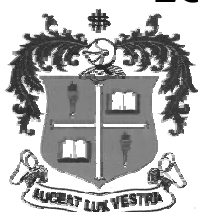# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

## B.Sc. DEGREE EXAMINATION – MATHEMATICS

### FIRST SEMESTER – NOVEMBER 2013

### PH 1101 - PHYSICS FOR MATHEMATICS - I

Date : 07/11/2013      Dept. No.                      Max. : 100 Marks
Time : 1:00 - 4:00

## PART - A

Answer **ALL** questions                                                                 (10 x 2 = 20)

1.  What are holonomic and non holonomic constraints?
2.  Draw velocity – time graph for a particle moving with constant velocity.
3.  State any two Kepler's law of planetary motion.
4.  What is gravitational red shift?
5.  Calculate the excess pressure inside a small air bubble of radius $10^{-4}$ m. Given the surface tension of water is $70 \times 10^{-3}$ $Nm^{-1}$
6.  State Hooke's law of elasticity.
7.  Mention any two basic characteristics of an ideal op-amp.
8.  What is flip-flop?
9.  If 4kg of a substance is fully converted into energy, how much energy is produced?
10. Distinguish between inertial and non inertial frames of reference

## PART - B

Answer any **FOUR** questions                                                           (4 x 7.5 = 30)

11. What is a projectile motion? Derive an expression for time of flight and range of a body projected at an angle with the horizontal.
12. a) Define gravitational potential.                    (2.5)
    b) Estimate the mass of the sun, assuming the orbit of the earth round the sun to be a circle. The distance between the sun and the earth is $1.49 \times 10^{11}$ m and $G = 6.66 \times 10^{-11}$ $Nm^2/kg^2$. (5)
13. Discuss Poiseuille's method for determining the coefficient of viscosity of a liquid.
14. With a neat circuit diagram, explain the working of an op-amp inverting amplifier.
15. Derive the expression for length contraction and time dilation.

## PART - C

Answer any **FOUR** questions                                                           (4 x 12.5 = 50)

16. Solve Lagrange's equation for i) Simple Pendulum ii) Atwood's machine.
17. a) Define escape velocity. Show that the escape velocity from the surface of the earth is 11km/s. (7.5)
    b) Determine the velocity of satellite so that it will be rotating in the parking orbit.    (5)
18. Obtain the relation between the three elastic moduli.
19. a) With a neat circuit diagram and truth table, explain the working of a full adder.    (8)
    b) Simplify using K-map: $Y = F(A, B, C) = \sum (1, 2, 3, 5, 7)$                         (4.5).
20. a) Deduce the formula for relativistic variation of mass with velocity.                  (10)

b) A particle of a mass 10x $10^{-24}$ kg is moving with a speed of 1.8 x $10^8$ m/s. Calculate its mass when it is in motion. (2.5)