

SECOND TERMINAL EXAMINATION, 2017

PHYSICS

Time : 3 hrs.

Class XI

M.M. : 70

Date – 28.2.2017 (Tuesday)

Name of the student _____ Section _____

GENERAL INSTRUCTIONS –

- All the questions are compulsory.
- There are **26** questions in total. Question Nos. **1 to 5** carry **1** mark each. Question Nos. **6 to 10** carry **2** marks each. Question Nos. **11 to 22** carry **3** marks each, question No. **23** is value based question and carries **4** marks and question Nos. **24 to 26** carry **5** marks each.
- There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- Use of calculator is not permitted.
- You may use log book if necessary.
- **Please check that this question paper contains 03 printed pages.**

- Q.1** Name the physical quantity expressed by moment of force. Is it a vector or a scalar quantity?
- Q.2** What makes a water-proof raincoat water-proof?
- Q.3** A gymnast with mass 50kg suspends herself from lower end of a rope. The upper end of rope is attached to the ceiling. What is the tension at the top of the rope?
- Q.4** When will the relative velocity of two moving objects be zero?
- Q.5** Two sound sources produce 12 beats in 4 seconds. By how much do their frequencies differ?
- Q.6** Establish the relation between angular momentum and moment of inertia of a rigid body.
- Q.7** Show that the value of acceleration due to gravity decreases with the altitude.
- Q.8** Show that the vectors $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{B} = -6\hat{i} + 9\hat{j} + 3\hat{k}$ are parallel.

OR

Find a unit vector perpendicular to $\vec{A} = 2\hat{i} - 3\hat{j} + 6\hat{k}$ and $\vec{B} = \hat{i} + \hat{j} - \hat{k}$.

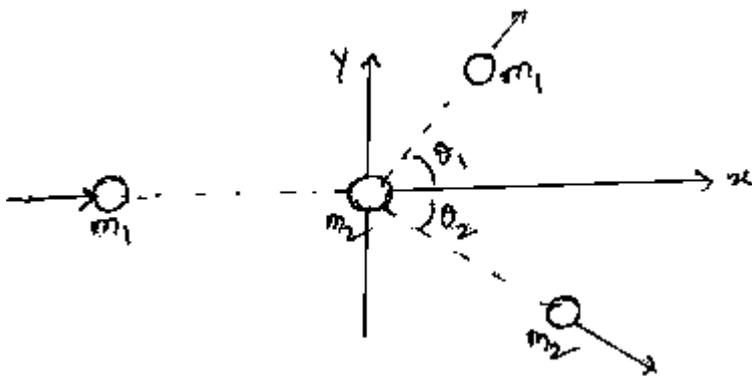
- Q.9** Why is it easier to pull a lawn roller than to push it?
- Q.10** State and prove work energy theorem.
- Q.11** The number of particles crossing a unit area perpendicular to x-axis in unit time is given by $n = -D \frac{n_2 - n_1}{x_2 - x_1}$ where n_1 and n_2 are number of particles per unit volume for the values of x meant to be x_1 and x_2 . Find the dimensions of the diffusion constant D.

- Q.12** Derive an expression for the excess pressure inside a liquid drop.
- Q.13** A plane is in level flight at constant speed and each of its two wings has an area of 25m^2 , the speed of the air is 180 km/hr over the lower wing and 234 km/hr over the upper wing of the surface, determine the plane's mass. Take air density to be 1 kg/m^3 and $g=9.8\text{ m/s}^2$.
- Q.14** State Newton's law of cooling. Deduce the relation $\log_e (\theta-\theta_0) = -kt + C$, where the symbols have their usual meanings.
- Q.15** An air chamber of volume 'V' has neck of area of cross – section A into which a ball of mass 'm' can move without friction. Show that when the ball is pressed down through some distance and released, the ball executes simple harmonic motion. Obtain the formula for time period of this simple harmonic motion.

OR

A displacement wave is represented by $y = 0.25 \times 10^{-3} \sin (500t - 0.025 x)$ where y, x are in metres and 't' is in sec. Deduce (i) amplitude (ii) time period (iii) angular frequency (iv) wavelength. Also deduce the amplitude of particle velocity and amplitude of particle acceleration.

- Q.16** A disc revolves with a speed of $33\frac{1}{3}\text{ rev/min}$ and has a radius of 15 cm . Two coins placed at 4cm and 14 cm away from the centre of the record. If the coefficient of friction between the coins and the record is 0.15 , which of the two coins will revolve with record?
- Q.17** Define gravitational potential energy. Derive an expression for gravitational potential energy of a body of mass 'm' near the surface of earth.
- Q.18** Consider the collision depicted in the figure to be between two billiard balls with equal masses $m_1 = m_2$. The first ball is called the cue while the second ball is called the target. The billiard player wants to 'sink' the target ball in a corner pocket, which is at an angle $\theta_2=37^\circ$. Assume that the collision is elastic and that friction and rotational motion are not important. Obtain θ_1 .



- Q.19** A solid cylinder of mass 10kg and radius 15cm is rolling perfectly on a plane of inclination 30° . The coefficient of static friction, $\mu_s = 0.25$.
- Find the force of friction acting on the cylinder.
 - What is the work done against friction during rolling?
 - If the inclination θ of the plane is increased, at what value of θ does the cylinder begin to skid?

- Q.20** Derive an expression for the position vector of the centre of mass of a system consisting of two particles.
- Q.21** Explain the formation of beats analytically. Prove that the beat frequency is equal to difference in frequencies of the two superposing waves.
- Q.22** A whistle of frequency 540 Hz rotates in a circle of radius 2 m at an angular speed of 15 rad/sec. What is the lowest and highest frequency heard by a listener a long distance away at rest with respect to centre of the circle? Can the apparent frequency be equal to the original frequency ? Take $v = 330$ m/s.
- Q.23** Sonia and Mahima are good friends and living in a city near equator. Sonia went to a country located near the north pole of the earth with her parents. Her friend Mahima requested her to bring a gold necklace as gold was cheaper in that country. Sonia purchased the necklace weighing 20 gm wt. and handed it over to Mahima. When Mahima got necklace weighted from local gold smith, its weight was less than 20 gm wt. Mahima told Sonia that she was cheating her. However, Sonia explained that weight of a body at different places are different. Sonia asked Mahima to return the necklace to her because she was not interested to spoil her friendship with Mahima.
- Why does weight of a body vary from place to place?
 - How does the weight of necklace vary at equator and at poles and why?
 - Comment on the attitude of Mahima.
 - What values are shown by Sonia.
- Q.24** Derive an expression for the rise of liquid in a capillary tube and show that the height of liquid column supported is inversely proportional to the curvature of the tube.

OR

State and prove Bernoulli's theorem.

- Q.25** What is an isothermal process? State two essential conditions for such a process to take place. Show analytically that work done by one mole of an ideal gas during volume expansion from V_1 to V_2 at temperature T is given by $W = RT \log_e \frac{V_2}{V_1}$.

OR

- State first law of thermodynamics.
 - Define molar specific heat at constant volume and at constant pressure. Derive the relation between them.
- Q.26** What is an organ pipe? Derive expression for stationary waves formed in a closed organ pipe and discuss normal modes of vibrations of the pipe.

OR

Define simple harmonic motion? Derive an expression for (i) displacement (ii) velocity (iii) acceleration and (iv) time period of a particle executing simple harmonic motion.

