

CSM—54/23
PART—II/PAPER—VI
PHYSICS
PAPER—I

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Time : 3 Hours

Full Marks : 250

*The question paper contains **18 (Eighteen)** questions in **GROUP—A (12)** and **GROUP—B (06)** together.*

GROUP—A

*Candidates to attempt **10 (ten)** questions within word limit of **250**.
Each question carries **15** marks.*

1. How does the Newton's equation $\vec{F} = m\vec{a}$, which describes the motion of a particle in rectilinear moving frame, gets changed, if the particle is moving in a rotation frame? Explain the meaning of each term in the equation. If the polar caps were to completely melt due to global warming, the melted ice, would redistribute itself over the earth. Use angular momentum ideas to explain how this change would effect the length of the day. Assume that sun, moon and planets exert negligibly small torques on earth.
2. Discuss the characteristics of a damped driven oscillator. When does resonance occur?
3. State and explain two postulates of special theory of relativity. What are Lorentz transformations. Explain terms (i) time dilation and (ii) length contraction.
4. Obtain the object-image relation for thin lens. A certain eyeglass lens is thin at center, even thinner at its top and bottom edges, and relatively thick at its left and right edges. Describe the defects in vision that this lens is intended to correct.
5. What are Newton's Rings? When do they form? Under what conditions the center spot in Newton's rings pattern is white?

6. Give a schematic illustration of a fiber. What are fiber characteristics? How does an electromagnetic pulse propagate in single mode fiber?
7. Explain 'Method of Images' technique in solving electrostatic problems. Consider a point charge q at a perpendicular distance d from a grounded infinite conducting plane. Find the force of attraction between q and the induced charge on the plane.
8. State Faraday's law. State Biot-Savart law. If the diameter of one of the MRI (Magnetic Resonance Imaging) coils is increased without changing the current, does the magnetic field it produces at its center increase, decrease or stay the same? Why?
9. What are magnetic materials? Draw hysteresis loop for a material, (i) which would be good for permanent magnet, (ii) computer memory material and (iii) which would be good for transformers.
10. Explain Planck's radiation law. Explain that it contains Wien displacement law and Stefan-Boltzmann law as consequences.
11. State zeroth, first and second laws of thermodynamics. Explain adiabatic process, isobaric process, isochoric process, isothermal process through P - V diagram. Explain the statement 'Most cooking involves isobaric processes'.
12. What is Gibbs paradox? How is it resolved?

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GROUP—B

Candidates to attempt 05 (five) questions within word limit of 300.

Each question carries 20 marks.

13. Explain Doppler effect for electromagnetic waves. At what speed would a particle have double the momentum predicted by Newtonian mechanics? Does it depend on the mass of the particle?
14. Describe Young's double slit experiment. If the double slits were illuminated with monochromatic (single-frequency) red light would the fringes be more widely or more closely spaced than if they are illuminated with monochromatic blue light? What happens if white light is used in this experiment?

15. What is lasing principle? Explain the working of He-Ne laser. An ordinary neon light fixture emits red light with the same 632.8 nm wavelength as a helium-neon laser? Why, then, is not such a light fixture classified as a laser?
16. Make an analogy between various quantities of simple harmonic motion and $L-C$ circuit.
17. Discuss qualitatively, Einstein theory of specific heat of solids and Debye theory of specific heat of solids.
18. Distinguish Microcanonical, Canonical and Grand-canonical ensembles. Which description shall suit for which physical situation?

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SPACE FOR ROUGH WORK

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