2103000206021001

EXAMINATION FEBRUARY-MARCH 2024

BACHELOR OF SCIENCE (SIXTH SEMESTER)

PHYSICS PAPER - VI (PH-606-CLASSICAL MACHANICS AND SOLID STATE PHYSICS)-LEVEL 2

[**Time: As Per Schedule]** **[Max. Marks: 50]**

Instructions:

1. Fill up strictly the following details on your answer book

a. Name of the Examination : **BACHELOR OF SCIENCE (SIXTH SEMESTER)**

b. Name of the Subject : **PHYSICS PAPER - VI (PH-606-CLASSICAL MACHANICS AND SOLID STATE PHYSICS)-LEVEL 2**

c. Subject Code No : **2103000206021001**

2. Sketch neat and labelled diagram wherever necessary.
3. Figures to the right indicate full marks of the question.
4. All questions are compulsory.
5. Symbols used in the paper have their usual meaning.
6. Scientific calculator may be used.

Seat No:

Student's Signature

Q.1 Answer the following questions in brief: (Attempt Any Ten) **10**

1. Give some phenomenon arising due to coriolis force.
2. Define critical temperature in super conductor
3. Why is moment of inertia not consider a vector nor a scalar?
4. Define coherent length.
5. Write down the equation of constraint for a rigid body.
6. What is the difference between Fermi surface and Fermi sphere?
7. What is meant by Brillouin zone?
8. What are the Euler angle?
9. What is the first brillouin zone?
10. Are superconductors diamagnetic or ferromagnetic?
11. What is meant by a rigid body?

Q.2 Attempt Any One of the following in details: **7**

(a) What is coriolis force? show that total coriolis force acting on a body of mass m in a rotating frame $-2m(\vec{w} \times \vec{v})$ where w angular velocity of the rotating frame and $\vec{v}$ is the velocity of the body in rotating frame

(b) Discuss the effect of Coriolis force on a freely falling particle.

Q.2 Attempt any one of the following **3**

(a) Find the horizontal component of the coriolis force acting on a body of mass 2 kg moving northward with a horizontal velocity of 20m/s, at 30° N latitude on earth.

(b) A body is falling freely from a height of 125 m above the surface of the earth, Calculate the time of flight and displacement due to coriolis force at the north pole.

Q.3 Attempt any one of the following in details: **7**

(a) Explain the term moment of inertia and product of inertia and inertia tensor of a rigid body.

(b) Obtain Euler's equation of motion for rigid body.

Q.3 Attempt any one of the following: **3**

(a) A solid cylinder of mass 5 kg rotates about its axis with angular speed 200 rad/s. The radius of the cylinder is 0.1 m. What is the K.E. associated with the rotation of cylinder? what is the magnitude of the angular momentum of cylinder about its axis?

(b) Show that the moment about its axis? inertia of a spherical shell having a mass M and internal and external radii r_1 and r_2 is $\frac{2M}{5}\frac{r_2^5 - r_1^5}{r_2^3 - r_1^3}$

Q.4 Attempt any one of the following in details: **7**

(a) What is Meissner Effect? Further explain the effect of magnetic field on the superconducting state.

(b) Derive the London equation and discuss how does it help in explaining the superconducting state.

Q.4 Attempt any one of the following: **3**

(a) The number density of free electrons in some metal is 1.34×10^{29} m^{-3}. Calculate the penetration depth predicted by the London model, assuming that all of the free electrons are superconducting. $m_e = 9.1 \times 10^{-31}$ kg, $\mu_0 = 4\pi \times 10^{-7}$ SI, $e = 1.6 \times 10^{-19}$ C

(b) Explain the difference between type-I and type-II superconductors.

Q.5 Attempt any one of the following in details: **7**

(a) Describe Harrison's construction of free electron Fermi surface in two dimension.

(b) What are brillouin zone? Discuss the construction of first three brillouin zone for a square lattice. Also draw the figure of First, second and third brillouin zone in reduce zone scheme.

Q.5 Attempt any one of the following: **3**

(a) Define electron orbits, open orbit and hole orbits with necessary diagram.

(b) Draw the energy bands of a linear lattice in extended, reduce and periodic zone schemes.

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