LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

SECOND SEMESTER – **APRIL 2013**

PH 2503/PH 2501/PH 2500 - MECHANICS

Date: 30/04/2013 Dept. No. Max. : 100 Marks

Time: 9:00 - 12:00

PART – A

Answer **ALL** the questions: (10 × 2 = 20 Marks)

1. Define centres of suspension and oscillation of a compound pendulum.
2. What do you understand by the principle of conservation of angular momentum?
3. Define (i) couple and (ii) moment of the couple.
4. State the condition for a floating body to be in stable equilibrium.
5. State Torricelli's theorem.
6. What is meant by Transpiration?
7. What are generalized coordinates? Write down the expression for generalised momentum.
8. What is meant by phase space?
9. State and explain Newton's law of gravitation.
10. Calculate the mass of the earth if the radius of earth is 6.4×10^{6}m, g = 9.8ms^{-2} and G=6.67×10^{-11}Nm^{2}kg^{-2}.

PART – B

Answer any **FOUR** questions: (4 × 7.5 = 30 Marks)

11. (a) What is a rocket? (1.5)

    (b) A rocket starts vertically upward with a speed of v_o. Establish the relation $v_o^2-v^2 = 2gh/(1+h/R)$ where v is the velocity of the rocket at a height h, R is the radius of the earth and g is the acceleration due to gravity. (6)

12. (a) Define centre of gravity. (2)

    (b) Find the position of centre of gravity of a solid tetrahedron. (5.5)

13. (a) Describe the working of a Pitot's tube. (5)

    (b) A Pitot's tube is fixed to a water pipe of diameter 8cm and the difference of pressure indicated by the gauge is 3cm of water column. Find the volume of water flowing per second through the pipe. (2.5)

14. Using Lagrange's equations of motion find the acceleration of the system in Atwood's machine. (7.5)

15. Write notes on:

    (i) Weightlessness (3.5)

    (ii) Parking orbits (4)

PART – C

Answer any **FOUR** questions: (4× 12.5 = 50 Marks)

16. (a) What is a compound pendulum? (2)

    (b) Derive an expression for the period of oscillation of a compound pendulum oscillating with small amplitude about an axis through its centre of gravity perpendicular to its plane. (6)

    (c) Show that the centre of oscillation and centre of suspension in a compound pendulum are reversible. (4.5)

17. (a) Define centre of pressure. (2.5)

    (b) Determine the position of centre of pressure of a triangular lamina immersed in a liquid (i) with its vertex touching surface and its base horizontal and (ii) with base coinciding with the free surface. (5+5)

18. (a) State and explain Bernoulli's theorem. (1.5+1)

    (b) Explain how Bernoulli's theorem is used to measure the rate of discharge through city water mains. (10)

19. (a) State and explain D'Alembert's principle. (1.5+1)

    (b) Using D'Alembert's principle, derive Lagrange's equation of motion for a holomonic conservative system. (10)

20. (a) State Kepler's laws of planetary motion. Deduce Newton's law of gravitation from Kepler's laws. (3+4)

    (b) Derive an expression for the escape velocity of an artificial satellite. (5.5)

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