BOARD QUESTION PAPER: MARCH 2016 PHYSICS

Time: 3 Hours
Total Marks: 70

Note:

i. All questions are compulsory.

ii. Neat diagrams must be drawn wherever necessary.

iii. Figures to the right indicate full marks.iv. Use of only logarithmic table is allowed.

v. All symbols have their usual meaning unless otherwise stated.vi. Answers to both sections must be written in the same answerbook.

vii. Answer to every question must be written on a new page.

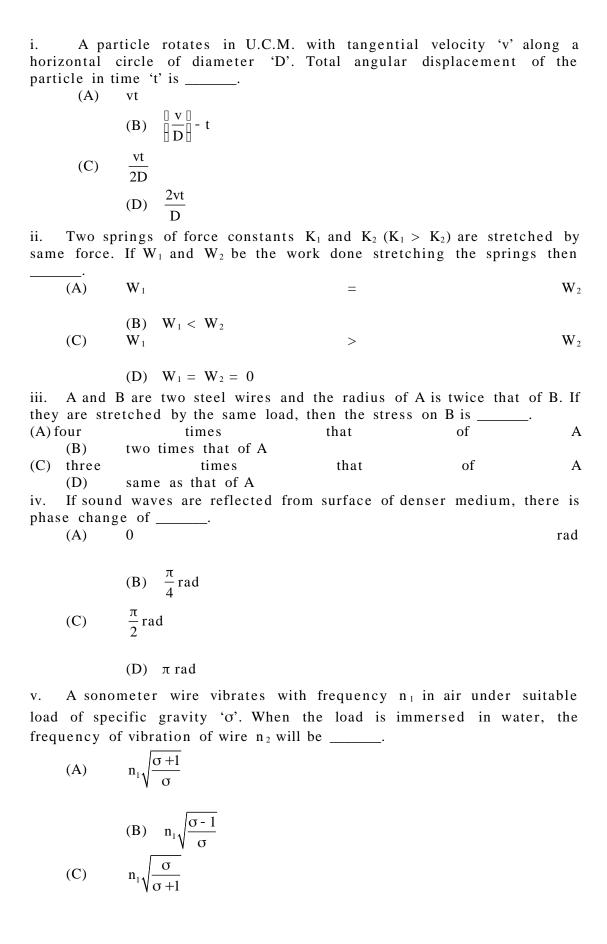
SECTION - I

Q.1. Attempt any SIX:

[12]

- i. In U.C.M. (Uniform Circular Motion), prove the relation $v=\omega$ where symbols have their usual meanings.
- ii. Derive an expression for critical velocity of a satellite revolving around the earth in a circular orbit.
- iii. Obtain an expression for total kinetic energy of a rolling body in the form $\frac{1}{2}MV^2 \frac{1}{n} 1 + \frac{K^2}{R^2}$.
- iv. Define 'emissive power' and 'coefficient of emission of a body'.
- v. A coin kept at a distance of 5 cm from the centre of a turntable of radius 1.5 m just begins to slip when the turnable rotates at a speed of 90 r.p.m. Calculate the coefficient of static friction between the coin and the turntable. $[g = 9.8 \text{ m/s}^2]$.
- vi. The fundamental frequency of an air column in a pipe closed at one end is in unison with the third overtone of an open pipe. Calculate the ratio of lengths of their air columns.
- vii. A particle performing linear S.H.M. has a period of 6.28 seconds and a path length of 20 cm. What is the velocity when its displacement is 6 cm from mean position?
- viii. The energy of the free surface of a liquid drop is 5π times the surface tension of the liquid. Find the diameter of the drop in C.G.S. system.
- Q.2. Select and write the most appropriate answer from the given alternatives for each sub-question:

 [7]



(D)
$$n_1 \sqrt{\frac{\sigma}{\sigma - 1}}$$

vi. For polyatomic molecules having 'f' vibrational modes, the ratio of two specific heats, $\frac{C_p}{C_v}$ is _____.

- $(A) \qquad \frac{1+f}{2+f}$
- (B) $\frac{2+f}{3+f}$
- (C) $\frac{4+f}{3+f}$
- $(D) \qquad \frac{5+f}{4+f}$

vii. A body of moment of inertia 5 kgm² rotating with an angular velocity 6 rad/s has the same kinetic energy as a mass of 20 kg moving with a velocity of _____.

$$(A)$$
 5 m/s

(B)
$$4 \text{ m/s}$$

$$(C)$$
 3 m/s

(D) 2 m/s

Q.3. A. Define linear S.H.M. Show that S.H.M. is a projection of U.C.M. on any diameter.

B. A metal sphere cools at the rate of 4 °C/min. when its temperature is 50 °C. Find its rate of cooling at 45 °C if the temperature of surroundings is 25 °C

[7]

OR

A. Explain analytically how the stationary waves are formed. Hence show that the distance between node and adjacent antinode is $\frac{\lambda}{4}$.

B. A set of 48 tuning forks is arranged in a series of descending frequencies such that each fork gives 4 beats per second with preceding one. The frequency of first fork is 1.5 times the frequency of the last fork, find the frequency of the first and 42 nd tuning fork.

[7]

i. What is the decrease in weight of a body of mass 600 kg when it is taken in a mine of depth 5000 m?

[Radius of earth = 6400 km, $g = 9.8 \text{ m/s}^2$]

- ii. State and prove theorem of parallel axes about moment of inertia.
- iii. Derive Laplace's law for spherical membrane of bubble due to surface tension.
- iv. A steel wire having cross sectional area 1.5 mm 2 when stretched by a load produces a lateral strain 1.5 \times 10 $^{-5}$. Calculate the mass attached to the wire.

$$(Y_{steel} = 2 \times 10^{11} \text{ N/m}^2, Poisson's ratio } \sigma = 0.291, g = 9.8 \text{ m/s}^2)$$

SECTION – **II**

Q.5. Attempt any SIX:

[12]

- i. What is 'diffraction of light'? Explain its two types.
- ii. Draw a neat labelled diagram for the construction of 'cyclotron'.
- iii. Distinguish between 'paramagnetic' and 'ferromagnetic' substances.
- iv. Write a short note on surface wave propagation of electromagnetic waves.
- v. The combined resistance of a galvanometer of resistance 500 Ω and its shunt is 21 Ω . Calculate the value of shunt.
- vi. The susceptibility of magnesium at 200 K is 1.8×10^{-5} . At what temperature will the susceptibility decrease by 6×10^{-6} ?
- vii. The co-efficient of mutual induction between primary and secondary coil is 2H. Calculate induced e.m.f. if current of 4A is cut off in 2.5×10^{-4} seconds.
- viii. The decay constant of radioactive substance is 4.33×10^{-4} per year. Calculate its half life period.
- Q.6. Select and write the most appropriate answer from the given alternatives for each sub-question: [7]
 - i. If the polarising angle for a given medium is 60° , then the refractive index of the medium is _____
 - (A)

	$\sqrt{\frac{3}{2}}$
	(C) 1
	$ \begin{array}{c} \text{(D)} \\ \sqrt{3} \end{array} $
ii.	The resolving power of a telescope depends upon the
	(A) length of the telescope
	(B) focal length of an objective
	(C) diameter of an objective
	(D) focal length of an eyepiece
iii. sphe	Electric intensity due to a charged sphere at a point outside the re decreases with
	(A) increase in charge on sphere.
	(B) increase in dielectric constant.
	(C) decrease in the distance from the centre of sphere.
	(D) Decrease in square of distance from the centre of sphere.
	In potentiometer experiment, if l_1 is the balancing length for e.m.f. of internal resistance r and l_2 is the balancing length for its terminal ntial difference when shunted with resistance R then:

(A)

$$l_1 = l_2 \begin{bmatrix} \frac{R+r}{R} \end{bmatrix}$$

(B)

$$l_1 = l_2 \left[\frac{R}{R + r} \right]$$

(C)

$$l_1 = l_2 \begin{bmatrix} \frac{R}{R-r} \end{bmatrix}$$

(D)

$$l_1 = l_2 \begin{bmatrix} \frac{R-r}{R} \end{bmatrix}$$

The energy of photon of wavelength λ is _____.

[h = Planck's constant, c = speed of light in vacuum]

(A)

 $hc\,\lambda$

(B)

 $\underline{h\lambda}$

(C)

 $\frac{\lambda}{hc}$

(D)

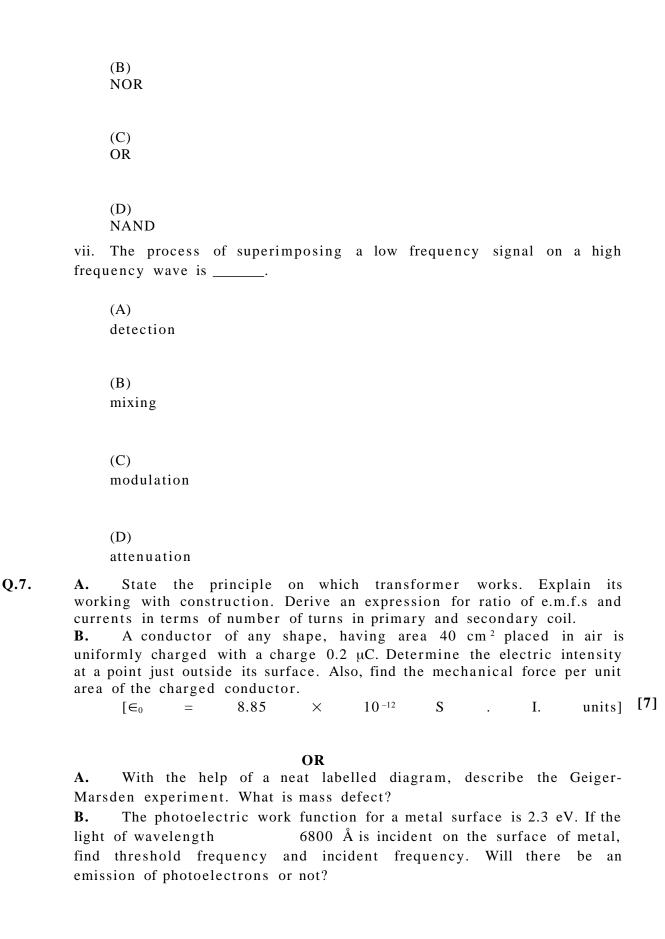
 $\frac{hc}{\lambda}$

Which logic gate corresponds to the truth table given below?

A	В	Y
0	0	1
0	1	0
1	0	0
1	1	0

(A)

AND



Q.8. Attempt any THREE:

[9]

- i. Determine the change in wavelength of light during its passage from air to glass. If the refractive index of glass with respect to air is 1.5 and the frequency of light is 3.5×10^{14} Hz, find the wave number of light in glass. [Velocity of light in air (c = 3×10^8 m/s)]
- ii. In biprism experiment, 10th dark band is observed at 2.09 mm from the central bright point on the screen with red light of wavelength 6400 Å. By how much will fringe width change if blue light of wavelength 4800 Å is used with the same setting?
- iii. Describe Kelvin's method to determine the resistance of galvanometer by using metre bridge.
- iv. Explain the elementary idea of an oscillator with the help of block diagram.