

PHYSICS (Subjective) GROUP - II

Time: 02:40 Hours

Marks: 68

SECTION – I**Write short answers to any EIGHT parts.**

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- (i) The length and width of a rectangular plate are measured to be 15.3cm and 12.80cm respectively. Find area of the plate.
- (ii) How uncertainty is estimated in power factors?
- (iii) When $V = 5.2 \pm 0.1V$ and $I = 0.84 \pm 0.05A$, what is percentage uncertainty in 'R'?
- (iv) Can measurement taken with a Vernier caliper be more precise than a measurement taken with a screw gauge? Explain.
- (v) Under what circumstances would a vector have rectangular component that are negative?
- (vi) Show that vector addition is commutative.
- (vii) What is torque? Write its units.
- (viii) Two row boats moving parallel in the same direction are pulled towards each other. Explain.
- (ix) Can the velocity of an object reverse the direction when acceleration is constant?
- (x) State Newton's 2nd law in terms of momentum.
- (xi) Draw the velocity-time graph for horizontal and vertical components of velocity of a projectile projected at certain angle with the horizontal.
- (xii) A projectile is fired at 45° with the horizontal. Show that $\text{Range} = 4 \times \text{vertical height}$.

3. Write short answers to any EIGHT parts.

16

- (i) Prove that $1kWh = 3.6Mj$
- (ii) An object has 1j of potential energy. Explain what does it mean?
- (iii) What sort of energy is in (a) compressed spring (b) water in a high dam?
- (iv) Show that $1 \text{ rad} = 57.3^\circ$
- (v) When mud flies off the tyre of a moving bicycle, in what direction does it fly? Explain.
- (vi) State the direction of these vectors in simple situations. (a) Angular momentum (b) Angular velocity
- (vii) For SHM of mass-spring system, prove that $P.E. = \frac{1}{2} kx_0^2$
- (viii) In relation to SHM, explain the equations (a) $y = A \sin(\omega t + \phi)$ (b) $a = -\omega^2 x$
- (ix) What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
- (x) Define beats. Explain its one use.
- (xi) Is it possible for two identical waves travelling in the same direction along a string to give rise to a stationary wave?
- (xii) Why does sound travel faster in solids than in gases?

4. Write short answers to any SIX parts.

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- (i) How would you manage to get more orders of spectra using a diffraction grating?
- (ii) How would you distinguish between un-polarized and plane-polarized light.
- (iii) What are Newton's rings?
- (iv) A simple microscope has convex lens of focal length 100cm. Find its magnifying power.
- (v) What is the difference between real and virtual image?
- (vi) How the power is lost in optical fiber through dispersion? Explain.
- (vii) Give an example of a process in which no heat is transferred to or from the system but the temperature of the system changes.
- (viii) Draw PV diagram which show four steps of Carnot engine.
- (ix) Why the entropy of the universe always increases?

SECTION – II Attempt any THREE questions. Each question carries 08 marks.

5. (a) Define gravitational field. Show that work done in gravitational field is independent of the path followed and also show that work done in closed path is zero. 05
- (b) Given that $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{B} = 3\hat{i} - 4\hat{k}$ find the length of the projection of $\vec{A}$ on $\vec{B}$. 03
6. (a) Discuss the elastic collision in one dimension and prove that speed of approach is equal to the speed of separation. 05
- (b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0km radius so that there will be no tendency for the pilot to fall down at the highest point? 03
7. (a) What is a Carnot heat engine? Show that efficiency of a Carnot heat engine depends on the temperature of the hot and cold reservoirs. 05
- (b) Water flows through a hose whose internal diameter is 1.0cm at a speed of $1.0ms^{-1}$. What should be the diameter of the nozzle if the water is to emerge at $21ms^{-1}$. 03
8. (a) Show that frequencies of stationary waves in a stretched string are quantized. 05
- (b) A 100gm body hung on a spring elongates the spring by 4cm. When a certain object is hung on the spring and set vibrating, its period is 0.568s. What is the mass of the object pulling the spring? 03
9. (a) Explain diffraction of x-rays by crystals. What are the uses of diffraction of x-rays? 05
- (b) A telescope is made of an objective of focal length 20cm and an eye-piece of 5.0cm, both convex lenses. Find the angular magnification. 03