

FIRST SEMESTER B. Tech.
MID-SEMESTER EXAMINATION, Jan 2023

Course Code- FCPH004
Course Title- PHYSICS

Time- 1.5 Hours

Max. Marks- 15

Note: - Attempt all questions. Missing data/ information if any, maybe suitably assumed & mention in the answer.

Q. No.	Question	Marks	CO
1a	A certain particle has a lifetime of 1.00×10^{-7} s when measured at rest. How far the particle will go before decaying, if its speed is $0.99c$ when it is created?	1	CO1
1b	Deduce an expression for velocity addition theorem and <u>show that the velocity of light is an absolute constant.</u>	2	CO1
2a	A particle of rest mass m_0 moving with a velocity $0.8c$ collide with another stationary particle of rest mass $5 \frac{m_0}{9}$ under perfectly inelastic collision. Find the velocity and rest mass of combined body.	2	CO1
2b	Prove the relation $E^2 - p^2 c^2 = m_0^2 c^4$ where p is the momentum.	1	CO1
3a	Discuss the effect of gravity on light.	1	CO1
3b	A harmonic Oscillator is represented by the equation $m \frac{d^2x}{dt^2} + b \frac{dx}{dt} + kx = 0$, given $m = 0.25$ kg, $b = 0.07$ kg s ⁻¹ , $K = 85$ N m ⁻¹ , calculate the number of oscillations in which its mechanical energy will drop to half of its initial value.	2	CO2
4a	Prove that the amplitude decrement in damped oscillator is logarithmic.	1	CO2
4b	Derive an expression for reflection and transmission coefficients of sound waves.	2	CO2
5a	Explain the production and uses of ultrasonic.	1.5	CO2
5b	Prove that the average power absorbed is same as the average power dissipated in a steady state condition of forced oscillator.	1.5	CO2

FIRST SEMESTER B. Tech. (PHYSICS)
END-SEMESTER EXAMINATION, MARCH 2023

Course Code – FCPH004

Course Title – PHYSICS

Time- 3 Hours

Max. Marks- 40

Note: - Attempt any two parts from each question. Missing data/information if any, maybe suitably assumed & mention in the answer.

S. No.	Questions	Marks	CO
1a	Derive Lorentz transformation equation for space and time.	4	CO1
1b	Explain the relativistic mass. If the relativistic mass of a particle has become twice its rest mass, then what is the ratio of its speed to that of light?	4	CO1
1c	What are the energy and momentum of a particle with mass 3.2×10^{-27} kilograms and velocity $0.9c$?	4	CO1
2a	What is damped oscillator? Find out the general solution and discuss in detail three conditions namely overdamped, critically damped and underdamped and show them graphically.	4	CO2
2b	Find out the expression of resonant driving frequency for a forced oscillator and what will be the maximum amplitude in this case? What will happen to deriving resonant frequency if the damping constant approaches zero?	4	CO2
2c	Prove the pressure wave equation, $\frac{\partial p}{\partial x} = -\rho_0 \frac{\partial^2 \eta}{\partial t^2}$, where p is excess pressure, ρ_0 is density and η is gas displacement.	4	CO2
3a	Derive an expression of interference from parallel thin films due to reflected light.	4	CO3
3b	In an arrangement for Fraunhofer diffraction, we use a slit of width 0.2 mm and the first minimum is at 5 mm on either side of central maximum. If the distance between the lens and the screen is 2m, calculate the wavelength of the light.	4	CO3
3c	What do you mean by double refraction? Briefly explain the construction and working mechanism of Nicole prism.	4	CO3
4a	What are the main features of Laser? Derive the Einstein coefficient relation.	4	CO4
4b	Explain principle, construction and working of He-Ne Laser.	4	CO4

4c	In a Laser, the total number of lasing particles are 3×10^{19} . If the Laser emits radiation of wavelength 7000 \AA , then calculate the energy of one emitted photon and total energy available per pulse. Assume the efficiency of Laser to be 100%.	4	CO4
5a	A step-index fiber has a core index of refraction of $n_1 = 1.425$. The cut-off angle for light entering the fiber from air is found to be 8.50° . (a) What is the numerical aperture of the fiber? (b) What is the index of refraction of the cladding of this fiber? (c) If the fiber were submersed in water, what would be the new numerical aperture and cut-off angle?	4	CO5
5b	What is the difference between step index fiber and graded fiber? Explain which one is better and why? Write any three applications of optical fiber.	4	CO5
5c	What is the advantage of optical fiber transmission over copper wire? What is <u>attenuation and dispersion in optical fiber</u> ? Discuss intramodal and intermodal dispersions in optical fiber.	4	CO5