RAN-2103000206021001

RAN-2103000206021001

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

Physics (Paper : PH - 606)

Classical Mechanics and Solid State Physics

[Total Marks: 50

સૂચના : / Instructions

(૧) 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.:

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. Classify type I and type II semiconductors from the following.
   Hg, Pb, Zn, NbTi, Nb_3Sn, $pbMo_6S_8$
2. What is meant by 'principle axes of inertia' ?
3. Give some phenomenon arising due to coriolis force.
4. Under what condition coriolis acceleration present ?
5. On which factor Fermi surface shape depends ?
6. What is the first brillouin zone ?
7. What is a *non-inertialframe* ? Give illustration.
8. Orbit that enclose empty state are known as .....
9. Distinguish between a symmetric top, spherical top & asymmetric top.
10. What is critical temperature?
11. A particle of mass 9g is at distance 4 cm from the axes of rotation .
    If angular velocity 8 rad/s then calculate psudo force on the particle.

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. Discuss rotating co-ordinate systems and obtain expression for effective force acting on a body accelerating in a uniformly rotating frame.

Q. 2 b. Attempt any one of the following **03**

1. Comment on the equation $\vec{g}_{eff} = \vec{g} - \vec{w}x\ (\vec{w}x\vec{r})$ drawing the necessary diagram.
2. A body having mass of 2 kg is allowed to fall freely from a height of 3 km above the surface of the earth. Calculate the time of flight and displacement due to coriolis force at the 45° N latitude on earth.

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

1. Obtain Euler's equation of motion for rigid body.
2. Find the principle moment of inertia about the centre of a uniform rectangular plate passing through perpendicular to its plane whose side a and b are parallel to x and y axes, respectively, with the origin at the centre of the plate.

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

1. A solid cylinder of mass 12kg rotates about its axis with angular speed 52 rad/s. The radius of the cylinder is 0.23m. What is the K.E associated with the rotation of cylinder? what is the magnitude of the angular momentum of cylinder about its axis.
2. Mention the moment of inertia of a disk about an axis perpendicular to its plane and passing through its centre. Find the moment of inertia about an axis perpendicular to its plane and passing through the circumference.

Q. 4 a. Attempt any one of the following in details: **07**

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

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

1. Explain the difference between type-I and type-II superconductors.
2. The number density of free electrons in some metal is $2.23 \times 10^{29}\ m^{-3}$. 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

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

1. Describe Harrison's construction of free electron Fermi surface in two dimension.
2. What are brillouin zone ? Discuss the construction of first three brillouin zone for a square lattice.

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

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

———————