RV Educational Institutions®
RV College of Engineering®

DEPARTMENT OF PHYSICS

SECOND SEMESTER BE PROGRAMS (CS, CD, CY, IS, AIML, & BT)

ACADEMIC YEAR 2022-2023

Date	10th July 2023	Maximum Marks	50
Course Code	22PHY22C	Duration	90 min
Course	QUANTUM PHYSICS FOR ENGINEERS	**CIE-I (Test)**	

Instruction: *Answer all questions.*

Qn	Questions	M	BTL	CO
1(a)	An excited state of an atom with lifetime of 10^{-8}s shows more broadening in its emitted spectral line than a state with lifetime of 10^{-3}s. Justify this statement by deriving a relation for spectral line broadening.	4	2	2
1(b)	Show that the de Broglie wavelength of an electron accelerated through a potential difference V is inversely proportional to $\sqrt{V}$.	4	1	1
1(c)	What is i) Born interpretation of wave function and ii) Normalization of wave function.	2	1	1
2(a)	Making use of the concept of matter waves setup one dimensional time independent Schrodinger wave equation.	6	2	2
2(b)	At time $t = 0$ a particle is represented by the wave function $$\Psi(x,0) = \begin{cases} \sqrt{(3/b)}(x/a), & 0 \le x \le a, \\ \sqrt{(3/b)}(b-x)/(b-a), & a \le x \le b, \\ 0, & \text{otherwise,} \end{cases}$$ where a and b are (positive) real constants representing two locations on the x-axis. What is the probability of finding the particle i) to the left of a and ii) to the right of a?	4	4	3
3(a)	For a particle in an one dimensional potential well of infinite depth, solve time independent Schrodinger wave equation and obtain normalized wave functions for first three allowed states.	6	1	1
3(b)	A particle in an one dimensional potential well of infinite depth makes two consecutive transitions from energy levels $E_{n+1} \rightarrow E_n \rightarrow E_{n-1}$ releasing energy of 3.384 eV and 2.632 eV respectively. Determine n.	4	4	3
4(a)	Obtain an expression for energy density of photons in terms of Einstein's coefficients.	7	1	1
4(b)	A laser operating at temperature of 300 K and wavelength of 680 nm is at thermal equilibrium. Determine the ratio of Einstein's coefficients A and B.	3	3	3
5(a)	With energy band diagram explain the construction and working of semiconductor laser.	7	1	1
5(b)	Two levels of an atomic system at thermal equilibrium has energy difference of 1.8 eV. If the system is at temperature 300 K, determine the ratio of population of these two energy levels.	3	3	3

BTL-Blooms Taxonomy Level, CO-Course Outcomes, M-Marks

Marks	Particulars	CO1	CO2	CO3	L1	L2	L3	L4
Distribution	Max Marks	26	10	14	26	10	6	8