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[23TBSPH03]

SECOND SEMESTER B.Tech EXAMINATION, APRIL- 2024

COMPUTATIONAL PHYSICS

Time: 3 Hours **Maximum Marks: 100**

Instructions:

Physical Constants:

i. Mass of the electron $m_e = 9.1 \times 10^{-31}$kg

ii. Charge of the electron $e = 1.602 \times 10^{-19}$c

iii. Planck's constant $h = 6.626 \times 10^{-34}$ Js

iv. Velocity of light $.c = 3 \times 10^{8}$ m/s

v. Boltzmann's constant, $k = 1.38 \times 10^{-23}$ J/k

ANSWER ALL QUESTIONS

		PART-A			05 X 02=10
1.	a	Define Simple Harmonic Motion	L-1	CO1	02
	b.	Explain Eigen wave function.	L-2	CO2	02
	c.	Define population inversion and meta-stable state.	L-1	C03	02
	d.	Explain numerical aperture of an optical Fiber	L-2	CO4	02
	e.	What are logic gates?	L-1	CO5	02
		PART-B	**06 X 05=30**		
2.	a.	For simple harmonic motion, define the following i. Wavelength ii. Amplitude iii. Time period iv. Frequency v. Phase	L-2	CO1	05
		OR			
	b.	Obtain an expression for equivalent force constant for springs which are connected in series to each other.	L-2	CO1	05
3.	a.	Calculate the first three permitted energy values for an electron in a one dimensional box of width 0.2 nm.	L-3	CO2	05
		OR			
	b.	State and explain Heisenberg's uncertainty principle.	L-3	CO2	05
4.	a.	Describe the requisites satisfied by a LASER system.	L-2	C03	05
		OR			
	b.	Explain spontaneous emission and stimulated emission with the help of energy level diagrams	L-3	C03	05
5.	a.	Explain with a block diagram the point-to-point communication system using an optical fiber.	L-3	CO4	05

		OR			
	b.	Explain the principle on which an optical fiber works with the help of a ray diagram.	L-3	CO4	**05**
6.	**a.**	Explain the function of OR gate and AND gate with the help of truth tables	L-2	C05	**05**
		OR			
	b.	Explain the function of NOR gate and NAND gate with the help of truth tables	L-2	C05	**05**
7.	**a.**	Analyze to find spring constant using an online simulation spring-mass system.	L-4	C06	**05**
		OR			
	b.	Analyze to find the refractive index of a material using TIR using online simulation.	L-4	C06	**05**
		PART-C	**06 X 10=60**		
8.	**a.**	Deduce an expression for the decay of the amplitude in damped oscillations.	L-2	CO1	**10**
		OR			
	b.	Deduce an expression for amplitude and phase of forced oscillations.	L-2	CO1	**10**
9.	**a.**	Using one-dimensional time independent Schrodinger's wave equation for a particle in a box of width "a", obtain the energy eigen values and eigen function.	L-3	CO2	**10**
		OR			
	b.	Setup one-dimensional time-independent Schrodinger's wave equation for a particle in a box of finite width	L-3	CO2	**10**
10.	**a.**	**i.** Derive an expression for energy density of a photon at thermal equilibrium in terms of Einstein's A & B coefficients. **ii.** Find the ratio of the populations of two states in a material that produces light of wavelength 6328Å at room temperature.	L-2 L-3	CO3 CO3	**06** **04**
		OR			
	b.	**i.** Describe the construction and working of CO_2 Laser with the help of a vibrational energy level diagram **ii.** Find the number of modes of standing waves in the resonant cavity of 1m length of a Laser operating at a wavelength of 632.8nm.	L-2 L-3	CO3 CO3	**06** **04**

11.	**a.**	**i.** With the help of neat diagrams, explain the any two types of optical fibers. **ii.** The angle of acceptance of an Optical fiber is 30° when kept in air. Estimate its angle of acceptance when it is in a medium of refractive index 1.33.	L-2 L-3	CO4 CO4	**06** **04**
		OR			
	b.	**i.** Deduce an expression for acceptance angle in terms of refractive indices of core & cladding of an optical fiber. **ii.** Find the attenuation of light in an optical fiber of length 500m, when a light signal of power 100mW emerges out of the fiber with a power 90mW.	L-2 L-3	CO4 CO4	**06** **04**
12.	**a.**	State and explain de-Morgan's theorems with an example for each theorem.	L-2	CO5	**10**
		OR			
	b.	Explain the working of a half adder and a full adder with the help of circuit diagrams and truth tables.	L-2	CO5	**10**
13.	**a.**	Discuss the procedure to find the wavelength of a given LASER experimentally with the necessary equations.	L-2	CO6	**10**
		OR			
	b.	Discuss the procedure to find the moment of inertia of an irregular body experimentally by setting up a Torsional Pendulum with the necessary formulae.	L-2	CO6	**10**