



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – NOVEMBER 2016

PH 2503/PH 2501/PH 2500 – MECHANICS

Date: 12-11-2016

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

PART-A

Answer ALL Questions

(10x2=20 marks)

1. Write the units of g and k.
2. State the law of conservation of angular momentum. Give one example of its application.
3. A ship is of 20000 tones Displacement of a load of 30 tons moved 50 metres across the deck makes the ship tilt through $(3/4)^\circ$. Calculate the metacentric height.
4. Define i) couple ii) moment of a couple.
5. State the law of efflux.
6. State Graham's law for diffusion of gases.
7. What are constraints? Give an example.
8. What is configuration space?
9. What is meant by gravitational constant? Mention its dimensions.
10. What is gravitational potential? Give the expression of it.

PART-B

Answer ANY FOUR Questions

(4x7.5=30 marks)

11. Derive an expression for the torsional rigidity of a wire.
12. Define centre of gravity. Find the position of centre of gravity of a solid tetrahedron.
13. State Fick's law of diffusion in liquids. Obtain the relation between time of diffusion and length of column.
14. i) Explain the term "virtual displacement" and state the principle of virtual work. (4.5 marks)
ii) State and explain D'Alembert's principle. (3 marks)
15. Describe the method of determining the gravitational constant.

PART-C

Answer ANY FOUR Questions :

(4x12.5 = 50marks)

16. i) What is a compound pendulum? (2 marks)
ii) Obtain an expression for the time period of oscillation of it. Discuss the conditions for its maximum and minimum time periods (7.5 marks)
iii) Show that the centres of suspension and oscillation in a compound pendulum are interchangeable. (3 marks)

17. i) Define centre of pressure. (2 marks)
- ii) Determine the position of centre of pressure of a rectangular lamina immersed vertically in a liquid with one edge in the surface of the liquid. (5.5 marks)
- iii) Find the thrust on the rectangular end of a tank of width 1 m and depth 0.6 m filled completely with water. Find the position where it acts. (5 marks)
18. i) State and prove Bernoulli's theorem. (7.5 marks)
- ii) The diameters of a water main where a venturimeter is connected to it are 20 cm and 10 cm. What is the rate of water flow, if the water levels in the two piezo-meter tubes differ by 5 cm? ($g=9.8 \text{ m/sec}^2$). (5 marks)
19. i) Derive Lagrange's equations of motion from D'Alembert's principle for a holonomic conservative system. (7.5 marks)
- ii) Apply them to the Atwood's machine to find the acceleration of the system. (5 marks)
20. i) What is meant by escape velocity? Derive an expression for the escape velocity. (5.5 marks)
- ii) State Kepler's laws of planetary motion. Deduce Newton's law of gravitation from Kepler's laws. (7 marks)
