

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 atleast **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  $90^\circ$  at a point where the co-latitude is  $60^\circ$ .
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.
  - (a) What is the minimum acceleration  $A$  of the car so that the front wheels just begin to lift off the ground ?
  - (b) 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)