Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, December 2023

Course: Physics for Computer Engineers — **Semester : I**

Program: B.Tech. CSE (All Batches) — **Time : 03 hrs.**

Course Code: PHYS 1032 — **Max. Marks: 100**

Instructions:

- **There are 3 Sections such as Section A, B & C.**
- **Section A is compulsory, however, Section B & Section C have internal choices.**
- **Scientific calculator is allowed.**

SECTION A

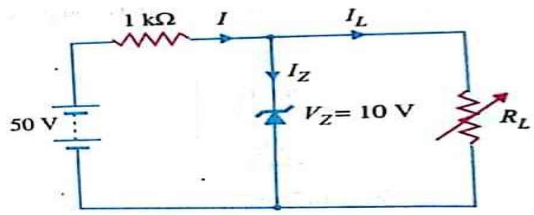
$(\mathbf{5Q \times 4M = 20\ Marks})$

S. No.		Marks	CO
Q 1.	Explain the fundamental principle of a hologram and mention any of its two properties.	**4**	**CO1**
Q 2.	Extract the constant 'a' if the vector $\vec{A} = (x + 3y)\hat{\imath} + (2y + 3z)\hat{\jmath} + (x + az)\hat{k}$ is a solenoidal vector.	**4**	**CO2**
Q 3.	Write Maxwell's equations in differential form for time-varying fields.	**4**	**CO3**
Q 4.	The threshold wavelength for photoelectric emission in Tungsten is 2300 Å. What wavelength of light must be used in order for electrons with a maximum energy of 1.5 eV to be ejected?	**4**	**CO4**
Q 5.	Differentiate between the Zener and avalanche breakdown mechanism in a p-n junction diode.	**4**	**CO5**

SECTION B

$(\mathbf{4Q \times 10M = 40\ Marks})$

S. No.		Marks	CO
Q 6.	Describe single mode, multimode and graded index fibres? Explain in detail the difference in structures of single mode step index and multimode graded index optical fibre.	**10**	**CO1**
Q 7.	A circular ring located on $x^2 + y^2 = 9$, $z = 0$ carries a direct current of I Ampere along $\hat{\boldsymbol{a}}_{\phi}$. Show that $$\vec{H}(0,0,h) = \frac{I\,\rho^2}{\{\rho^2 + h^2\}^{3/2}}\widehat{a_z}$$ Also find the value of $\vec{H}$ at (0, 0, 4).	**10**	**CO2**

Q 8.	For the given circuit, determine the range of load resistance R_L that will result in a constant voltage of 10 V across R_L. Maximum value of Zener current is 32 mA.  	**10**	**CO5**
Q 9.	Correlate the kinetic energy of recoiling electron and the energy of incident photon in Compton scattering as $$K.E. = h\upsilon \frac{2\alpha \sin^2 \phi/2}{1 + 2\alpha \sin^2 \phi/2}, \text{ where } \alpha = \frac{h\upsilon}{m_0 c^2}$$ **OR** If a proton and a deuteron have the same kinetic energy, then find out which one of these have a longer wavelength?	**10**	**CO4**
SECTION-C $(\mathbf{2Q} \times \mathbf{20M} = \mathbf{40}\ \boldsymbol{Marks})$			
Q 10.	(a) State Faraday's law of electromagnetic induction. How can it be expressed as one of the Maxwell's equations for time varying field?	**10**	**CO3**
	(b) Derive Energy Eigen value of a particle confined in one-dimensional box and hence calculate the energies of first two excited energy levels in terms of ground energy level $[E_0]$.	**10**	**CO4**
Q 11.	(a) Pair production and pair annihilation were the first experimental evidence of conversion from energy into mass and back. Using this information, Illustrate the phenomenon of pair production and pair annihilation with a proper Justification that the pair production phenomenon cannot happen in an empty space.	**15**	**CO4**
	(b) A magnetic field $\vec{B} = B_0(\hat{\imath} + 2\hat{\jmath} - 4\hat{k})$ exists at a point. If a test charge moving with a velocity $\vec{v} = v_0(3\,\hat{\imath} - \hat{\jmath} + 2\hat{k})$ experiences no force at a certain point, what will be the electric field at that point in SI units?	**5**	**CO3**
	OR		
	(a) What is the difference between phase and group velocities in the context of wave motion. Additionally, show that how the de Broglie group velocity, linked to the wave packet, is equivalent to the particle's velocity?	**15**	**CO4**
	(b) A steady current element of $10^{-3}\mathbf{a}_z$A.m is located at the origin in free space. Determine the magnetic field intensity due to this current element at (1, 0, 0).	**5**	**CO3**

Standard Physics Constants and their values:

Constants	Standard values
Planck's constant (h)	$6.626 \times 10^{-34}\, Js$
Permittivity of free space (ε_0)	$8.854 \times 10^{-12}\, F/m$
Velocity of light (c)	$3 \times 10^{8}\ m/s$
Boltzmann constant (k_B)	$1.38 \times 10^{-23}\ J/K$
Rest mass of an electron (m_0)	$9.11 \times 10^{-31}\, kg$
Rest mass of an electron (m_p)	$1.67 \times 10^{-27}\, kg$
Charge on electron (e)	$1.6 \times 10^{-19}\, C$