R5609

Sub. Code
522401/521403

M.Sc. DEGREE EXAMINATION, APRIL – 2021

Fourth Semester

Physics /Physics (Spl. In Biosensors)

MATERIAL SCIENCE

(CBCS – 2016 onwards)

(Common for M.Sc. Physics / M.Sc. Physics Spl. in Biosensors)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

All questions carry equal marks.

1. What causes fatigue in a material?
2. State Hooke's law.
3. Give two postulates of kinetic theory of gases.
4. What is the use of vacuum pump?
5. Justify, LASER is a monochromatic light.
6. State the condition to achieve population inversion in laser.
7. What is the role of matrix in a composite material?
8. How can composite materials help to protect the environment?
9. What is MEMS?
10. What is a piezoelectric material?

Part B (5 × 5 = 25)

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

11. (a) Describe in detail the applications of polymers.

Or

(b) Write a detailed note on the mechanism of condensation polymerization.

12. (a) Pen down the assumptions and postulates of kinetic theory of gases.

Or

(b) Illustrate the working of turbo molecular pump with neat sketch.

13. (a) Discuss the three and four level systems in population inversion.

Or

(b) Mention the types and applications of Q-switching.

14. (a) Write a notes on

(i) metal matrix composites and

(ii) ceramic matrix composites.

Or

(b) Discuss the cement matrix composite for smart structures.

15. (a) Discuss in detail the vibration control of shape memory alloys with an example.

Or

(b) Write a note on the applications of porous silicon in MEMS fabrication.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

Each questions carry equal marks.

16. A relatively large plate of a glass is subjected to a tensile stress of 40 MPa. If the specific surface energy and modulus of elasticity for this glass are 0.3 J/m^2 and 69 GPa, respectively, determine the maximum length of a surface flaw that is possible without fracture.

17. Discuss in detail the thin film deposition by thermal evaporation method.

18. What are photorefractive materials? Explain the fundamentals of photorefractive phenomena. Also discuss how LASER works based on photoelectric effect.

19. Assume that the composite described has a cross-sectional area of 320 mm^2 (0.50 $in.^2$**)** and is subjected to a longitudinal load of 44,500 N (10,000 lbf).

    (a) Calculate the fiber—matrix load ratio.

    (b) Calculate the actual loads carried by both fiber and matrix phases.

    (c) Compute the magnitude of the stress on each of the fiber and matrix phases.

20. What are shape memory alloys? With a neat sketch explain the strain-stress characteristics of SMAs.

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R5610

Sub. Code
522402

M.Sc. DEGREE EXAMINATION, APRIL – 2021

Fourth Semester

Physics (Spl.in Biosensors)

MOLECULAR SPECTROSCOPY

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** questions.

1. What is meant by bond length?

2. Why the hybridization of 2s and 3p orbitals is not possible?

3. Why homonuclear diatomic molecules such as H_2 do not have pure rotational spectrum?

4. Distinguish oblate and prolate symmetric tops.

5. What is mutual exclusion principle?

6. Why anti-Stokes lines are less intense than Stokes lines?

7. What is meant by population inversion?

8. What is hyper Raman scattering?

9. What is the principle of nuclear quadrupole resonance?

10. Give Bloch equation and explain the terms in it.

Part B (5 × 5 = 25)

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

11. (a) Explain the energy changes involved in a covalent bond formation on the basis of valence bond theory.

Or

(b) What is hybridization of orbitals? Give the necessary condition and characteristics of hybridization of atomic orbitals.

12. (a) Outline the importance of the study of quadrupole hyperfine interaction in microwave spectra.

Or

(b) The first line in the pure rotational spectrum of HCl appears at 21.18cm^{-1}. Calculate bond length of the molecule. Given atomic masses of H and Cl are 1.008 and 35.45 amu respectively.

13. (a) Explain the vibrational course structure of the electronic band.

Or

(b) Explain the various factors that affect the vibrational frequency in poly atomic molecules.

14. (a) Describe in detail the photoacoustic Raman scattering.

Or

(b) What is multiphoton absorption? Explain with the example of two photon absorption process.

15. (a) Describe in detail the determination of crystal symmetry using Mössbauer spectroscopy.

Or

(b) Discuss in detail the spin-spin coupling in NMR spectrum.

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

Answer any **three** questions.

16. Explain the formation of hydrogen molecule based on Heitler – London theory along with the explanation of the potential energy curve.

17. Explain in detail how the information about molecular structure is obtained from Raman spectroscopy.

18. Write a detailed account on how intensities of transitions between vibrational states are calculated using Franck Condon's principle.

19. Give a detailed note on the principle of Coherent Anti-Stokes Raman Scattering and compare it with Raman spectroscopy.

20. Discuss the principles of NMR spectroscopy and explain the spin-lattice interaction in it.

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R5611	Sub. Code 522507

M.Sc DEGREE EXAMINATION, APRIL – 2021

Fourth Semester

Physics (Spl. Biosensors)

NANOMATERIALS

(CBCS – 2016 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

All questions carry equal marks.

1. Kirkendall effect
2. One dimensional Nanostructure
3. LB films
4. Nanocomposites
5. Self assembled Monolayer
6. Electrospraying
7. Etching (dry and wet)
8. MBE
9. Applications of Nanomaterials
10. Lattice Mismatch

Part B (5 × 5 = 25)

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

11. (a) Briefly explain about the role played by surface area in enhancing the properties of Nanomaterials.

Or

(b) Write notes on Kirkendall effect.

12. (a) Write short notes on multi layer Nanocomposites.

Or

(b) Briefly explain two-dimensional Nanostructure & Zero dimensional Nanostructure.

13. (a) Discuss any two Fabrication method of CNT.

Or

(b) Write short notes on SAM & LB films.

14. (a) Elucidate types of Epitaxial growth techniques.

Or

(b) Write short notes on Top down method and Bottom up method.

15. (a) Applications of Nanomatenals.

Or

(b) Write notes on Dip Pen Lithograp.

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss the surface defect in Nanomaterials.

17. Write notes on:

    (a) Metal Nano cluster

    (b) Semi conductor

    (c) Nanocomposites

18. Discuss in detail about?

    (a) Dip Pen Nanolithography

    (b) Etching process

19. Write notes on:

    (a) Mechanochemical process

    (b) Inert gas condensation

20. Comment on the future applications of Nanostructure and their advantage and disadvantage?

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