

GOVERNMENT DEGREE COLLEGE, NANDIKOTKUR
DEPARTMENT OF PHYSICS

Name of the Lecturer : Smt. C. Sumalatha

I Year B.Sc.-Physics: I Semester

Course I: MECHANICS, WAVES AND OSCILLATIONS
QUESTION BANK



UNIT- I

1. Mechanics of Particles.

2. Mechanics of Rigid bodies.

SECTION-A

I. Multiple choice Questions. Each carries one mark.

1. The Scattering cross section has dimensions of Ans.[b]
a) volume b)Area c)Mass d)Density
2. In Rutherford Scattering experiment the number of Scattered particles per unit area is proportional to Ans.[c]
a) P b)Z c)Z² d)V²
3. In Rutherford Scattering experiment of α -particles by metallic foils, with the increase of atomic number of nucleus, the scattering angle is Ans.[c]
a) Remains unchanged b)Decreases c)Increases d)none

II. Fill in the Blanks. Each carries one mark.

1. The rate of Precession of spinning top is inversely proportional to the _____
(Angular momentum).
2. The Precessional period of Earth's axis of rotation is _____
(26000Years).
3. The angular velocity of the Earth about its axis increases then the value of 'g' at equator _____
(Decreases).

III. Short answer questions. Each carries two marks.

1. State Newton's laws?
2. What is variable mass?
3. What is meant by impact parameter?
4. What is Rutherford's scattering cross section?
5. Define a rigid body.
6. Define angular momentum.
7. Define Torque.
8. What is gyroscope?

SECTION- B

Essay type Questions: Each carries 10 marks.(10M)

1. Explain the motion of a system of variable mass. Derive the expression for final velocity of a rocket.
2. What is Rutherford's Scattering? Obtain an expression for Rutherford's α -particle scattering.
3. Explain the rotational kinematic relations. Deduce the equations of motion for a rigid rotating body.
4. Derive the Euler's equations of rotational motion for a rigid body.
5. Obtain an expression for precessional velocity of the symmetric top.
6. Explain the principle and working of a gyroscope. Explain about precession of equinoxes.

UNIT-II

3. Motion in a Central Force Field.

SECTION-A

I. Multiple choice Questions. Each carries one mark.(1M)

1. Which is not a Kepler's law Ans.[d]
- a) Law of periods b) Law of orbits
c) Law of areas **d) Law of continuity**
2. The quantity that remains conserved for a particle moving under the action of central force is Ans.[b]
- a) Linear momentum **b) Angular momentum**
c) Force d) Acceleration
3. Kepler's second law follows from the law of conservation of Ans.[a]
- a) **Angular momentum** b) Linear momentum
c) Energy d) Mass

II. Fill in the Blanks. Each carries one mark.(1M)

1. A planet revolving around sun in an elliptical orbit has a constant _____
(**Angular momentum about the sun**)
2. The total energy of the particle is E and the eccentricity is ϵ . The particle will follow parabolic orbit if _____
(**$E=0$ and $\epsilon=1$**)
3. A body of mass m is taken from earth surface to the height h equal to radius of earth, the increase in potential energy will be _____
(**$1/2 mgR$**)

III. Short answer questions. Each carries two marks.(2M)

1. Define central forces and give examples.
2. State Kepler's laws of planetary motion.

SECTION-B

IV. Essay type Questions: Each carries 10 marks.(10M)

1. What are conservative forces? Show that central forces are conservative.
2. Calculate the total energy of a particle moving under the influence of central force field for different conic sections.
3. Write Kepler's laws and derive them.
4. Derive an expression for time period, orbital velocity and escape velocity for satellite motion.
5. Explain about Global Positioning system(GPS), Weightlessness, Physiological effects of astronauts.

UNIT-III

4. Relativistic Mechanics.

SECTION-A

I. Multiple choice Questions. Each carries one mark.(1M)

1. A rod is moving with a speed of $0.8c$ in a direction at 60° to its own length. Find the %
Ans.[d]
a)2% b)3% c)7% d)9%
2. If a particle is at rest relative to an observer at rest at the center of a rotating frame of reference
Ans. [a]
a) Centrifugal force b)Coriolis force
c) Gravitational force d)Acceleration due to gravity
3. With what velocity an electron should move so that its kinetic energy equals its rest mass energy? Ans.[c]
a) $3/2 c$ b) $\sqrt{3/2} c$ c) $\sqrt{3/2} c$ d) $2C$

II. Fill in the Blanks. Each carries one mark.(1M)

1. The rest mass of the particle of momentum p and kinetic energy T is _____
[$m_0=(p^2-T^2)/2Tc^2$]

2. The speed of an electron having kinetic energy 2 MeV will be _____

[2.93×10^{-8} sec]

3. The amount of work done to increase the speed of an electron from $c/3$ to $2/3c$ is _____ [143.58keV]

III. Short answer questions. Each carries two marks.(2M)

1. What is a frame of reference?
2. What is an Inertial frame?
3. What is a non-inertial frame?
4. Write the Galilean transformation equations only?
5. Write the Lorentz transformation equations only?
6. Write the Lorentz-inverse transformation equations only?
7. State the two postulates of special theory of relativity.

SECTION-B

Essay type Questions: Each carries 10 marks.(10M)

1. Explain Michelson-Morley experiment with proper theory and what is the importance of this experiment?
2. Derive Lorentz transformation equations.
3. What is length contraction and time dilation? Explain.
4. Derive velocity transformation equations.
5. Derive Einstein's mass-Energy relation.

UNIT-IV

5. Undamped, Damped and Forced oscillations.

6. Coupled oscillations.

SECTION-A

I. Multiple choice Questions. Each carries one mark.(1M)

1. In the case of critical damping b Ans.[c]

- a) $b^2 > \omega^2$ b) $b^2 = \omega^2$ c) $b^2 < \omega^2$ d) $b^2 + \omega^2 = 0$

2. Two systems have same resonance frequency. Their quality factors are in the ratio 1:2, the ratio of relaxation time is Ans.[b]

- a) 2:1 b) 1:2 c) 1:4 d) 4:1

3. The principle of coupled oscillation is used in Ans.[a]

- a) Transformer b) Rectifier c) Amplifier d) Inverter

II. Fill in the Blanks. Each carries one mark.(1M)

1. power dissipation in damped harmonic oscillator is _____ [P=2bE]

2. At what phase Potential Energy and Kinetic Energy are equal in case of SHM _____ [45°]

3. The quantity is exchanged between individual oscillators of coupled oscillators _____ [Energy]

III. Short answer questions. Each carries two marks.(2M)

1. Define simple harmonic motion?

2. What are Damped oscillations?

3. What are Forced oscillations?

4. What is Resonance?

5. Define Logarithmic decrement.

6. Define Relaxation time.

7. Define Q-factor.

SECTION-B

Essay type Questions: Each carries 10 marks.(10M)

1. What are the physical characteristics of simple harmonic oscillator? Derive the equation of motion of simple harmonic oscillator and find its solution.
2. Derive the equation of motion of damped harmonic oscillator and find its solution.
3. Derive the equation of motion of forced harmonic oscillator and find its solution.
4. Define coupled oscillators. Explain about two coupled oscillators.

UNIT-V

7. Vibrating Strings.

8. Ultrasonics.

SECTION-A

I. Multiple choice Questions. Each carries one mark.(1M)

1. Beats are the results of, Ans.[d]
a) Diffraction b) Destructive Interference
c) Constructive Interference
d) Super position of two waves with almost same frequency.
2. If the energy flows across every plane in the direction of propagation of the wave then it is Ans.[b]
a) Stationary wave b) progressive wave
c) Electromagnetic wave d) Both a and c
3. A wave is described by the equation where all distances are in cms and time in second then, Ans. [d]
a) The amplitude is 4 cm b) The wavelength is 4cm
c) The period is sec d) The wave is travelling in –ve X-direction.

II. Fill in the Blanks. Each carries one mark.(1M)

1. 1MHz ultrasound beam traversing 10cm of material having an attenuation of 1dB/cm then the percent reduction in intensity _____ (90%)
- 2.The speed of Ultrasound in water is _____ (1500m/s)
- 3.If an ultrasound generator generates 100 number of cycles with pulse of duration 1msec then the time period is _____(10⁻⁵ sec)

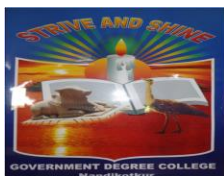
III. Short answer questions. Each carries two marks.(2M)

- 1.Distinguish between harmonics and overtones.
- 2.What are Ultrasonic waves?
- 3.What are the properties of ultrasonics?
- 4.Explain about SONAR system.

SECTION-B

IV. Essay type Questions: Each carries 10 marks.

- 1.Derive the equation of Transverse wave propagation along a stretched string and also general solution of wave equation .What are its significance?
- 2.Explain about modes of vibration of stretched string clamped at both the ends.
- 3.What is magnet ostriction? Explain the production of ultrasonics with the help of magnetostriction.
- 4.Explain piezo electric effect. Describe how ultrasonics are produced with piezo electric crystals.
- 5.Describe different methods of ultrasonic detectors.
- 6.What are the applications of ultrasonics? Explain.



GOVERNMENT DEGREE COLLEGE - NANDIKOTKUR

II Year B.Sc – Physics: III Semester

Course III: HEAT AND THERMODYNAMICS

PART – A

Short Questions

1. What is transport Phenomenon?
2. What is mean free path? Deduce an expression for the mean free path a molecule?
3. Derive an expression for work done by an ideal gas in isothermal process?
4. State and explain the Second law of thermodynamics?
5. Explain about T-S diagram?
6. Derive an expression for Thermodynamic scale of temperature?
7. Explain about Carnot theorem?
8. Derive Clausius-Clayperon equation from Maxwell's equations. What are its applications?
9. Derive the specific heat relations from Maxwell's equations? ($C_p - C_v = R$ or $C_p / C_v = \gamma$)
10. Explain about principle of refrigeration?
11. What are the differences between adiabatic and Joule-Thomson expansion?
12. Give the applications of low temperature Physics?
13. Define black body? Explain Ferry's black body?
14. Derive Stefan-Boltzmann law and Wien's displacement law?
15. Explain energy distribution of black body radiation?

PART - B

ESSAY QUESTIONS

16. Derive Maxwell's law of distribution of molecular speeds?
17. Derive an expression for the coefficient of viscosity and heat conduction on the basis of kinetic theory of gases?
18. Describe the Carnot's heat engine and it's working. Derive an expression for its efficiency?
19. What is entropy? Derive an expression for change in entropy in reversible and irreversible process?
20. Define thermodynamic potentials. Obtain Maxwell's equations using these potentials?
21. Explain Joule-Kelvin effect. Describe porous plug experiment and explain the results of the experiment?
22. Explain with theory the adiabatic demagnetization method for producing low temperatures?
23. Derive Planck's radiation law. How does it explain Wien's displacement law and Rayleigh-Jeans law?
24. What is solar constant? How is the temperature of the sun determined?