LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SECOND SEMESTER – APRIL 2017

16UPH2MC01- MECHANICS

Date: 22-04-2017   Dept. No.   Max. : 100 Marks
01:00-04:00

Part – A   **Answer ALL Questions**   **(10 x 2 = 20 marks)**

1. What do you mean by inertia?

2. State the Newton's universal law of gravitation.

3. What are conservative forces?

4. Define centre of mass.

5. What is a rigid body? Is it possible to have a perfect rigid body?

6. Compare inertia and moment of inertia.

7. Define simple harmonic motion and give its differential equation.

8. State the Kepler's laws of planetary motion.

9. What is the velocity of light in air and in a medium of refractive index 1.5.

10. State the postulates of special theory of relativity.

Part – B   **Answer ANY FOUR Questions**   **(4 x 7.5 = 30 marks)**

11. (a) State and prove law of conservation of linear momentum.   **(4)**
    (b) Two billion people with average mass 60 kg jump above the earth's surface with a speed of 4 m s^{-1} from the same spot. The mass of the earth is 6×10^{24} kg. What will be the effect of this action on the earth?   **(3.5)**

12. Show that the work done by a force is equal to the change in kinetic energy.

13. State and prove (i) perpendicular axes theorem for plane lamina and (ii) parallel axes theorem.

14. Obtain the period of simple harmonic oscillation of a loaded spring.

15. What are Lorentz transformation equations and derive the same.

16. (a) An experimenter observes a radioactive atom moving with a velocity of 0.25c. The atom then emits a β particle which has a velocity of 0.9c relative to the atom in the direction of its motion. What is the velocity of the β particle, as observed by the experimenter.   **(3.5)**
    (b) How fast would a rocket have to go relative to an observer for its length to be contracted to 99% of its length at rest?   **(4)**

Part – C   **Answer ANY FOUR Questions**   **(4 x 12.5 = 50 marks)**

17. (a) Deduce the expression for the velocity of a charged particle in an uniform constant electric field at a given time. **(7.5)**

(b) An electron is accelerated from rest for 1 nanosecond by an electric field, $E_x = 1\ V\,m^{-1}$. What is the final velocity of the electron? **(5)**

18. (a) Give a note on the system of variable mass. **(2.5)**

(b) With necessary theory deduce the velocity of a rocket. **(10)**

19. (a) Obtain the expression for acceleration of a body rolling down an inclined plane without slipping. Extend this, as a special cases : for solid sphere, disc, ring and spherical shell. **(7.5)**

(b) A solid sphere and a hollow sphere roll down an inclined plane from the same height. Calculate the ratio of their accelerations. **(5)**

20. Show that the discharge is oscillatory and undamped in a circuit containing an inductance and a capacitor.

21. Prove the invariance of velocity of light through Michelson-Moreley experiment.

22. (a) State and prove the law of conservation of angular momentum. **(5)**

(b) Obtain the expression for the distance of closest approach of proton to a nucleus. **(10)**

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