National Officers Academy
Mock Exams for CSS-2022
April 2022(Final Mock)
PHYSICS, PAPER-I

TIME ALLOWED: THREE HOURS PART-I(MCQS): MAXIMUM 30 MINUTES	PART-I (MCQS) PART-II	MAXIMUM MARKS = 20 MAXIMUM MARKS = 80

NOTE:
  i.   **Part-II** is to be attempted on the separate **Answer Book**.
  ii. Attempt **ONLY FOUR** questions from **PART-II**. **ALL** questions carry **EQUAL** marks.
  iii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
  iv. Use of Calculator is allowed.

SUBJECTIVE PART — PART-II

Q. No. 2. (a) State and prove the Gauss's Divergence Theorem.
          (b) Define and explain the line integral and the surface integral of a vector.

Q. No. 3. (a) What is surface tension? How surface tension is responsible for rising of liquid in capillaries?
          (b) Water circulates throughout a house in a hot-water heating system. If the water is pumped at a speed of 0.50 m/s through a 4.0cm diameter pipe in the basement under a pressure of 3.0 atm, what will be the flow speed and pressure in a 2.6cm diameter pipe on the second floor 5.0 m above? Assume the pipes do not divide into branches.
          (c) When blood pressure is measured, why must the cuff be held at the level of the heart?

Q. No. 4. (a) What do you mean by phase and group velocity? Derive a relation between a group and phase velocity.
          (b) What is superposition of waves? Show that the standing waves are produced by the superposition of two waves of equal amplitudes moving in opposite direction.

Q. No. 5. (a) Derive equation of Lorentz velocity transformations and show that speed of light is independent of the relative motion between the frames of reference.
          (b) The siren of a police car emits a source tone at a frequency of 1125 Hz. Find the frequency that would you receive in your car under the following circumstances.
            (i) Your car at rest, police car moving towards you at 29 m/s.
            (ii) Police car at rest, your car moving towards it at 29 m/s.
            (iii) Your and police car are moving towards one another at 14.5 m/s.

Q. No. 6. (a) Discuss Young's double slit experiment. How can we find the fringe width and angular spacing using this experiment?
          (b) Explain gyroscope and its precision.

Q. No. 7. (a) Differentiate between Fermi-Dirac, Bose-Einstein and Maxwell-Boltzman statistics.
          (b) When 20.9 J was added as heat to a particular ideal gas, the volume of the gas changed from 50 cm3 to 100 cm3 while the pressure remained at 1 atm.
            (i) By how much did the internal energy of the gas change?
            (ii) If the quantity of gas present was 2 x 10-3mol, find Cp.

Q. No. 8. Write a note on any two of the following:
          (a) Diffraction Gratings   (b) Brownian motion
          (c) Lissajous figures   (d) Equivalence of mass and energy

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Best of Luck for CSS-2022