



RAN-2103000206021001

B. Sc. (Sem. - VI) Examination September - 2025

Physics (Paper - PH-606)

Classical Mechanics and Solid State Physics

Time: 2 Hours]

[Total Marks: 50

સૂચના : / Instructions

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.

Fill up strictly the details of signs on your answer book

Name of the Examination:

B. Sc. (Sem. - VI)

Name of the Subject :

Physics (Paper - PH-606) Classical Mechanics and Solid State Physics

Subject Code No.: **2103000206021001**

Seat No.:

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Student's Signature

- (2) Draw neat diagrams wherever necessary.
- (3) Symbols used in the paper have their usual meaning.
- (4) Figures to the right indicate full marks of the question.
- (5) Scientific calculator may be used

Q. 1. Answer the following questions in brief: (Attempt any ten)

(10)

1. Explain the term critical magnetic field in superconductor
2. What is meant by Brillouin zone?
3. On which factor Fermi surface shape depends ?
4. Distinguish between a symmetric top, spherical top & asymmetric top.
5. Define London penetration depth.
6. What condition do superconductor require ?
7. Why is moment of inertia not consider a vector nor a scalar ?
8. Under what condition coriolis acceleration present ?

9. How Does Coriolis Force Effect Wind Direction?
10. What is a inertial frame ? Give illustration.
11. Give some phenomenon arising due to coriolis force.

Q. 2. a. Attempt any one of the following in details: (07)

1. Discuss the effect of Coriolis force on a freely falling particle.
2. What is coriolis force ? Show that total Coriolis force acting on a body of mass m in a rotating frame $-2m(\vec{\omega} \times \vec{v})$ where $\vec{\omega}$ angular velocity of the rotating frame and $\vec{v}$ is the velocity of the body in rotating frame

Q. 2. b. Attempt any one of the following (03)

1. How does the coriolis force affect the flow of the wind?
2. A body is falling freely from a height of 2356 m above the surface of the earth. Calculate the time of flight and displacement due to coriolis force at the north pole.

Q. 3. a. Attempt any one of the following in details: (07)

1. Explain rotational kinetic energy of rigid body.
2. Explain the term moment of inertia and product of inertia and inertia tensor of a rigid body.

Q. 3. b. Attempt any one of the following: (03)

1. The moment of inertia of a ring about an axis perpendicular to its plane and passing through its centre is MR^2 where M is the mass of the ring and R is its radius, find the moment of inertia about an axis perpendicular to its plane and passing through the circumference
2. Show that the moment of 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. a. Attempt any one of the following in details: (07)

1. What is Meissner Effect? Further explain the effect of magnetic field on the superconducting state.
2. Give an elementary treatment of BCS theory of superconductivity

Q. 4. b. Attempt any one of the following: (03)

1. Explain classification of superconductor.
2. The number density of free electrons in aluminium is $1.629 \times 10^{29} \text{ m}^{-3}$. Calculate the penetration depth predicted by the London model, assuming that all of the free electrons are superconducting.
 $m_e = 9.1 \times 10^{-31} \text{ kg}$, $\mu_0 = 4\pi \times 10^{-7} \text{ SI}$, $e = 1.6 \times 10^{-19} \text{ C}$

Q. 5. a. Attempt any one of the following in details: (07)

1. 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.
2. Describe Harrison's construction of free electron Fermi surface in two dimension.

Q. 5. b. Attempt any one of the following: (03)

1. Explain periodic zone scheme.
2. Define electron orbit, hole orbit and open orbits.
