

C 22101

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2022

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS—II

(2021 Admissions)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in the question paper have their usual meanings.***Section A***Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall ceiling 24.*

1. Define the time average of a function $f(t)$ with proper diagrams.
2. Explain Coriolis force. What is the effect of Coriolis force on wind moving over the surface of earth?
3. Briefly explain the characteristic impedance of a travelling wave.
4. Explain the terms :
 - (a) Apogee, and
 - (b) Perigee.
5. Define :
 - (a) Phase velocity, and
 - (b) Group velocity.
6. Write the equation of a forced damped harmonic oscillator and describe the terms involved.
7. Define central force motion and list any two features of central force motion.
8. Discuss the condition for non-dispersive wave.
9. Two particles are interacting under a central force. Explain how a two-body problem can be reduced to a one-body problem.
10. Briefly explain about the two types of wave motion.

Turn over

11. State and explain the principle of equivalence.
 12. With proper examples explain simple harmonic motion.

(8 × 3 = 24 marks)

Section B*Answer atleast five questions.**Each question carries 5 marks.**All questions can be attended.**Overall ceiling 25.*

13. State and prove Kepler's third law.
 14. Explain the Foucault pendulum. Calculate the time it will take the plane of oscillation of a Foucault's pendulum to turn through 90° at a point where the co-latitude is 60° .
 15. Find the spring constant k and damping constant b of a damped oscillator having a mass of 5 kg, frequency of oscillation 0.5 Hz, and logarithmic decrement 0.02.
 16. A cylinder of mass M and radius R rolls without slipping on a plank that is accelerated at rate A . Find the acceleration of the cylinder.



17. The centre of mass of a 1600 kg car is midway between the wheels and 0.7 m above the ground. The wheels are 2.6 m apart.
- What is the minimum acceleration A of the car so that the front wheels just begin to lift off the ground ?
 - If the car decelerates at rate g , what is the normal force on the front wheels and on the rear wheels ?
18. Explain the Q factor of an oscillator. In one experiment, a paper weight suspended from a hefty rubber band had a period of 1.2 s and the amplitude of oscillation decreased by factor 2 after three periods. What is the estimated Q of this system ?
19. Discuss Newton's model to determine the velocity of sound in air. Account for the correction required to obtain observed result.

(5 × 5 = 25 marks)

Section C

*Answer any **one** question.
The question carries 11 marks.*

20. Establish the differential equation of motion for a damped harmonic oscillator and write down the general solution for displacement for oscillatory motion and sketch it. Show that the energy falls exponentially with time.
21. State Fourier's theorem. Determine the values of Fourier's coefficients. What are conditions of its applicability? Discuss Fourier analysis of a non-periodic function with suitable plots.

(1 × 11 = 11 marks)

C 4393-B

(Pages : 2)

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**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021**

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS—II

(2020 Admissions)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in the question paper have their usual meanings.***Section A (Short Answer Type)***Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Define fictitious force ? Deduce an expression for the force experienced by a particle in a co-ordinate system with uniform acceleration A .
2. State and explain the principle of equivalence.
3. Define inertial and non-inertial frame of references with proper examples.
4. Explain what is meant by the Galilean transformations.
5. What is a central force ? Show that the motion of a particle under central force is always confined to a single plane.
6. State law of equal areas. How is it related to angular momentum ?
7. Establish the differential equation of a harmonic oscillator and write down its general solution.
8. Explain Simple Harmonic Motion and discuss its characteristics.
9. Briefly explain about (a) Phase velocity ; and (b) Group velocity
10. Differentiate between dispersive and non-dispersive sinusoidal waves.
11. Write down the general expression for a plane progressive wave traveling :
 - (a) Positive x direction ; and
 - (b) Negative x direction.
12. Write two important properties of travelling waves.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph / Problem Type)

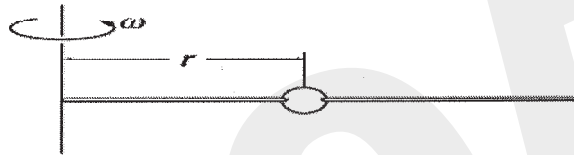
Answer at least **five** questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. A small weight of mass m hangs from a string in an automobile which accelerates at rate A . What is the static angle of the string from the vertical, and what is its tension? Analyze the problem both in an inertial frame and in a frame accelerating with the car.
14. A bead slides without friction on a rigid wire rotating at constant angular speed ω . Find the force exerted by the wire on the bead.



15. Define the Foucault Pendulum. If m is the mass and l is the length of the pendulum, find the time for the plane of oscillation to rotate once.
16. A satellite of mass $m = 2000$ kg is in elliptic orbit about the earth. At perigee (closest approach to the earth) it has an altitude of 1100 km and at apogee (farthest distance from the earth) its altitude is 4100 km. Calculate the energy needed to put the satellite into orbit by neglecting losses due to friction.
17. What are stationary satellites? Calculate the height at which such a satellite must revolve in its orbit around the earth.
18. Evaluate the time average values of the potential and kinetic energies of a frictionless harmonic oscillator.
19. Define Q factor of an oscillator. A musician's tuning fork rings at A above middle C , 440 Hz. A sound level meter indicates that the sound intensity decreases by a factor of 5 in 4 s. Calculate the Q of the tuning fork.

(5 × 5 = 25 marks)

Section C (Essays)

Answer any **one** question.

The question carries 11 marks.

20. What is a Pulse? Discuss Fourier analysis of a non-periodic function with suitable plots.
21. State and prove Kepler's laws of planetary motion. Show that the areal velocity of a planet around the sun is constant.

(1 × 11 = 11 marks)