C 4393 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Write Galilean transformation equations for position and velocity for inertial frames of reference.
2. What do you mean by fictitious force ?
3. State and explain Kepler's second law of planetary motion.
4. What do you mean by centre of mass of a system ? Write the expression for position vector of centre mass of a system of two particles with masses m_1 and m_2 and position vectors r_1 and r_2 respectively.
5. State and explain the principle of equivalence.
6. What is the condition for the periodic motion of a damped harmonic oscillator ?
7. Define simple harmonic motion. Give two examples.
8. Write the equation for an undamped forced harmonic oscillator and explain the terms in it.
9. Show that the transverse wave on a continuous string is non-dispersive.
10. What is Refraction ? Why does it happen ?
11. Show that the total energy of a simple harmonic oscillator is constant.
12. What is Modulation ?

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Deduce an expression for the apparent force on a particle of mass m in a rotating co-ordinate system with angular velocity Ω.

14. What is a Foucault pendulum ? Find the time for the plane of oscillation to rotate once at a latitude 45°for a pendulum with mass m, length l and frequency $\sqrt{\frac{g}{l}}$.

15. For what values of n are circular orbits stable with the potential energy $U(r) = -A/r^n$, where $A > 0$?

16. A satellite of mass m = 2000 kg is in elliptical orbit about the earth. At perigee, it has an altitude 1,100 km and at apogee its altitude is 4,100 km. What is the energy required to put the satellites into orbit ?

17. Perform Fourier analysis of a travelling wave in a homogeneous non-dispersive medium.

18. Derive an expression for the superposition of two sinusoidal travelling waves. Find out the expression for modulation frequency and average frequency.

19. Obtain the relation between group velocity and the phase velocity.

(5 × 5 = 25 marks)

Section C (Essay Type)

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

20. (a) Explain the general properties of central force motion.

    (b) Plot and explain energy diagram for planetary motion.

21. Set up the equation of motion for the undamped forced oscillator. Analyse the system and explain the variation of amplitude with the driving frequency.

(1 × 11 = 11 marks)

C 82450 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2020

Physics/Applied Physics

PHY 2B 02/APH 2B 02—MECHANICS

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*

1. Distinguish between inertial and non- inertial frames of reference.
2. Deduce an expression for fictitious force experienced by a particle in a co-ordinate system with uniform acceleration A.
3. What is the effect of Coriolis force on wind moving over the surface of earth ?
4. List any two features of central force motion.
5. State and explain principle of equivalence.
6. Derive the equation of motion of a mass suspended by a spring.
7. What is meant by the time average of a function f(t) ?
8. Define the Q-factor of an oscillator. What is its significance ?
9. Define simple harmonic motion. Give two examples.
10. Define the phase velocity of a wave.
11. What is the condition for a nondispersive wave ?
12. What is meant by the characteristic impedance of a travelling wave ?

(ceiling-20)

Section B (Paragraph/Problem Type)

Answer **all** *questions in a paragraph of about* **half a page to one page.**
Each correct answer carries a maximum of 5 *marks.*

13. Obtain the relation between accelerations of a particle with respect to an inertial system and that with respect to a rotating co-ordinate system of angular velocity Ω if the origins of the two systems coincide.
14. Determine the horizontal deflection of a particle dropped from a tower of height 50m at the equator. Also find out the time taken to fall through this height. (Angular velocity of earth is 7.29×10^{-5} radians/sec.

Turn over

15. A space vehicle of mass 3000kg is in circular orbit of radius 2R=12800km about the earth. What is the minimum energy required to transfer the vehicle to a circular orbit of radius 4R?(Radius of earth = 6400km)

16. Obtain an expression for minimum velocity with which a body on surface of the earth is to be projected to escape from the gravitational field. If the acceleration due to gravity on the moon is one sixth that of the earth, calculate the value of velocity of escape from surface of moon.(Radius of moon = 1.74×10^6m)

17. Find the Fourier co-efficients of the square pulse using Fourier integral.

18. A 0.3 Kg mass is attached to a spring and oscillates at 2 Hz with a Q of 60. Find the spring constant and the damping constant.

19. Derive the expression for energy of the damped harmonic oscillator. Plot the energy-time graph and explain.

(ceiling-30)

Section C (Essay type)

Answer any one question in about **two pages.**

Answer carries 10 *marks.*

20. State and prove Kepler's first and second laws of planetary motion.

21. Derive the expression for the phase velocity of sound in air using Newton's method. How does the observed value differ from the calculated value ? How is it rectified ?

($1 \times 10 = 10$)