25900155

Reg.No : .....

Name : .....

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

MGU-UGP (HONOURS) REGULAR EXAMINATION MARCH 2025

SECOND SEMESTER

Discipline Specific Core Course (DSC) - MG2DSCPHY100 - MODERN PHYSICS

(2024 ADMISSION ONWARDS)

Duration: 1.5 Hours **Maximum Marks: 50**

Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I) and Appreciation(Ap)

Students should attempt at least one question from each course outcome to enhance their overall outcome attainability.

Part A

Short Answer Questions

Answer any **10** questions

Each question carries **2** marks

1. What is the difference between an inertial and non inertial frame of reference? [K] / [CO1]
2. State two postulates of special relativity. [U] / [CO1]
3. Explain the mass- energy relation. [U] / [CO1]
4. What are the features of a blackbody? [K] / [CO2]
5. What is the physical significance of wave function? [K] / [CO2]
6. Classify electromagnetic spectrum based on wavelength or frequency. [U] / [CO2]
7. In the photoelectric effect, what happens if the frequency of incident light is increased while keeping intensity constant? [U] / [CO2]
8. What will be the ratio of de Broglie wavelength of a proton and an electron, if they have the same velocity? The ratio of their mass $m_p/m_e = 1836$. [A] / [CO2]

9. What is the effect of increasing the principal quantum number on an atom's energy levels? [K] / [CO3]

10. An astronomer finds a new absorption line with λ= 164.1 nm in the ultraviolet region of the Sun's continuous spectrum. He attributes the line to hydrogen's Lyman series. Is he right? Justify your answer [U] / [CO3]

11. Define stimulated absorption in the context of laser physics. [U] / [CO4]

12. Write the steady state form of Schrodinger's equation in three dimensions [K] / [CO5]

13. Give the physical interpretation of the wave function. [U] / [CO5]

14. A particle is confined in a 1D box of length L. Find the ratio of the energy of the first excited state to the energy of the ground state. [A] / [CO5]

[2x10 = 20]

Part B

Short Essay Questions

Answer any **6** questions

Each question carries **5** marks

15. A train moving at 0.6 c has a proper length of 200 m. What is its observed length for a stationary observer? [U] / [CO1]

16. A spaceship travels at 0.9 c relative to Earth. If 1 hour passes on the spaceship, how much time passes on Earth? [A] / [CO1]

17. Elaborate one example where Classical Physics failed and the new Quantum Physics solved the problem. [K] / [CO2]

18. A microscope using photons is employed to locate an electron in an atom to within a distance of 0.2 Angstrom. What is the uncertainty in the momentum of the electron located in this way? [U] / [CO2]

19. A metal has a work function of 3 eV. What is the longest wavelength of light that can cause photoelectric emission from this metal? [A] / [CO2]

20. Discuss the process of energy absorption and emission in an atom. [K] / [CO3]

21. Describe the process of population inversion and its role in the amplification of light in lasers. What methods are used to achieve it? [U] / [CO4]

22. Given the wave function for a free particle as $\psi = Ae^{(\frac{-i}{\hbar})(Et-px)}$ .Obtain the time dependent form of Schrodinger equation. [U] / [CO5]

[5x6 = 30]