PHYSICS 2018

Time: 2 Hours 40 Minutes Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)(40)

NOTE: Answer any 10 questions from this section.

2.(i) If the vector $\vec{A}=a\hat{i}+\hat{j}-2\hat{k}$ and $\vec{B}=\hat{i}+a\hat{j}+\hat{k}$ are perpendicular to each other, then find the value of 'a'.

(ii) Calculate the angle of projection for which the maximum height of a projectile is equal 1/3 of its horizontal range.

(iii) Define static and dynamic equilibrium and write the conditions of equilibrium.

(iv) What will be the effect on acceleration due to gravity and universal constant of gravitation if mass of the earth becomes 4 times and its radius remains the same?

(v) A brick of mass 2 kg is dropped from a height of 5 m above the ground. What is its vvelocity at a height of 3 m above the ground?

(vi) A 15 kg block is suspended by a spring of spring constant 5×10^3 N/m. Calculate the frequency of vibration of the block displaced from its equilibrium position and then released.

(vii) An Astronomical Telescope has a length of 105 cm and its magnification is 6. Determine the power objective and eyepiece.

(viii) What is diffraction of light? Defferentiate between Fresnel and Fraunhofer diffraction.

(ix) A crane lifts a load of 6000 N through a vertical distance of 15 m in 30 s. What is the potential energy at the highest point of this operation?

(x) A standing wave is established in a 135 cm long string fixed at both ends. The string vibrates in four loops when driven at 130 Hz. Determine the fundamental frequency.

(xi) A man weighing 60 kg is standing on the floor of an elevator. Calculate the force exerted by the man when the elevator is ascending at the rate of $2\ m/s^2$.

(xii) Write Newton's formula for speed of sound in air. What was Newton's fault? Give Laplace's corrected formula.

(xiii) A balloon tied up with a wooden piece is moving upward with velocity of 15 m/s. At a height of 300 m above the ground, the wooden piece is detached form the balloon. How much time will it take to reach the ground.

(xiv) Prove that the projection of a particle moving in a circle with constant angular velocity, performs simple harmonic motion along one of the diameters of the circle.

(xv) A microscope has an objective of 12 mm focal length and eyepiece of 25 mm focal length. What is the distance between the lenses? What is the magnifying power if the object is in sharp focus when it is 15 mm from the objective?

SECTION'C' (DETAILED- ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section. (28)

Define scalar and vector products of two vector, giving an example of each. Show that $\vec{A}.\vec{B}=\vec{B}.\vec{A}$. Also show that the magnitude of vector product of two vectors is equal to area of parallelogram.

What is a diffraction grating and grating element? How is diffraction grating used to determine the wavelength of monochromatic light? Derive the relevant mathematical expression.

What is a magnifying glass and visual angle? With the help of a labelled diagram, give the construction and working of magnifying glass and also derive the formula for its magnifying power.