces*   (b) *Rhizobium*

    (c) *Escherichia*   (d) *Mycobacterium*

5. The first transgenic plant to be produced is

    (a) Brinjal   (b) Tobacco

    (c) Rice   (d) Cotton

6. What is Dimethyl sulfoxide used for?

    (a) A gelling agent   (b) Cryoprotectant

    (c) Chelating agent   (d) An Alkylating agent

7. The maximum number of existing transgenic animals is of —————————

    (a) Fish   (b) Mice

    (c) Cow   (d) Pig

8. The association of endotoxin in gram-negative bacteria is due to the presence of —————————

    (a) Steroids

    (b) Peptidoglycan

    (c) Lipopolysaccharides

    (d) Polypeptide

9. This is also called a biogas ——————————

    (a) Biobutanol   (b) Biodiesel

    (c) Bioethanol   (d) Biomethane

10. Which of the following is related to genetic engineering?

    (a) Plasmid   (b) Mutation

    (c) Plastid   (d) Heterosis

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

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

Answer should not exceed one page or 250 words

11. (a) Explain briefly on the Biotechnology application.

Or

(b) Classification and biological importance of carbohydrates and Protein.

12. (a) Write about Biotechnological applications of rDNA technology.

Or

(b) Write a short note on Gene cloning and ethical issues.

13. (a) Explain Plant cell and Tissue culture.

Or

(b) Write short notes on Callus culture and Plant Micropropagation.

14. (a) Write about the Methods of gene transfer.

Or

(b) Explain the Scope of animal biotechnology.

15. (a) Explain Biogas Production.

Or

(b) What are the regulatory aspects of bio medical waste management? Explain.

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

Answer any **five** questions.

16. Write about the structure and function of cells - Prokaryotes and Eukaryotes.

17. Define Genetic Engineering? What are molecular tools used in genetic Engineering.

18. Explain the Plant genetic engineering and its application of crop improvement.

19. Define and classify transgenic plants and its application.

20. Describe the Scope of Animal biotechnology.

21. Write short notes on

    (a) Methods of gene transfer

    (b) Transgenic animals model for human disorders

22. Explain detailed accounts on Primary and Secondary metabolitics.

23. What is Bioremediation? Explain detailed accounts on Bioremediation of toxic metal ions?

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M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Nanoscience and Technology

INTRODUCTION TO NANOSCIENCE

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 1 = 10)

Answer **all** questions.

1. Nano wires are used in _____.

    (a) Transistors   (b) Resistors

    (c) Capacitors   (d) Transducers

2. Which one of the following is an example for semiconducting nanowires?

    (a) Nickel   (b) Platinum

    (c) Silicon   (d) All of the above

3. Which one of the following does not comes under the category ceramic materials?

    (a) Al_2O_3 (b) SiO_2

    (c) Si_2N_4 (d) SiC

4. The synthesized magnetic nano particles from _____ have been found to self-arrange automatically.

    (a) Zinc   (b) Copper

    (c) Iron   (d) Zirconium

5. Coating the nano crystals with the ceramics is carried that leads to

    (a) Corrosion   (b) Corrosion resistant

    (c) Wear and tear   (d) Soft

6. The extensively used nano particles as catalyst is _____.

    (a) Silver   (b) Copper

    (c) Gold   (d) Cerium

7. In which one of the following nanomaterial the quantum confinement occurs in two directions?

    (a) One dimensional

    (b) Two dimensional

    (c) Three dimensional

    (d) Zero dimensional

8. A semiconductor has _____ temperature coefficient of resistance.

    (a) Positive   (b) Zero

    (c) Negative   (d) None of the above

9. The bulk nanomaterials come under _____ dimensional nanomaterials?

    (a) Zero   (b) One

    (c) Two   (d) Three

10. Which one of the following is an example of zero-dimensional nanostructure?

    (a) Nanoparticles   (b) Nanorods

    (c) Nanotubes   (d) All of the above

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

Answer should not exceed one page or 250 words.

11. (a) Write short note on polymer- based nanocomposites.

Or

(b) Give brief note on Nanocomposites and their application.

12. (a) What are Nanowires in Nanotechnology?

Or

(b) What is carbon nanotubes? Explain it.

13. (a) What are the factors influencing the properties of Nanomaterials.

Or

(b) Difference between Nanoparticles and Nanotechnology.

14. (a) What are Nanomaterials? Explain their properties and application.

Or

(b) What are the different types of Nanomaterials? Explain it.

15. (a) What are 2D Nanostructure? Give example.

Or

(b) What are the types of Nanostructures are found in nature?

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Part C (5 × 8 = 40)

Answer any **five** questions.

16. What is Nanotechnology? What are the types of Nanotechnology (with example)?

17. Describe about Super hydrophobic surfaces and their application.

18. Define Nanoparticles. Explain the uses, size and properties.

19. Describe the notes on Single-walled carbon nanotubes. Explain the preparation, properties and their application.

20. Describe about the Bio-sensor and Bio-chips for Nanomedical application.

21. What are the differences between intermolecular and interparticle forces?

22. Describe about the Nanotechnology - based drug delivery system and their application.

23. What are fullerenes Nanomaterials? Explain the properties and their application.

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	533501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Nano Science and Technology

THIN FILM TECHNOLOGIES AND CHARACTERISTICS

(CBCS – 2022 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

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

1. For a thin film interference what should be the order of magnitude of the thickness between two layer in order to observer the interference effect

    (a) 10^{-2}m   (b) 10^{-4}m

    (c) 10^{-6}m   (d) 10^{-8}m

2. Which of the following is conserved when the light waves interfere

    (a) Intensity   (b) Energy

    (c) Amplitude   (d) Momentum

3. Vacuum evaporation and cathode sputtering are two methods used to produce which of the following types of components?

    (a) Diodes   (b) Thin-film

    (c) Thick-film   (d) Transistors

4.   Give the thickness range of the film used in thin film technology.

(a)   0.5 – 2.5 mills   (b)   0.02 – 8 mills

(c)   10 – 20 mills   (d)   0.05 – 0.07 mills

5.   How the process of film deposition carried out in cathode sputtering

(a)   Slower than evaporation method

(b)   Faster than evaporation method

(c)   Similar to same as evaporation method

(d)   All of the mentioned

6.   Which process is used to deposit metal on glass, ceramic or plastic?

(a)   Skin plating technique

(b)   Gas plating technique

(c)   Electro less plating technique

(d)   Electroplating technique

7.   Which of the following process is involved in thin film technology

(a)   Screen printing   (b)   Ceramic firing

(c)   Skin screening   (d)   All of the above

8.   An ancient process is used till today for production of circuit film is,

(a)   Silk screening technique

(b)   Surface mount technology

(c)   Ceramic printing technique

(d)   Screen printing technique

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9. What is the factor that differentiates between Electro less deposition and Catholic Deposition?

   (a) Nature of electrolyte

   (b) Cathode

   (c) External field

   (d) Anode

10. Which of the following can be used for producing oxide films on their surfaces during anodic oxidation?

   (a) La, Cen, PR, ND

   (b) He, Ne, AR, Kr

   (c) NH, FL, M.C., Live

   (d) Al, Ta, Nab

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

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

11. (a) Write about Hertz- Knudsen equation.

                    Or

   (b) Discuss about the features of Sputtering processes.

12. (a) Explain about the coalescence and depletion.

                    Or

   (b) Give the short notes Models for 3D nucleation.

13. (a) Give the short notes on Structure development in Deposition technology.

                    Or

   (b) How to control temperature in deposition technology?

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14. (a) Explain the structural aspects of epitaxial?

Or

(b) Write about the difference between homo and hetero-epitaxial?

15. (a) Write about optical characteristics of thin films.

Or

(b) Explain the application of multilayer film.

Part C (5 × 8 = 40)

Answer any **five** questions.

16. In detail, explain the role of thin film in devices?

17. Explain about the Plasma-plasma discharge?

18. Give the short notes on role of energy enhancement in nucleation.

19. Explain about the adsorption and surface diffusion in deposition technology.

20. Give brief notes on epitaxial of compound semiconductor?

21. Explain the Band-gap engineering?

22. How do we analysis thin film?

23. Explain about Electrical characteristics of thin films.

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