Roll No. _____ [Total No. of Pages : 2

PG2S-066-B-22

M.Sc. II Semester (CBCS) Degree Examination

PHYSICS

Basic Nuclear Physics

Paper : HCT- 2.1

Time : 3 Hours **Maximum Marks : 80**

Instructions to candidates:

Answer **all** questions of **15** Marks each and any **two** questions of **10** marks each.

1. a) From Helium nuclei scattering, estimate radius of gold nucleus.
   b) What do you mean by isotones? Give example. **(12+3)**

(OR)

2. a) Give any three ground state properties of deuteron.
   b) Prove that nuclear forces are charge independent. **(5+10)**

3 a) Compare and contrast pickup and stripping reactions with examples.
   b) Derive an expression for threshold energy of an endoergic reaction. **(8+7)**

(OR)

4. a) Derive Bethe- Weizsacker semi empirical mass formula.
   b) Discuss the stability limits against spontaneous fission. **(10+5)**

5. Give an account of Fermi theory of beta decay. **(15)**

(OR)

6. Discuss the interaction of gamma rays with matter. **(15)**

7. Discuss the fundamental interactions in nature and their general feature. **(15)**

(OR)

8. Derive four factor formula and give importance of each term. **(15)**

9. Nuclear magnetic dipole moment. (10)

10. Compound nucleus theory of nuclear reactions. (10)

11. Construction and working of GM Counter. (10)

12. Conservation laws in elementary particle interactions. (10)

Roll No. _____ [Total No. of Pages : 2

PG2S-069-B-22

M.Sc. II Semester (CBCS) Degree Examination

PHYSICS

Elementary Concepts in Physics

Paper : OET - 2.1

Time : 3 Hours **Maximum Marks : 80**

Instruction to Candidates:

*Answer **all** question of **15** marks each and any **two** questions of **10** marks each.*

1. a) State and prove the law of conservation of angular momentum. (7+8)

   b) State and explain Kepler's laws of planetary motion. Prove that areal velocity is constant.

(OR)

2. a) Derive the expression for gravitational potential energy. (7+8)

   b) Explain in detail the geostationary and polar satellites.

3. a) Define simple harmonic motion. Derive an expression for kinetic and potential energy of a particle executing SHM. (7+8)

   b) Define interference of light. Explain Youns's double slit experiment.

(OR)

4. a) Define the polarization of light and explain the types of polarization. (7+8)

   b) Explain the construction and working of astronomical telescope.

5. a) Write a note on Coloumb's law of electrostatic force. (6+9)

   b) State and derive Biot-Savart law.

(OR)

6. a) State and explain Ohm's law. (7+8)

b) What is Electric generator? Distinguish between alternating and direct current.

7. a) Explain the working of a Carnot's engine with the help of a neat labelled diagram. (10+5)

b) State and explain the second law of thermodynamics with its consequences.

(OR)

8. a) Define elasticity. Explain the different types of elastic moduli. (7+8)

b) State and explain Hooke's law.

9. Distinguish between conservative and non-conservative forces. (10)

10. Explain the conditions of constructive and destructive interference. (10)

11. Explain Faradays law of electromagnetic induction. (10)

12. Write a note on Carnot engine. (10)

Roll No. _____ [Total No. of Pages : 2

PG2S-067-B-22

M.Sc. II Semester (CBCS) Degree Examination

PHYSICS

Basic Solid State Physics

Paper : HCT - 2.2

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer all questions of 15 marks each and any two questions of 10 marks each.

1. a) Explain the terms: Point Groups and Space Groups.
   b) Define "Reciprocal lattice". Describe the Wigner-Seitz unit cell for any two-dimensional Bravais lattice. **(6+9)**

(OR)

2. a) Explain the crystal structures of NaC1 and ZnS.
   b) Define "geometrical structure factor". Derive an expression for the scattering amplitude in terms of this factor. **(6+9)**

3. a) Explain vander Waals – London interaction between two neutral atoms of an inert gas.
   b) Show that the Madelung constant, α, for the infinite one-dimensional line of ions of alternating sign, with distance, R, between the ions is $\alpha = 2 \text{ in} 2$. **(8+7)**

(OR)

4. a) Describe the phonon dispersion relation of a linear monatomic lattice.
   b) Show that there are as many modes of vibration as there are mobile atoms in a finite one-dimensional lattice of identical atoms. **(8+7)**

5. a) Explain 'Free-electron model". Using this model, show that $k_F = (3\pi^2 n)^{1/2}$.
   [k_F – Radius of the Fermi sphere in k-space, n – Electron concentration].
   b) Discuss the Kronig-Penney one-dimensional energy band model by considering the case for which the potential barriers become delta functions. **(7+8)**

(OR)

6. a) Distinguish between Frenkel and Schottky point defects.
   b) What is a "Frank-Read source"? Explain Frank-Read mechanism of dislocation multiplication. **(6+9)**

7. a) Explain the Hall effect in a two-carrier semiconductor.

b) Show that Hall constant, $R = (p \mu_h^2 - n \mu_e^2) / [e (n \mu_e + p \mu_h)^2]$, where n, p are electron and hole concentrations and μ_e, μ_h are electron, hole mobilities respectively. **(9+6)**

(OR)

8. a) What is "persistent current"? Explain Meissner effects for a bulk superconductor exhibiting a complete Meissner effect.

b) Explain the thermodynamics of superconducting transition. **(9+6)**

9. Explain Bragg diffraction condition in terms of reciprocal lattice. **(10)**

10. Write a note on quantization of lattice vibrations. **(10)**

11. Write a note on Grain boundary and Stacking faults. **(10)**

12. Write a brief note on Type-I and Type-II superconductors. **(10)**

Roll No. _____ [Total No. of Pages : 2

PG2S-070-B-22

M.Sc. II Semester (CBCS) Degree Examination

PHYSICS

Modern Physics

Paper : OET - 2.2

Time : 3 Hours **Maximum Marks : 80**

Instructions to Candidates:

Answer **All** questions of **15 marks** each and **Two** questions of **10 marks** each.

1. a) Write down the basic properties of atomic nucleus.
   b) Explain the natural radioactivity and laws of radioactivity decay. **(6+9)**

(OR)

2. a) Explain the construction and working of GM counter.
   b) Write down the medical and industrial applications of nuclear radiations. **(9+6)**
3. a) Define Space lattice and the unit cell. Mention the different types of crystal systems.
   b) Describe the ZnS crystal structure. **(7+8)**

(OR)

4. a) What are the different types of bonding in solids? Explain.
   b) Explain zero resistivity and Meissner effect in superconductors. **(8+7)**

5. a) What is population inversion? Explain the different population inversion techniques.
   b) Describe the principle and working of Nitrogen Laser with neat diagram. **(5+10)**

(OR)

6. a) What is holography? Explain the principle of recording and reconstruction of holograms with neat diagram.
   b) Write down the applications of Lasers. **(10+5)**

7. a) Define Plasma and explain its nature and occurrence.

   b) Explain the motion of charged particles in magnetic field. **(8+7)**

(OR)

8. a) What is diode? Mention the different types of diodes.

   b) What is transistor? Describe transistor characteristics for common emitter configuration. **(6+9)**

9. Describe the process of Nuclear fusion and fission processes with an example. **(10)**

10. Describe the features of nearly free electron model. **(10)**

11. Describe the construction and working of Semiconductor Laser. **(10)**

12. Write a note on PN-junction and its biasing techniques. **(10)**
