Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Supplementary Examination, December 2023

Course: Physics **Semester : I**

Program: B.Tech. Biotechnology (SOHST) **Time : 03 hrs.**

Course Code: PHYS 1021 **Max. Marks: 100**

Instructions:

- All questions are compulsory (**Q. No. 24, 26** and **27** has an internal choice)
- All **highlighted** representations are **vector quantities**.
- Scientific calculators can be used for calculations.

SECTION A

(20Q × 1.5M = 30 Marks)

- All questions are compulsory, Each Question carries **1.5 Marks**
- Write very Short Answers/ Solve

Q. No.	Statement of question	Marks	CO
Q 1.	Mention the process under which an electron jumps from higher energy state to lower energy state by the influence of incident photon (a) stimulated emission (b) spontaneous emission (c) simple emission (d) none of these.	**1.5**	**CO1**
Q 2.	In ruby laser which ions give rise to the laser action? (a) Al_2O_3 (b) Al^{3+} (c) Cr^{3+} (d) none of them	**1.5**	**CO1**
Q 3.	Holography produces the image (a) real (b) virtual (c) both (a) & (b) (d) none of these.	**1.5**	**CO1**
Q 4.	Optical fibre communication is based on the phenomenon of (a) refraction (b) total internal reflection (c) polarisation (d) diffraction	**1.5**	**CO1**
Q 5.	The inner most part of the optical fibre in known as (a) core (b) cladding (c) sheath (d) optical fibre axis.	**1.5**	**CO1**
Q 6.	If m_1 be the refractive index of core, m_2 that of cladding and m_0 of the medium meeting end face of fibre, the value of numerical aperture (NA) can exceed 1 when (a) $m_0 = 1$ (b) $m_0 > 1$ (c) m2 < m1 (d) $m_2 > m_1$.	**1.5**	**CO1**
Q 7.	A vector field ($\vec{A}$) will be conservative when (i) $\vec{\nabla} \cdot \vec{A} = 0$ (ii) $\vec{\nabla} \times \vec{A} = 0$ (iii) none of these (iv) both (a) and (b)	**1.5**	**CO2**
Q 8.	What is the origin of displacement current?	**1.5**	**CO2**
Q 9.	The divergence of curl of a vector is always (a) 1 (b) π/2 (c) 1/2 (d) zero	**1.5**	**CO2**
Q 10.	The unit of ε_0 in SI system of units is (a) Nm^2/C^2 (b) C/S (c) C^2/Nm^2 (d) N/C	**1.5**	**CO2**

Q 11.	In EM wave (a) electrons produce magnetic field only (b) electron produce electric field only (c) time variation of electric field produces magnetic field and vice-versa (d) time variation of electric field guides the wave	**1.5**	**CO2**
Q 12.	Displacement current appears because of (a) time varying electric field (b) time varying magnetic field (c) negative charge only (d) positive charge only	**1.5**	**CO3**
Q 13.	The work done in displacing a charge 2C through 0.5 m on an equipotential surface is (a) zero (b) 4 J (c) 1 J (d) none of these	**1.5**	**CO3**
Q 14.	Write down Stokes' theorem.	**1.5**	**CO3**
Q 15.	The phase velocity of de-Broglie wave associated with an electron is given by (a)E/p (b) $\lambda\nu$ (c) hc/λ (d) h/k	**1.5**	**CO4**
Q 16.	The existence of matter wave is experimentally proved by (a) Raman (b) Davisson and Germer (c) de-Broglie (d) none of these	**1.5**	**CO4**
Q 17.	Heisenberg uncertainty relation holds good for (a) microscopic and macroscopic particles (b) only microscopic particles (c) only macroscopic particles (d) none of these	**1.5**	**CO4**
Q 18.	What is wave particle duality?	**1.5**	**CO4**
Q 19.	The energy levels of a particle in a box are (a) equally spaced (b) continuous (c) not-equally spaced (d) none of these	**1.5**	**CO4**
Q 20.	Nanoscience can be represented when the size is of the order of a) few milimeter b) few nanometer c) few centimeter d) few kilometer	**1.5**	**CO5**
	SECTION B **($4Q \times 5M = 20$ Marks)** • All questions are compulsory, **Q 24.** has an internal choice. Each Question carries **5 Marks** • Write very Short Answers/ Solve		
Q 21.	What is superposition principle of electrostatics?	**5**	**CO2**
Q 22.	Outline Maxwell's equations in differential form.	**5**	**CO2**
Q 23.	Explain Biot-Savart's Law with proper diagram.	**5**	**CO3**
Q 24.	Discuss different types of optical fibers. **OR** Describe construction of holography.	**5**	**CO1**
	SECTION C **($2Q \times 15M = 30$ Marks)** • All questions are compulsory, **Q 26.** has an internal choice, Each Question carries **15 Marks**		

• Write long answer/ Derive/ Solve			
Q 25.	**(a)** Explain Ampere's Circuital law with proper diagram. Using Stoke's Theorem obtain the differential form of the Ampere's law. **(9)** **(b)** Calculate the magnetic field (with direction) at a distance R from a infinite current (I) carrying wire. **(6)**	**15**	**CO3**
Q 26.	**(a)** Derive time independent Schrodinger wave equation. **(10)** **(b)** Calculate the lowest energy of an electron confined in a 1-D cubical box of each side 2 Å. **(5)** **OR** **(a)** Explain Einstein's equation for photoelectric effect with proper explanation. **(5)** **(b)** X-rays with $\lambda = 2$ Å are scattered from a graphite bock. The scattered radiation is viewed at 90° to the incident beam. Estimate the Compton shift. **(5)** **(c)** Discuss Heisenberg's uncertainty principle in quantum mechanics. **(5)**	**15**	**CO4**
SECTION-D **(2Q × 10M = 20 Marks)** • All questions are compulsory, **Q.No. 27** has an internal choice, Each Question carries **10 Marks** • Write long answer/ Derive/ Solve			
Q 27.	Describe the construction and working of a Ruby laser by drawing a neat diagram and labelling the components used. **(10)** **OR** Describe the construction and working of a He-Ne laser system with proper diagram and labelling the components used. **(10)**	**10**	**CO1**
Q 28.	**(a)** Mention any four differences between a classical computer and quantum computer. **(4)** **(b)** Given $\|\psi\rangle = 6\|0\rangle - 5i\|1\rangle$. Find its normalized state. **(6)**	**10**	**CO5**

Constant	Standard Values
Planck's Constant (h)	6.63×10^{-34} Joule − sec
Permittivity of free space (ε_0)	8.85×10^{-12} Farad/meter
Velocity of light (c)	3×10^{8} m/sec
Boltzmann constant (k_B)	1.38×10^{-23} JK^{-1}
Rest mass of an Electron (m_o)	9.11×10^{-31} kg
Mass of the proton (m_p)	1.67×10^{-27}kg
Charge of an electron (e)	1.6×10^{-19} C