D3BPH2102 (PAGES 2) Reg.No..............................

Name: ....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2022

(Regular/Improvement/Supplementary)

PHYSICS: COMPLEMENTARY COURSE FOR MATHEMATICS AND CHEMISTRY

GPHY3C03T: MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time: 2 Hours Maximum Marks: 60

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 Marks)

1. Distinguish between centrifugal force and Coriolis force with suitable examples.

2. What is potential and kinetic energy possessed by a particle? Give its unit.

3. State and explain law of conservation of mechanical potential energy.

4. Give two examples of law of conservation of linear momentum.

5. Explain the significance of mass energy relation.

6. State the postulates of special theory of relativity.

7. How did the Michelson-Morley experiment invalidate the concept of ether?

8. What are the different types of wave motions?

9. Write down the general expression for a plane progressive harmonic wave moving along

    (i) +ve x-direction and   (ii) -ve x-direction.

10. Derive relationship between energy density and intensity of a wave.

11. Write down Rayleigh – Jeans formula and explain their symbols.

12. What is meant by normalization?

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 Marks)

13. Prove that law of conservation of energy is Galilean invariant.

14. Show that the force $F = (2xy + z^2)\hat{\imath} + x^2\hat{\jmath} + 2xz\hat{k}$ is not conservative.

15. The length of a rod is 6 meters. If the rod is moving with a velocity 0.5c relative to Earth, find the length of the rod as observed by an observer moving with the rod?

16. What is the apparent mass of a 1 kg object that has been accelerated to 90% of light speed?

(PTO)

17. Show that the distance between two points is invariant under Galilean transformation.

18. An electron has a speed of 600 m/s with an accuracy of 0.005 %. Calculate the uncertainty with which we can locate the position of the electron.

19. An electron is accelerated from rest through a potential difference of V volts. Prove that the de Broglie wavelength is given by

$$\lambda = \frac{12.27 \; A^0}{\sqrt{V}}$$

SECTION C: Answer any 1 question. Each carries *ten* marks.

20. What are central forces? Give the properties of a particle moving under central force. Show for a particle moving under central force, the angular momentum is conserved and the areal velocity remains constant.

21. Define simple harmonic motion. Set up the differential equation and find the expression for its velocity, displacement and period.

(1 x 10 = 10 Marks)