PHYSICS HSSC–I
SECTION – A (Marks 17)

Time allowed: 25 Minutes

| Version Number | 1 | 7 | 1 | 2 |

Note: Section – A is compulsory. All parts of this section are to be answered on the OMR Answer Sheet provided separately. It should be completed in the first 25 minutes and handed over to the Centre Superintendent along with the Question Paper. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Choose the correct answer A / B / C / D by filling the relevant bubble for each question on the OMR Answer Sheet according to the instructions given there.

1) A $70kg$ man runs up a long flight of stairs in $4\ sec$. The vertical height of stairs is $4.5m$. Calculate his power output in Watts.
   A. $6.7 \times 10^2 W$
   B. $7.7 \times 10^{-2} W$
   C. $7.5 \times 10^{-1} W$
   D. $7.7 \times 10^2 W$

2) The travel time of light from moon to earth is:
   A. 8 min 20 sec
   B. 1 min 20 sec
   C. 1 min
   D. 8 min

3) The cross product of two parallel vectors is:
   A. Negative of a vector
   B. Null Vector
   C. Unit vector
   D. AB

4) The two vectors are at $45°$ to each other when:
   A. $|\vec{A}.\vec{B}| = |\vec{A} \times \vec{B}|$
   B. $|\vec{A} + \vec{B}| = 0$
   C. $|\vec{A} \times \vec{B}| = 0$
   D. $|\vec{A}.\vec{B}| = 0$

5) Distance between an object and its real image formed by convex lens cannot be:
   A. Less than 2f
   B. Greater than 2f
   C. Greater than f
   D. Equal to 4f

6) For which energy source, the original source is the moon:
   A. Wind
   B. Waves
   C. Tides
   D. Geothermal

7) One radian is equal to:
   A. $90°$
   B. $29°$
   C. $57°$
   D. $45°$

8) The moment of inertia of a thin rod of length 'r' is:
   A. $\frac{1}{2}mr^2$
   B. mr^2
   C. $\frac{2}{5}mr^2$
   D. $\frac{1}{12}mr^2$

9) For angles greater than critical angle, all the light is:
   A. Scattered
   B. Reflected
   C. Refracted
   D. Polarized

10) If λ for air is 1.4 and at STP condition $\sqrt{P/\rho} = 280\ m/s$. What is the speed of sound in air?
    A. 373 m/s
    B. 313 m/s
    C. 333 m/s
    D. 353 m/s

11) The average diastolic pressure in a normal human body is:
    A. 120
    B. $75 - 80$
    C. $85 - 90$
    D. 110

12) The efficiency of a petrol engine is:
    A. $0.25 - 0.3$
    B. $0.3 - 0.35$
    C. $0.35 - 0.4$
    D. $0.4 - 0.45$

13) 43.75 is round off to 3 significant figures as:
    A. 43.00
    B. 43.8
    C. 43.90
    D. 43.850

14) What is unit vector in the direction of vector $A = 4i + 3j$
    A. $\frac{4i}{5} - \frac{3j}{5}$
    B. $\frac{4i + 3j}{5}$
    C. $\frac{4i - 3j}{5}$
    D. $\frac{3}{4}i + \frac{4}{5}j$

15) How many nanoseconds are there in one year?
    A. $3.156 \times 10^{-16} ns$
    B. $3.1536 \times 10^7 ns$
    C. $3.1536 \times 10^{16} ns$
    D. $3.1 \times 10^{-8} ns$

16) The turbine in a steam power plant takes steam from boiler at $427°C$ and exhausts into a low temp reservoir at $77°C$. What is max possible efficiency?
    A. 0%
    B. 60%
    C. 50%
    D. 70%

17) The dimensions of co-efficient of viscosity η are:
    A. $ML^{-1}T^2$
    B. MLT^{-1}
    C. $ML^{-1}T^{-1}$
    D. $ML^{-1}T^{-2}$

For Examiner's use only:

Total Marks: ☐ 17

Marks Obtained: ☐

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Time allowed: 2:35 Hours

Total Marks Sections B, C and D: 68

NOTE: The Questions of sections B, C and D are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly.

SECTION – B (Marks 21)
(Chapters 1 to 6)

Q. 2 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Find the value of $2\left|\vec{A}\times\vec{B}\right|^2 +2(\vec{A}.\vec{B})^2$ where $\vec{A}$ and $\vec{B}$ are unit vectors.

(ii) Draw Velocity – time graphs when:

a. Acceleration is zero

b. Acceleration is constant (non-zero)

c. Acceleration is constant (non-zero) and negative

(iii) Find the angle of projection of a projectile for which its maximum height is double of its horizontal range.

(iv) A 1000 kg body at the top of an incline 10m high and 100 m long is released and rolls down the hill. What is its speed at the bottom of the hill if average retarding force due to friction is 735 N ($g = 9.8\,m/s^2$).

(v) Calculate the moment of Inertia of a body having mass of 10 kg and radius 5m for the following conditions:

a. The body is a hoop.

b. The body is a solid disc.

c. The body is a sphere.

(vi) Prove that earth's gravitational field is a conservative field.

(vii) Write down the characteristics of an ideal fluid. Also differentiate between turbulent and laminar flow.

(viii) a. Briefly describe why fog droplets appear to be suspended in air.

b. A person is standing near the fast moving train. Is he in danger of falling towards it? Briefly explain.

(ix) What is the least speed at which an aeroplane can execute a vertical loop of 1 km radius, so that there will be no tendency for the pilot to fall down at the highest point?

(x) Check the correctness of the relation $\sqrt{m.v} = \sqrt{F \times l}$ where ' v ' is the speed of transverse wave on a stretched string of tension 'F', length 'l' and mass 'm'.

SECTION – C (Marks 21)
(Chapters 7 to 11)

Q. 3 Answer any SEVEN parts. All parts carry equal marks. **(7 x3 = 21)**

(i) Prove that for a simple pendulum $T = 2\pi\sqrt{l/g}$

(ii) Under what conditions does the addition of two SHMs produce a resultant which is also SHM.

(iii) Two tuning forks exhibit a beat frequency of 10 Hz. The frequency of one tuning fork is 256 Hz. Its frequency is then lowered slightly by adding a bit of wax to one of its prongs. The two forks then exhibit a beat frequency of 12 Hz. Determine the frequency of the second tuning fork.

(iv) What is the effect of temperature on the speed of sound in air?

(v) Write a note on Huygen's Principle.

(vi) Sodium Light ($\lambda = 589nm$) is incident normally on a grating having 3000 lines / cm. What is the highest order of the spectrum obtained with this grating?

(vii) Write a short note on different types of 'Optical Fibres'.

(viii) An Astronomical telescope having magnifying power of 5 consists of two lenses 24 cm apart. Find the focal length of the lenses.

(ix) Differentiate between Adiabetic and isothermic process. Draw diagram showing both processes.
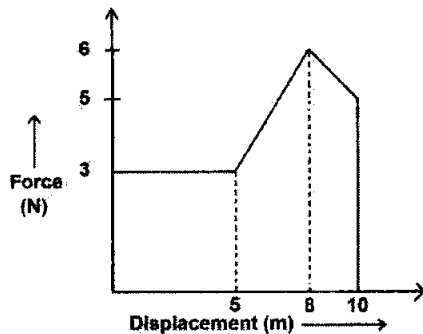
(x) Derive $C_p - C_v = R$

SECTION – D (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. (13 x 2 = 26)

Q. 4 a. Find the total work done as an object moves from $x = 0$ to $x = 10$. (03)

b. Derive Bernoulli's equation'. (06)

c. A reversible engine works between the temperature whose difference is $100°$. If it absorbs 746 J of heat from the source and rejects 546 J to the sink. Calculate the temperature of the source and sink. (04)

Q. 5 a. Write a detailed note on Doppler's Effect. (07)

b. Find expressions for the time of flight and height of the projectile for a projectile motion. (04)

c. The magnitude for dot and cross products of two vectors are 2 and $4 - 2\sqrt{3}$ respectively.

Find the angle between the two vectors. (02)

Q. 6 a. Write a note on 'Young's Double Slit Experiment'. (07)

b. Write a note on energy conservation in SHM. (04)

c. A 1000 kg car travelling with a speed of 144 km/hr rounds a curve of radius 100m. Find the necessary Centripetal Force. (02)

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