(DPHY 21)

M.Sc. (Final) DEGREE EXAMINATION, DECEMBER 2008.

Second Year

Physics

Paper V — ELECTROMAGNETIC THEORY AND MODERN OPTICS

Time : Three hours **Maximum : 100 marks**

Answer any FIVE questions.

All questions carry equal marks.

1. Obtain the boundary conditions that are to be satisfied by the electric and magnetic fields at the surface of separation of two dielectric media.

2. Derive Fresnel's equations for reflection and refraction of electromagnetic waves at a plane boundary separating two media for TE and TM polarizations. Explain total internal reflection.

3. (a) Discuss the absorption and emission processes. What are Einstein coefficients?

(b) Describe the process of amplication in a medium.

4. Explain the line broadening mechanism in laser output. Describe the working of GaAs laser with a neat sketch.

5. What are the advantages of a hologram over an ordinary photograph? Explain the main characteristics of holograms.

6. Give a brief account of hologram recording materials. Comment on film resolution and source coherence and stability.

7. Solve the wave equation for a step index fibre. Obtain an expression for the light gathering power of an optical fibre.

8. Explain how optical fibres are prepared? Mention the different materials used for optical fibres and their relative merits and demerits.

9. Answer any TWO of the following :

(a) Anomalous dispersion

(b) Boltzman's principle and the population of energy levels

(c) Types of holograms

(d) Attenuation in optical fibres.

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(DPHY 22)

M.Sc. (Final) DEGREE EXAMINATION, DECEMBER 2008.

Second Year

Physics

Paper VI — NUCLEAR PHYSICS, MOLECULAR AND RESONANCE SPECTROSCOPY

Time : Three hours **Maximum : 100 marks**

Answer any FIVE questions.

All questions carry equal marks.

1. (a) What is meant by nuclear spin and nuclear magnetic moment? How is the magnetic moment determined experimentally?

(b) Explain charge and spin dependence of nuclear forces.

2. (a) Explain the shell model of the nucleus. How did it explain magic numbers?

(b) Discuss the formulation of semi empirical mass formula.

3. (a) What are the general features and efficiency of a nuclear reactor?

(b) Explain Gamow's theory of α-decay.

4. (a) Explain Fermi's theory of β-decay. What factors influence the β-spectrum?

(b) Explain nuclear isomerism.

5. (a) Explain the principle of NMR and obtain the resonance condition.

(b) Describe the working of NMR spectrometer and mention its applications.

6. (a) What is nuclear quadrupole resonance? What are the fundamental requirements of NQR spectroscopy?

(b) Draw the block diagram of NQR spectrometer and explain its working.

7. (a) Give the theory of diatomic linear symmetric top.

(b) How the rotational spectra of diatomic molecules can be explained based on this model.

8. (a) Obtain the energy levels and vibrational spectrum of a diatomic molecule treating it as a simple harmonic oscillator.

(b) What are PQR branches? Explain their significance.

9. Write notes on any TWO of the following :

(a) Meson theory of nuclear forces

(b) Properties of elementary particles

(c) ESR spectroscopy

(d) Rigid rotator.

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M.Sc. (Final) DEGREE EXAMINATION, DECEMBER 2008.

Second Year

Physics

Paper VII — SOLID STATE PHYSICS — I

Time : Three hours **Maximum : 100 marks**

Answer any FIVE questions.

All questions carry equal marks.

1. Give a database account of Crystal point groups and space groups. Explain the structure of diamond.

2. Explain the concept of reciprocal lattice. How is this concept useful in determining the structure of crystals from X-ray diffraction?

3. Differentiate between primary and secondary bonds giving suitable examples. How are elastic constants of solids determined?

4. Give the general theory of harmonic approximation and comments on its results. What do you mean by quantization of Lattice vibrations?

5. Work out an expression for the specific heat of solids following Einstein's model. How does specific heat depend on temperature and to what extent does this modd agree with experimental results?

6. Explain the consequences of periodicity in a lattice. Give a brief wave mechanical interpretation of energy bonds.

7. Give the theory of nearly free electron model. How does it lead to zone schemes for energy bands?

8. Obtain expression for the population of donor and acceptor levels in the state of thermal equilibrium in extrinsic semiconductors. Explain the temperatures dependence of electrical conductivity for extrinsic semiconductors.

9. Write notes on any TWO of the following :

(a) Crystal systems.

(b) Ball and spring model of a harmonic crystal.

(c) Kronig - Penny model.

(d) Photoelectric effect.

wk 7

(DPHY 24)

M.Sc. (Final) DEGREE EXAMINATION, DECEMBER 2008.

Second Year

Physics

Paper VIII — SOLID STATE PHYSICS — II

Time : Three hours **Maximum : 100 marks**

Answer any FIVE questions.

All questions carry equal marks.

1. What is meant by local field in a solid dielectric? Explain dielectric polarization and the sources of polarizability in a solid.

2. Name a few materials that exhibit ferroelectricity. Discuss the thermodynamic theory of ferroelectric transitions. Explain antiferroelectricity.

3. What are Schottky and Frenkel defects? Obtain an expression for Frenkel defect concentration. What are planar imperfections?

4. What is VanVlek paramagnetism? Explain nuclear paramagnetism and describe how cooling is achieved by adiabatic demagnetization?

5. Give an account of Weiss theory of ferromagentism and bring out its merits and demerits.

6. Explain the Neel's model of ferrimagnetism. Explain how magnetically ordered structures are determined.

7. Explain superconductivity. Describe the effect of (a) magnetic field (b) frequency and (c) isotopes on superconductors. Mention a few industrial applications of superconducting materials.

8. How are cooper pairs formed? Describe the BCS theory of superconductivity and compare its predictions with experiment.

9. Write notes on any TWO of the following :

(a) Dielectric losses.

(b) Grain boundaries.

(c) Heisenberg model of ferromagnetism.

(d) High temperature superconductors.

wk 7

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(DPHY 24)