Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, January 2021

Course: Physics **Semester: I**
Course Code: PHYS1021
Programme: B Tech- Food Technology **Max. Marks: 100**
Total pages: 2 **Time: 03 hrs.**

Instructions:

- All questions are compulsory (**Q12** has internal choice)
- Use blank paper as rough work to solve the questions in section-A and write only the correct options (type brief answers/ numerical values, no upload)

SECTION A

S. No.		Marks	CO
Q1.	(i) Which of the following statements is **true** for photoelectric effect? (a) Photoelectric current is proportional to the frequency of the radiation used, for all retarding voltages. (b) Photoelectric current is proportional to the intensity of light used for all retarding voltages. (c) Photoelectric current is proportional to the wavelength of radiation used, for all retarding voltages. (d) Photoelectric current is proportional to energy of the radiation used for all retarding voltages. (ii) Which of the following statements is **false** for photoelectric effect? a) The Stopping Potential (Extinction voltage) depends on the incident photon frequency b) The Stopping Potential depends on the incident photon energy. c) The Stopping Potential depends on the incident photon intensity. d) The Stopping Potential depends on the incident photon wavelength.	**5**	**CO4**
Q2.	If a Magnetic field of 1800 Ampere/Meter produce a magnetic flux of 3 x 10^{-5} Weber, in an iron bar of cross sectional area 0.2 cm^2, the relative permeability will be- (a) 663.14 (b) 319.1 (c) Infinite (d) None of above	**5**	**CO3**
Q3.	List the properties of a well-behaved wave function.	**5**	**CO4**
Q4.	The maximum potential gradient which a 0.5 mm thick mica sheet can be subjected is -------- Volts. (Given- The dielectric strength for mica is 10^8 V/m.)	**5**	**CO2**
Q5.	Name four lasers and write main application area for each type of lasers.	**5**	**CO1**
Q6.	The first line of the principal series of sodium D-Line at 5890 Å corresponds to a	**5**	**CO1**

	transition from the first excited state to the ground state. The energy (in eV) of the first excited state will be ----------		
SECTION B			
Q7.	Obtain the continuity equation for a charge placed in the interior of a dielectric. Also obtain the expression for relaxation time and give its significance	**10**	**CO2**
Q8.	Discuss the principles of Quantum Computing; Describe the prospects and challenges of quantum computing.	**10**	**CO5**
Q9.	State Faraday's law of electromagnetic induction. Obtain the differential form of it. A conducting circular loop of radius 20 cm lies in the z = 0 plane in a magnetic field **B** = 10 cos 377t $\mathbf{a_z}$ mWb/m^2. Calculate the induced voltage in the loop.	**10**	**CO3**
Q10.	(a) Show that the minimum energy of incident radiation should be ~ 256 KeV in order to transfer half of its energy to recoiled electron. (b) Show that de-Broglie wave length of electrons accelerated through a potential of V volts is given by $$\lambda = \left(\sqrt{\frac{150}{V}}\right) \text{Å}$$	**10**	**CO4**
Q11.	Write the Differential form of Maxwell's equation for time varying fields. Point out the term, which expresses the displacement current density. Write few lines about the displacement current.	**10**	**CO3**
SECTION-C			
Q12.	An X ray photon is scattered by a target material. Obtain an expression for the shift in wavelength created for the incoming and outgoing photon. If an electron is also scattered in the process, then derive the relation between electron and photon scattering angles. **OR** Derive the expression for the eigenvalue and eigen function of a particle of rest mass m_0, trapped in a one-dimensional box of length L. Also, find the probability of finding a particle trapped in a 1D box of length L, between 0.25L to 0.5L, in its ground state.	**20** **20**	**CO4** **CO4**

Physical constants: $h = 6.63 \times 10^{-34}\, J - s,\ c = 3 \times 10^{8}\, m/s,\ k_B = 1.38 \times 10^{-23}\, J/K, \mu_0 = 4\pi \times 10^{-7} H/m$
$\varepsilon_0 = 8.854 \times 10^{-12} F/m$, mass of proton= 1.6726 x 10^{-27} Kg