



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**B.Sc. DEGREE EXAMINATION – MATHEMATICS**

FIRST SEMESTER – NOVEMBER 2015

**PH 1101 - PHYSICS FOR MATHEMATICS - I**

Date : 11/11/2015  
Time : 01:00-04:00

Dept. No.

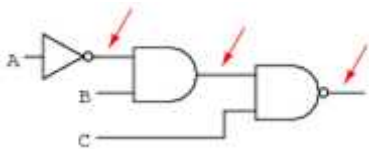
Max. : 100 Marks

**Part A**

**Answer all questions:**

**(10×2=20 marks)**

1. What are constraints? Give an example.
2. A 10 kg object experiences a horizontal force which causes it to accelerate at  $5 \text{ m/s}^2$ , moving it through a distance of 20 m, horizontally. How much work is done by the force?
3. State Newton's law of gravitation.
4. State any two Kepler's laws.
5. Why mercury does not wet the surface of the glass?
6. Account for the spherical shape of liquid drop.
7. What is a flip flop?
8. Convert the following logic gate circuit into a Boolean expression, writing Boolean sub-expressions next to each gate output in the diagram:



9. State the postulates of special theory of relativity.
10. A rod of 1m long is moving along its length with a velocity  $0.8c$ . Calculate its length as it appears to an observer on earth.

**Part B**

**Answer any four questions:**

**(4×7.5 = 30 marks)**

11. (a) Derive the relation between linear and angular velocity. (4.5 marks)  
(b) Compare the angular velocity of the earth about its axis with that of the hour hand of a clock. (3 marks)
12. Calculate the density of the earth and mass of the sun.
13. Derive Poiseuille's formula for the rate of flow of liquid through a capillary tube.
14. Simplify using K map:  $Y = F(A, B, C, D) = (2, 3, 4, 5) + d(10, 11, 12, 13, 14, 15)$
15. With a neat diagram and truth table, explain the working of a full adder.
16. Deduce Einstein's mass - energy relation.

## Part C

**Answer any four questions:**

**(4×12.5 = 50marks)**

17. Set up the Lagrangian and derive equations of motion for
- (a) Simple pendulum and
  - (b) Atwood's Machine
- 18.(a) Derive Newton's law of gravitation from Kepler's law of planetary motion. **(5 marks)**
- (b) Define escape velocity and derive an expression for the escape velocity of a satellite moving around the earth. **(7.5 marks)**
- 19.(a) Deduce an expression for the excess pressure inside a curved liquid surface. **(7.5 marks)**
- (b) Explain the molecular theory of surface tension. **(5 marks)**
20. With a neat circuit diagram, explain the function of op amp as (a) integrator and (b) Differentiator.
21. Describe the Michelson- Morley experiment with a neat diagram and explain the physical significance of negative results.
22. Describe Quincke's method for determining the surface tension and angle of contact of mercury.

\*\*\*\*\*