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Reg. No. :

Code No. : 7805 Sub. Code : WPHSE 21

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2024.

Second Semester

Physics — Skill Enhancement Course

PHYSICS FOR COMPETITIVE EXAMINATIONS

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. The dimensional formula for G (Universal Gravitational constant)
(a) $M^{-2}L^3T^{-2}$ (b) $M^{-1}L^3T^{-2}$
(c) $M^{-1}L^2T^{-2}$ (d) $M^{-2}L^3T^{-1}$
2. Resistance of a fluid to change the motion and shape is
(a) Surface tension (b) Fluidity
(c) Viscosity (d) Resistivity

3. If the net external force acting on a system is zero, then
(a) $P = \text{constant}$ (b) $\omega = \text{constant}$
(c) $a = \text{constant}$ (d) $L = \text{constant}$
4. In a ——— system, there is no exchange of matter, but exchange of energy is possible between the system and its surroundings.
(a) isolated (b) closed
(c) adiabatic (d) open
5. Which of the following is an intensive variable?
(a) Internal energy (b) Temperature
(c) Mass (d) Volume
6. At what temperature, the density of water is higher
(a) 0°C (b) 100°C
(c) 4°C (d) -273°C
7. Which of the following colours of the rainbow has the shortest wavelength
(a) Violet (b) Blue
(c) Indigo (d) Yellow

8. Above _____ the noise becomes physically painful to human ears.

- (a) 50 dB (b) 80 dB
(c) 30 dB (d) 100 dB

9. For a sound wave, the frequency is 8800 Hz and the speed is 352 m/s in a given medium, the wavelength of the wave is

- (a) 0.4 m (b) 0.03 m
(c) 0.25 m (d) 0.04 m

10. If symmetry is present, then _____ is the easiest method to find the electric field.

- (a) Coulomb's law (b) Gauss' law
(c) Lorentz law (d) Faraday's law

11. The magnetic field at the center due to a circular current is

- (a) $4\mu_0 i / a$ (b) $2\mu_0 i / a$
(c) $\mu_0 i / 4a$ (d) $\mu_0 i / 2a$

12. The magnetic induction at a point 4cm from a long current carrying wires is 10^{-3}T , the magnetic field induction at a distance of 2cm from the same current carrying wire will be

- (a) $2 \times 10^{-4}\text{T}$ (b) $2 \times 10^{-3}\text{T}$
(c) $3 \times 10^{-3}\text{T}$ (d) $4 \times 10^{-3}\text{T}$

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13. According to the special theory of relativity the laws of physics are same in

- (a) Every inertial frame of reference
(b) Every non-inertial frame of reference
(c) All frames of reference
(d) Never been same

14. The mean life time of a radio nuclide, if its activity decreases by 4% for every one hour would be (product is non-radioactive)

- (a) 25 hrs (b) 1.042 hrs
(c) 2 hrs (d) 30 hrs

15. The stopping potential for a photoelectric emission process is 10V. Find the maximum kinetic energy of the electrons ejected in the process

- (a) $3.2 \times 10^{-19}\text{J}$ (b) $1.6 \times 10^{-19}\text{J}$
(c) $3.6 \times 10^{-18}\text{J}$ (d) Zero

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

16. (a) Derive an expression for the frequency of simple harmonic motion.

Or

(b) State and explain the laws of planetary motion.

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[P.T.O.]

17. (a) Discuss about blackbody radiation.

Or

- (b) Write short notes on the law of equipartition of energy.

18. (a) Explain the phenomenon of diffraction by a single slit experiment.

Or

- (b) Write a short note on resonance.

19. (a) The average distance r between the electron and the proton in the hydrogen atom is 5.3×10^{-11} m. What is the magnitude of the average electrostatic force that acts between these two particles?

Or

- (b) Two long, straight wires carrying electric currents 10 A in opposite directions the separation between the wires is 5 cm. Find the magnetic field at a point P midway between the wires.

20. (a) Describe briefly about matter waves and obtain an expression for the de-Broglie wavelength of a particle.

Or

- (b) Derive an expression for Lorentz-Fitzgerald length contraction.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

21. (a) State Newton's law of gravitation. Derive the equation for gravitational force and use it to determine the mass of the Earth.

Or

- (b) Derive an expression for co-efficient of viscosity of a liquid by Poiseuille's method.

22. (a) Explain (i) Charle's law and (ii) Boyle's law.

Or

- (b) State and explain Wien's displacement law.

23. (a) Explain the Young's double slit interference method. Obtain an expression for bandwidth.

Or

- (b) Verify the laws of vibrating strings.

24. (a) Discuss any two applications of Gauss' law.

Or

- (b) (i) A long solenoid is formed by winding 20 turns per cm. What current is necessary to produced a magnetic field of 20 mT inside the solenoid?

- (ii) Explain the magnetic field observed in a toroid.

25. (a) Explain Compton scattering and obtain the expression for the Compton shift.

Or

- (b) A hypothetical train moving with a speed of $0.6c$ passes by the platform of a small station without being slowed down. The observers on the platform note that the length of the train is just equal to the length of the platform which is 200 m.
- (i) Find the rest length of the train
 - (ii) Find the length of the platform as measured by the observers in the train.
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