BOARD QUESTION PAPER : JULY 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. **Select and write the most appropriate answer from the given alternatives for each sub-question:** **[7]**

i.   The difference in tensions in the string at lowest and highest points in the path of the particle of mass 'm' performing vertical circular motion is:
   (A)   2 mg   (B)   4 mg
   (C)   6 mg   (D)   8 mg

ii.   The body is rotating with uniform angular velocity (ω) having rotational kinetic energy (E). Its angular momentum (L) is:

   (A) $\dfrac{2E}{\omega}$ (B) $\dfrac{E^2}{\omega}$

   (C) $\dfrac{E}{\omega^2}$ (D) $\dfrac{E}{2\omega}$

iii.   The S.I. unit of compressibility is _____.

   (A) $\dfrac{m^2}{N}$ (B) Nm^2

   (C) $\dfrac{N}{m^2}$ (D) $\dfrac{kg}{m^3}$

iv.   The working of RADAR is based on _____.
   (A)   resonance   (B)   speed of a star
   (C)   Doppler effect   (D)   speed of rotation of sun

v.   If two capillary tubes of different diameters are partially dipped in the same liquid vertically, then the rise of liquid _____.
   (A)   is same in both the tubes.
   (B)   is more in the tube of larger diameter.
   (C)   will not be in smaller diameter tube.
   (D)   is more in the tube of smaller diameter.

vi.   A sonometer wire vibrates with three nodes and two antinodes, the corresponding mode of vibration is _____.
   (A)   First overtone   (B)   Second overtone
   (C)   Third overtone   (D)   Fourth overtone

vii. Two gases exert pressure in the ratio 3:2 and their densities are in the ratio 2:3, then the ratio of their R.M.S. velocities is _____.

(A) 2 : 3   (B) 3 : 2

(C) 2 : 1   (D) 1 : 2

Q.2. Attempt any SIX :   **[12]**

i. Draw a neat labelled diagram showing the various forces and their components acting on a vehicle moving along curved banked road.

ii. Obtain an expression for critical velocity of a satellite orbiting around the earth.

iii. Draw a neat labelled diagram of rise of liquid in capillary tube showing different components of tension (force).

iv. State any four assumptions of kinetic theory of gases.

v. A tube open at both ends has length 47 cm. Calculate the fundamental frequency of air column. (Neglect end correction. Speed of sound in air is 3.3×10^2 m/s).

vi. A uniform solid sphere has a radius 0.1 m and density 6×10^3 kg/m^3. Find its moment of inertia about a tangent to its surface.

vii. A particle executes S.H.M. with a period of 10 seconds. Find the time in which its potential energy will be half of its total energy.

viii. A stone of mass 2 kg is whirled in a horizontal circle attached at the end of 1.5 m long string. If the string makes an angle of 30° with vertical, compute its period. (g = 9.8 m/s^2)

Q.3. Attempt any THREE   **[9]**

i. State Kepler's laws of planetary motion.

ii. Obtain an expression for torque acting on a body rotating with uniform angular acceleration.

iii. A steel wire having cross-sectional area 2 mm^2 is stretched by 10 N. Find the lateral strain produced in the wire.

(Given : Y for steel = 2×10^{11} N/m^2, Poisson's ratio $\sigma = 0.29$)

iv. A body cools from 62 ^{o}C to 54 ^{o}C in 10 minutes and to 48 ^{o}C in the next 10 minutes. Find the temperature of the surroundings.

Q.4. A. Explain the formation of stationary wave by analytical method. Show that nodes and antinodes are equally spaced in a stationary wave.

B. The speed limit for a vehicle on road is 120 km/hr. A policeman detects a drop of 10% in the pitch of horn of a car as it passes him. Is the policeman justified in punishing the car driver for crossing the speed limit?

(Given : Velocity of sound = 340 m/s)   **[7]**

OR

A. Define practical simple pendulum.

Show that motion of bob of pendulum with small amplitude is linear S.H.M. Hence obtain an expression for its period. What are the factors on which its period depends?

B. The total free surface energy of a liquid drop is $\pi\sqrt{2}$ times the surface tension of the liquid. Calculate the diameter of the drop in S.I. unit.   **[7]**

SECTION – II

Q.5. Select and write the most appropriate answer from the given alternatives for each sub-question: **[7]**

i. A parallel beam of light travelling in water is incident obliquely on a glass surface. After refraction its width _____.

   (A) decreases   (B) increases

   (C) remains the same   (D) becomes zero

ii. If 'a' is the aperture of telescope and 'λ' is the wavelength of light then resolving power of telescope is _____.

   (A) $\dfrac{\lambda}{1\cdot22a}$ (B) $\dfrac{1\cdot22a}{\lambda}$

   (C) $\dfrac{1\cdot22\lambda}{a}$ (D) $\dfrac{a}{1\cdot22\lambda}$

iii. From earth's surface, ionospheric layer of atmosphere lies between _____.

   (A) 12 km to 50 km   (B) 50 km to 80 km

   (C) 80 km to 400 km   (D) 400 km to 700 km

iv. The kinetic energy of emitted photoelectrons is independent of _____.

   (A) frequency of incident radiation.

   (B) intensity of incident radiation.

   (C) wavelength of incident radiation.

   (D) collector plate potential.

v. In hydrogen atom Balmer series in obtained when the electron jumps from _____.

   (A) higher orbit to first orbit

   (B) first orbit to a higher orbit

   (C) higher orbit to the second orbit

   (D) second orbit to a higher orbit

vi. The fraction of the total current passing through the galvanometer is _____.

   (A) $\dfrac{S}{S+G}$ (B) $\dfrac{G}{S+G}$

   (C) $\dfrac{S+G}{G}$ (D) $\dfrac{S+G}{S}$

vii. A meter gauge train is heading north with speed 54 km/hr in earth's magnetic field 3×10^{-4} T. The e.m.f. induced across the axle joining the wheels is _____.

   (A) 0·45 mV   (B) 4·5 mV

   (C) 45 mV   (D) 450 mv

Q.6. Attempt any SIX: **[12]**

i. Distinguish between intrinsic and extrinsic semiconductor. (Give any two points).

ii. Draw the block diagram of a receiver in communication system.

iii. A point is situated at 6·5 cm and 6·65 cm from two coherent sources. Find the nature of illumination at the point, if wavelength of light is 5000 Å.

iv. Draw the diagrams showing the dipole moments in paramagnetic substance when external magnetic field is (a) absent (b) strong.

v. A voltmeter has a resistance of 100 Ω. What will be its reading when it is connected across a cell of e.m.f. 2 V and internal resistance 20 Ω?

vi. The susceptibility of magnesium at 300 K is $1 \cdot 2 \times 10^{-5}$. At what temperature will the susceptibility increase to $1 \cdot 8 \times 10^{-5}$?

vii. What is de Broglie wavelength of an electron accelerated through 25000 volt?

viii. Draw the schematic symbols for AND, OR, NOT and NAND gate.

Q.7. Attempt any THREE: **[9]**

i. Using analytical method for interference bands, obtain an expression for path difference between two light waves.

ii. State law of radioactive decay. Hence derive the relation $N = N_o e^{-\lambda t}$. Represent it graphically.

iii. 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 $1 \cdot 5$ and the frequency of light is 5×10^{14} Hz. Find the wave number of light in glass (velocity of light in air $c = 3 \times 10^8$ m/s).

iv. Light of wavelength 3000 Å falls on a metal surface having work function $2 \cdot 3$ eV. Calculate the maximum velocity of ejected electrons.
(Planck's constant $h = 6 \cdot 63 \times 10^{-34}$ Js, Velocity of light $c = 3 \times 10^8$ m/s, mass of an electron = $9 \cdot 1 \times 10^{-31}$ kg)

Q.8. A. What is electromagnetic induction?

Prove theoretically $e = \dfrac{d\phi}{dt}$

B. A potentiometer wire has length of 2 m and resistance 10 Ω. It is connected in series with resistance 990 Ω and a cell of e.m.f. 2 V. Calculate the potential gradient along the wire. **[7]**

OR

A. With the help of a neat diagram, describe the construction and working of van de Graff generator.

B. A moving coil galvanometer has a resistance of 25 Ω and gives a full scale deflection for a current of 10 mA. How will you convert it into a voltmeter having range 0 – 100 V? **[7]**