R6030	Sub. Code
	533101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Nano Science and Technology

BASICS OF MATHEMATICS AND QUANTUM MECHANICS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. What is relation between Beta and Gamma functions ?
2. Write down equation for Laguerre polynomials.
3. What is photons?
4. Write down Heisenberg uncertainty principle.
5. Draw the wave function for a particle in a box at the $n = 2$ energy level
6. Define quantum confinement.
7. Define exciton.
8. Draw the diagram for the donor level and acceptor level for n-type and p-type semiconductor.
9. What is depletion layer?
10. What is significance of Ohmic contact?

Part B (5 × 5 = 25)

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

11. (a) How does inverse transformation method works?

Or

(b) Prove the Legendre's theorem.

12. (a) Write down the limitations of the Classic theory.

Or

(b) Derive the wave equation for the one dimensional.

13. (a) Derive the equation for the quantum Free particles.

Or

(b) Explain resonant tunnelling diode.

14. (a) Explain dielectric constant of nanomaterials with respect to its size variation.

Or

(b) Explain the photo-induced electron transfer.

15. (a) Explain the band theory of solid with illustrations.

Or

(b) What is heterostructure and draw a diagram for the semiconducting heterostructure?

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Find the eigenvalue and eigenvector of the matrix $A = \begin{pmatrix} 7 & 3 \\ 3 & -1 \end{pmatrix}$.

17. Derive Schrodinger time dependent wave equation.

18. Derive density of states for one dimensional.

19. Discuss the changes in absorption and emission with particle size of nanomaterial.

20. Describe the density of state 2D, ID and OD with appropriate diagram.

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R6031	Sub. Code
	533102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Nanoscience and Nanotechnology

BASICS OF MATERIALS SCIENCE

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Define unit cell.
2. What is Frenkel defect?
3. What is spontaneous polarization?.
4. Define ionic solid.
5. What are nanosemiconductor devices?
6. Define specific heat.
7. Draw a structure of long chain polymer.
8. State the Hooke's in the elasticity.
9. What is point defect?
10. Define crystallographic grain boundary.

Part B (5 × 5 = 25)

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

11. (a) Discuss the crystal symmetry operations.

Or

(b) Draw a following planes in the XYZ coordinates (i) (001), (ii) (010), (iii) (100), (iv) (111). (v) (110).

12. (a) Explain mechanical property of solid.

Or

(b) What are differences between and diamagnetism and paramagnetism?

13. (a) Discuss the band structures of excitons.

Or

(b) Explain Dalton's atomic theory.

14. (a) Explain general characteristics of polymer.

Or

(b) Explain viscoelastic deformation.

15. (a) Explain the stacking faults defect.

Or

(b) Explain Hall Petch strengthening behaviour.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Discuss the seven crystal system.

17. Derive equation for the Ferimi-Dirac distribution.

18. Discuss the temperature dependent electrical conductivity.

19. Write an essay on classification of polymer.

20. Discuss the role of defects on the properties of solids.

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R6032	Sub. Code
	533103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Nanoscience and Nanotechnology

BASIC BIOTECHNOLOGY

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. Write the significance of buffer in biological system.
2. What is Vmax and Km?
3. Define Gene cloning.
4. What is DNA ligase?
5. Define Callus.
6. What is meant by Somatic Embryogenesis?
7. Write the significance of Stem cell.
8. Define gene transfer.
9. What is meant by Phytoremediation?
10. What is Biogas?

Part B (5 × 5 = 25)

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

11. (a) Describe the structure and properties of water.

Or

(b) How will you explain structure, classification and significance of aminoacids?

12. (a) Describe the types of Vectors applied in Cloning Strategies.

Or

(b) Describe the merits and demerits of cloning.

13. (a) Give an account of Plant micropropagation.

Or

(b) Discuss the impact of transgenic plants in plant biotechnology.

14. (a) How will you maintain cell lines in the laboratory?

Or

(b) Elaborate the basic techniques of animal cell culture.

15. (a) Write a short note on primary and secondary Metabolites.

Or

(b) Discuss the concept of bioremediation with example.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Describe the structure and function of Prokaryotic and eukaryotic cell.

17. Explain the steps involved in Recombinant DNA technology through a diagrammatic representation.

18. Explain the applications of Plant genetic engineering in crop improvement.

19. Discuss the different methods of gene transfer in Biotechnology.

20. Explain the production steps, advantages and applications of Single Cell Protein (SCP).

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R6033	Sub. Code
	533104

M.Sc. DEGREE EXAMINATION, NOVEMBER 2021.

First Semester

NanoScience and Technology

INTRODUCTION TO NANOSCIENCE

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. What is surface area?

2. Define tunnel effect.

3. What is supersaturation?

4. What is aggregation?

5. Define quantum dots.

6. Write short notes on Fullernes.

7. State the Coulomb's law.

8. What are the applications bilayers?

9. Define Nanofluidics.

10. Define Brownian movement.

Part B (5 × 5 = 25)

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

11. (a) Explain quantum confinement?

Or

(b) Why band gap increases in semiconductor nanomaterials compared to its bulk form?

12. (a) Explain the fundamentals of nucleation and growth.

Or

(b) Discuss Spinodal decomposition.

13. (a) Explain intrinsic and extrinsic semiconductors.

Or

(b) Compare the physical properties of nanomaterials and bulk materials.

14. (a) Explain different structure of RNA with appropriate picture.

Or

(b) Briefly explain one-dimensional nanomaterial with suitable example.

15. (a) What are difference between intermolecular and interparticle force?

Or

(b) Explain self-assembly thermodynamics of micelles.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Write an essay on composite materials.

17. Discuss the thermodynamics of phase transition.

18. Write an essay on CNT and Fullerenes.

19. Explain covalent bond interaction based on valance band theory and molecular orbital theory.

20. Write about interaction between nanomaterials and proteins, nanomaterials and cell surface receptors with proper examples.

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R6034	Sub. Code
	533501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Nanoscience and Technology

THIN FILM TECHNOLOGIES AND CHARACTERISTICS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is a thin film?

2. How does sputtering deposition work?

3. What is surface diffusion?

4. Write any two uses of self assembly?

5. What is the difference between aggregation and agglomeration?

6. What is Adsorption?

7. What is epitaxy process?

8. What is the use of semiconductor?

9. How do you make a thin film?

10. What is multilayer films?

Part B (5 × 5 = 25)

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

11. (a) Write the derivation of Hertz-Knudsen equation.

Or

(b) Explain detailed about Reactive sputtering.

12. (a) What is nucleation and growth and explain their difference?

Or

(b) Define Role of energy enhancement in nucleation.

13. (a) Write short notes on Deposition technology of

(i) Stress

(ii) Adhesion

Or

(b) Explain about Growth monitoring of deposition technology.

14. (a) Describe the lattice misfit and imperfections.

Or

(b) Make notes on Strained layer epitaxy.

15. (a) Explain about Optical properties of thin film.

Or

(b) Write the application of thin film.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Explain about

    (a) Plasma structure

    (b) Microwave excitation.

17. What is Self assembly? Explain about Self assembly mechanisms and controls for nanostructures of 0 and 1 dimension?

18. Briefly explain about Semiconductor devices and applications.

19. Describe

    (a) PVD and

    (b) CVD

20. Explain detailed accounts on Electrical and Mechanical properties of thin films.

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R6035	Sub. Code
	533301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Nanoscience And Technology

NANOBIOTECHNOLOGY AND NANOMEDICINE

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is mean by MWCNT and Nanomotors?

2. List out the Nanomaterials used in medical field.

3. Define DNA biosensor.

4. Comment on Nanostructured solar cells.

5. Define synthetic Nanocomposite.

6. Write any two applications of Nanotechnology in Agriculture.

7. Mention the types of Nanoparticles used in MRI.

8. Define BioMEMs.

9. Define Gene therapy.

10. What are Quantum dots?

Part B (5 × 5 = 25)

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

11. (a) Give an account of the significance of Nanowire.

Or

(b) Illustrate the types of Carbon Nanotube and its application.

12. (a) Explain the role of self assembled mono layers in Nanobiometrics.

Or

(b) How will you explain the concept of DNA as a smart glue?

13. (a) Give an account of Graft copolymerization.

Or

(b) Discuss the characterization and applications of Metal based nanocomposite.

14. (a) How will you explain the advantages of Imaging technology?

Or

(b) Write a short note on Biosensors.

15. (a) Discuss the merits of drug delivery in Nanobiotechnology.

Or

(b) Discuss in detail about the cell therapy.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Explain the application of Nanocarriers and also add a note on the role of Nanomedicine in diagnosis and treatment.

17. Explain the types of biosensors and write the efficiency of 3D structure of proteins as biosensor.

18. Discuss the salient features of natural fibre composite and its application.

19. Explain the role of nano particles for bio analytical applications.

20. Explain the applications of Nanobased drug delivery for non communicable diseases.

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R6036	Sub. Code
	533302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Nanoscience and Technology

NANOELECTRONICS AND NANODEVICES

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What are the nanodevices?
2. What is lithography?
3. What is meant by memory devices?
4. Write any two uses of sensor?
5. What are the different types of electrochemical cells?
6. What is GMR effect?
7. What is Transistor?
8. Define nanorobatics.
9. What is electroluminescence process?
10. What is quantum dot?

Part B (5 × 5 = 25)

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

11. (a) Write about Basics of nanoelectronics.

Or

(b) Explain detailed about physical fundamentals of nanoelectronics.

12. (a) Make notes on Nano ferroelectrics.

Or

(b) Write short notes on Calorimetric sensors.

13. (a) Write short notes on spin dependent tunneling.

Or

(b) Explain about spin transfer/torque.

14. (a) Describe Nano scale MOSFET.

Or

(b) Make notes on Micro and nano mechanics.

15. (a) Explain about Quantum cascade lasers.

Or

(b) Write Electronic properties of carbon based nano materials.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain detail about Basics of lithographic techniques for nanoelectronics.

17. Write about Identification of hazardous solvents and gases.

18. Briefly explain about Landau Lifshitz Gilbert equation.

19. Describe photochemical molecular nano devices.

20. Explain detailed accounts on LED and their applications.

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R6037	Sub. Code
	533303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Nanoscience and Technology

NANO ENGINEERING

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. How semiconductors are fabricated by lithography method?
2. Mention the advantages of magnetic data storage.
3. How carbon materials are classified? Give the examples.
4. Explain the unique property of RGO.
5. Comment on the effect of nano-electromechanical system.
6. Short note on magnetic sensor.
7. Write short note on effect of size dependent properties of Nanomaterials.
8. What are the difference between Rashba couplings and spin orbit couplings?
9. Define the hybridisation.
10. Draw the schematic diagram of electrochemical cell.

Part B (5 × 5 = 25)

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

11. (a) What is meant by N-type semiconductor? Discuss the synthetic route and application of N-type semiconductor.

Or

(b) Write a short note on the properties of magnetic data storage material. Give the three examples.

12. (a) Discuss the following terms.

(i) Synthesis procedure of carbon nanotubes. (2)

(ii) Application of carbon nanotubes. (2)

(iii) Properties of carbon nanotubes. (1)

Or

(b) Describe the role of carbon material in energy storage devices.

13. (a) Bring out significance of thermal sensor and mechanical sensor in nano electronic device.

Or

(b) Write the Schematic diagram and working principle of micro actuators.

14. (a) Make a short note on:

(i) Spin polarized electron tunnelling. (3)

(ii) Datta-das spin field effect transistor. (2)

Or

(b) How to utilize the Rashba effect in spin field effect transistor?

15. (a) What are the importance of semi conducting polymer? Explain their types with suitable examples. Mention their properties.

Or

(b) What is liquid crystallinity? Explain their preparation and properties.

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Write a working principle of Electron holography with schematic diagram.

(b) What are the differences between the direct and indirect band gap materials? Explain their types with suitable examples.

17. Write the structure and properties of Carbon materials. Give an account on merit and demerit of RGO materials.

18. How nanomaterials are used in design of Nano electronic device. Write an advantages of magnetic sensor.

19. (a) Describe the electron transport in magnetic multilayers. (5)

(b) Why is spintronic important? Explain their properties. (5)

20. Make detail note on following steps in Electrochemical cell.

(a) Injection. (2)

(b) Transport. (2)

(c) Exciton Formation. (3)

(d) Light emission. (3)

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R6038	Sub. Code
	533503

M.Sc. DEGREE EXAMINATION, NOVEMBER 2021.

Third Semester

Nanoscience and Nanotechnology

MICROSYSTEM TECHNOLOGY

(CBCS – 2019 onwards)

Time : Three Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is CVD?
2. Define Evaporation.
3. Define Etching process.
4. Comment on Insulators.
5. What is USC?
6. What is mean by radiation?
7. Define Nanobiosensor.
8. What is fluid pressure sensor?
9. Define MEMS and its applications
10. What is microsystem technology?

Part B (5 × 5 = 25)

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

11. (a) Describe in detail about Physical vapour deposition method.

Or

(b) Give an account of Fabrication Patterning approaches.

12. (a) Explain fabrication process of Dry etching technology for semiconductors.

Or

(b) How will you explain Microsystem fabrication technique?

13. (a) Discuss in detail about lithography technique and its types.

Or

(b) Give an account of Silicon MEMS fabrication technology.

14. (a) Describe in detail about the packaging of MEMS device.

Or

(b) Briefly explain about the overview of Pressure sensors.

15. (a) Write a short note on the Non silicon MEMS fabrication techniques.

Or

(b) Give an account of Si Carbide MEMS.

Part C

(3 × 10 = 30)

Answer any **three** questions.

16. Explain the Chemical vapour deposition methods in detail.

17. Explain the technology of Silicon fabrication processes and its applications.

18. Describe about advanced lithographic techniques

19. Explain the applications of Bionanosensor devices in the medical field

20. How will you explain Micro stereolithography technique?

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