

RAN-2103000206021001
B.Sc. (Sem. VI) Examination March - 2026
Physics : PH-606 : Classical Mechanics & Solid State Physics
[Total Marks: 50]
સૂચના : / Instructions

- (1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the above details on your answer book.
- (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.

Seat No.:

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Student's Signature

Q. 1 Answer the following questions in brief: (Attempt any ten) (10)

1. What are the Euler angle ?
2. Distinguish between a symmetric top, spherical top & asymmetric top.
3. Define fermi surface.
4. Orbit that enclose filled state are known as
5. What is a coope pair?
6. What condition do super conductor require?
7. On which factor shape of the Fermi surface depends? Is it exact circle?
8. Give some phenomenon arising due to coriolis force.
9. A particle of mass 7 g is at distance 4cm from the axes of rotation. If angular velocity 10 rad/s then calculate psudo force on the particle.
10. What are the differences between rigid body and solid body?
11. Mention the direction of angular momentum ?

Q. 2 (a) Attempt any one of the following in details: (7)

- (1) Discuss rotating co-ordinate systems and obtain expression for effective force acting on a body accelerating in a uniformly rotating frame.
- (2) Discuss the effect of Coriolis force on a freely falling particle.

Q. 2 (b) Attempt any one of the following : (3)

- (1) Explain principle of Newtonian relativity.
- (2) A body is falling freely from a height of 1675 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: (7)

- (1) Explain angular momentum of a rigid body. Show that the angular momentum of a rigid body is not necessarily always in the same direction as the instantaneous axis of rotation.
- (2) Derive Euler's equations of motion for a rotating rigid body about a fixed point.

- Q. 3 (b) Attempt any one of the following: (3)**
- (1) Calculate angular momentum of ice skater spinning at 5.8 rev/s given his moment of inertia is 0.4 kgm^2 . He reduces his rate of spin by extending his arm, find his value of moment of inertia when his angular speed becomes 2.54 rev/s.
 - (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: (7)**
- (1) Explain the basic theory of superconductivity based on BCS theory.
 - (2) What is Meissner effect? Obtain an expression for the London penetration depth of magnetic field for superconductor?
- Q. 4 (b) Attempt any one of the following: (3)**
- (1) The number density of free electrons in some metal is $2.034 \times 10^{29} \text{ m}^{-3}$. Calculate the penetration depth predicted by the London model, assuming that all of the free electrons are superconducting.
 $m_e = 9.1 \times 10^{-31} \text{ kg}$, $\mu_0 = 4\pi \times 10^{-7} \text{ SI}$, $e = 1.6 \times 10^{-19} \text{ C}$
 - (2) Distinguish between type I and type II superconductors.
- Q. 5 (a) Attempt any one of the following in details: (7)**
- (1) What are brillouin zone ? Discuss the construction of first three brillouin zone for a square lattice.
 - (2) Describe Harrison's construction of free electron Fermi surface in two dimension.
- Q. 5 (b) Attempt any one of the following: (3)**
- (1) Explain reduce zone scheme.
 - (2) Explain electron orbits and hole orbits with necessary diagram.