Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: PHYSICS I **Semester: I**
Course Code: PHYS1007
Programme: BTech : APE-UP, APE-GAS, Chemical **Max. Marks: 100**
Time: 03 hrs.
Instructions: All questions are compulsory (**Q9**, **Q10** and **Q12** have internal choice)
Total pages: 2

SECTION A

S. No.		Marks	CO
Q1.	Describe magnetic hysteresis briefly with suitable diagram and hence define hard and soft magnetic materials	**4**	**CO2**
Q2.	Prove that dispersive power of a plane transmission grating takes the form $\frac{d\theta}{d\lambda}=\frac{\phi}{\lambda\sqrt{1-\phi^2}}, where, \phi=\frac{m\lambda}{d}$ $\theta=diffraction\, angle, \lambda=wavelength, d=grating\, element, m=orders$	**4**	**CO1**
Q3.	State Heisenberg uncertainty principle. Using de Broglie relation show that $\left\lvert\frac{\Delta\lambda}{\lambda}\right\rvert=\left\lvert\frac{\Delta p}{p}\right\rvert, the\, symbols\, have\, usual\, meanings.$	**4**	**CO3**
Q4.	The area of a magnetic hysteresis loop between B and H is 125 m^2. The smallest units along Y (B) and X (H) axes are 0.02 Wb/m^2 and 35 A/m, respectively. Determine hysteresis loss per cycle.	**4**	**CO2**
Q5.	Calculate de Broglie wavelength of a 100 KeV electron moving with relativistic speed.	**4**	**CO3**

SECTION B

S. No.		Marks	CO
Q6.	Explain the concept of displacement current, and describe how it helps in modifying Ampere’s circuital law.	**8**	**CO2**
Q7.	Discuss photoelectric effect with characteristic properties. Calculate stopping potential for an electron moving with velocity of 0.01c non-relativistically.	**8**	**CO3**
Q8.	A multimode step index fiber has core and clad refractive indices of 1.52 and 1.48, respectively. Calculate V number and number of modes for the above fiber with core size 10 times the working wavelength.	**8**	**CO1**

Q9.	Discuss the phenomenon of double refraction and index ellipsoids for positive and negative crystals with net diagram. **OR** Discuss construction and working of RUBY LASER with net diagram.	**8**	**CO1**
Q10.	Calculate percentage uncertainty in its momentum if an electron with 5 KeV kinetic energy is measured within position uncertainty of 0.5 nm. **OR** *Calculate the probability of finding a particle* $\in$ *its third quatum state between* $\frac{L}{12}$ ¿ $\frac{L}{2}$. The particle is trapped inside 1D potential box of length L.	**8**	**CO3**
SECTION-C			
Q11.	(a) Derive the expression for Compton shift in the form $\Delta\lambda=\lambda'-\lambda=\frac{h}{m_0 c}(1-cos\phi)$ *where* $\phi =$ *angle between scattered photon* $\wedge$ *incident photon direction* (b) A solid (5×10^{28} atoms/m^3) shows electronic polarizability of 10^{-40} F-m^2. Calculate dielectric constant of the solid assuming local field as Lorentz field.	**10** **10**	**CO3** **CO2**
Q12.	(a) Consider Schrodinger time independent wave equation and solve it for a trapped particle in 1D potential box of length L to obtain normalized wave function in the form $\psi_n(x)=\sqrt{2/L}\sin(n\pi x/L)\, for, 0<x<L$ (b) Calculate total energy of an electron trapped in 3D potential box of length 5 nm (each side) in its 1st non-degenerate quantum state. **OR** (a) Derive Schrodinger time independent wave equation in 1D case. (b) Calculate kinetic energy of an electron trapped in 1D potential box of length 5 nm in its 5th quantum state. Also calculate de Broglie wavelength at this quantum state.	**10** **10** **10** **10**	**CO3**
Physical constants: $h=6.63\times10^{-34}J-s, c=3\times10^{8}m/s, k_B=1.38\times10^{-23}J/K, \mu_0=4\pi\times10^{-7}H/m$ $\varepsilon_0=8.854\times10^{-12}F/m$			