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G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.



UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.

(For those admitted in June 2021 and later)

PROGRAMME AND BRANCH: B.Sc., PHYSICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
VI	PART III	CORE ELECTIVE	U21PH6E2A	QUANTUM MECHANICS

Date & Session: 29.04.2025/FN

Time : 3 hours

Maximum: 75 Marks

Course Outcome	Bloom's K-level	Q. No.	SECTION – A (10 X 1 = 10 Marks) Answer <u>ALL</u> Questions.
CO1	K1	1.	When light is incident on certain metallic surfaces, electrons are released, that are called as a) photoelectric effect b) photoelectrons c) threshold electrons d) photosynthesis
CO1	K2	2.	$h\nu_0$ is referred to as a) threshold frequency b) threshold function c) work function d) photoelectric effect
CO2	K1	3.	Identify the group velocity in a dispersive medium a) greater than phase velocity b) lesser than phase velocity c) equal to phase velocity d) none of the above
CO2	K2	4.	What will be the wavelength of de Broglie's electrons when accelerated through 54V? a) 2.5 angstrom b) 1.7 angstrom c) 4.5 angstrom d) 6.5 angstrom
CO3	K1	5.	Identify the application of uncertainty relation a) ground state energy of hydrogen atom b) Mass of meson c) both a and b d) none of the above
CO3	K2	6.	The wave associated with a particle in motion is called a) Compton wave b) de Broglie wave c) matter wave d) Schrodinger wave
CO4	K1	7.	$R+T =$ a) 1 b) 0 c) 2 d) 4
CO4	K2	8.	Diffraction of a beam of electrons by a slit is an example for a) Heisenberg's Uncertainty principle b) photoelectric effect c) Compton effect d) Tunnel effect
CO5	K1	9.	For a particle inside the box, the particle cannot move beyond the walls and so the amplitude of the associated wave _____ a) will be high at the walls b) a minimum value at the walls c) must drop to zero at the walls d) a maximum value at the walls
CO5	K2	10.	A particle executing simple harmonic motion along the x direction and let k be the restoring force per unit displacement then the potential energy of the particle is a) $\frac{1}{2} ky^2$ b) $2 ky^2$ c) $\frac{1}{2} kx^2$ d) $2 kx^2$

Course Outcome	Bloom's K-level	Q. No.	<p align="center">SECTION – B (5 X 5 = 25 Marks) Answer ALL Questions choosing either (a) or (b)</p>
CO1	K3	11a.	Write a short note on photoelectric effect. (OR)
CO1	K3	11b.	What is Compton effect? explain in detail.
CO2	K3	12a.	Derive the relation between group velocity and phase velocity. (OR)
CO2	K3	12b.	Derive the expression for group velocity.
CO3	K4	13a.	Derive the expression for ground state energy. (OR)
CO3	K4	13b.	Discuss the experimental setup of gamma ray microscope.
CO4	K4	14a.	What do you understand by the terms “Eigen value” and “Eigen function” (OR)
CO4	K4	14b.	Write a short notes on time dependent and time independent equations of Schrodinger.
CO5	K5	15a.	Discuss the theory of a simple harmonic oscillator. (OR)
CO5	K5	15b.	How does a particle with energy lower than the barrier height, tunnel through it?

Course Outcome	Bloom's K-level	Q. No.	<p align="center">SECTION – C (5 X 8 = 40 Marks) Answer ALL Questions choosing either (a) or (b)</p>
CO1	K3	16a.	Explain how the particle nature of radiation was confirmed by photoelectric effect and Compton effect. (OR)
CO1	K3	16b.	Explain the postulates of Bohr with regards to hydrogen atom.
CO2	K4	17a.	Discuss briefly the wave nature of matter and obtain an expression of de Broglie wavelength for matter waves. (OR)
CO2	K4	17b.	Describe Davisson and Germer experiments for the study of electron diffraction. What are the results of the experiments?
CO3	K4	18a.	Give an account of Heisenberg's uncertainty principle. Outline an idealised experiment to bring out its significance. (OR)
CO3	K4	18b.	Explain the principles on which the electron microscope works. Compare this instrument with an optical microscope.
CO4	K5	19a.	What are the postulates of wave mechanics? Derive Schrodinger's equation. (OR)
CO4	K5	19b.	State and Explain Ehrenfest's theorem.
CO5	K5	20a.	Solve the Schrodinger's equation for the case of hydrogen atom. Neglect electron spin and assume the nucleus to be stationary. (OR)
CO5	K5	20b.	Explain what do you understand by the terms potential well and potential barrier. How does a particle with energy lower than the barrier height tunnel through it? Give an example.

