


Name:			
Enrolment No:			
UPES End Semester Examination, December 2024 Course: Physics for Health Sciences Semester : 1st Program: B. Tech Biomedical Engineering/Biotechnology/Food Technology Duration : 3 Hours Course Code: PHYS 1039 Max. Marks: 100			
Instructions: Attempt all the questions. Use of non-programmable scientific calculator is permitted.			
S. No.	Section A	Marks	COs
Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)			
Q1	Define wavefronts in wave optics.	1.5	CO1
Q2	Optical fibers work on the principle of total internal reflection. Is this statement true or false?	1.5	CO1
Q3	Which of the following describes Snell's law of refraction? a. $n_1 \cos \theta_1 = n_2 \cos \theta_2$ b. $n_1 \sin \theta_1 = n_2 \sin \theta_2$ c. $n_1 \cos \theta_1 = n_2 \tan \theta_2$ d. $n_1 \sin^{-1} \theta_1 = n_2 \sin^{-1} \theta_2$	1.5	CO1
Q4	In transverse waves, the particles vibrate parallel to the direction of wave propagation. Is this statement true or false?	1.5	CO1
Q5	Holography can employ coherent light sources. Is this statement true or false?	1.5	CO1
Q6	State the law of radioactive decay.	1.5	CO2
Q7	Define the half life of a radioactive nucleus.	1.5	CO2
Q8	Illustrate the symbolic representation of any element.	1.5	CO2

Q9	Electromagnetic force includes only magnetic effects. Is this statement true or false?	1.5	CO2
Q10	A step down transformer decreases the output voltage. Is this statement true or false?	1.5	CO2
Q11	Extrinsic semiconductors do not involve doping. Is this statement true or false?	1.5	CO3
Q12	Define a unit cell.	1.5	CO3
Q13	Define the mass action law.	1.5	CO3
Q14	Hard X-Rays have more penetrating power. Is this statement true or false?	1.5	CO3
Q15	The lattice angles of cubic lattice are orthogonal. Is this statement true or false?	1.5	CO3
Q16	Ψ^2 gives the probability density of finding a particle within a defined space. Is this statement true or false?	1.5	CO4
Q17	Which of the following describes dual nature of matter? a. $\lambda=ph$ b. $\lambda=p/h$ c. $\lambda=h/p$ d. None of the above	1.5	CO4
Q18	Define the term Nanoscience.	1.5	CO4
Q19	1D nanostructures are characterized by charge confinement in two dimensions. Is this statement true or false?	1.5	CO4
Q20	State the uncertainty principle.	1.5	CO4
Section B (4Qx5M=20 Marks)			
Q 1	a. Define acceptance angle of an optical fiber with the help of a diagram. b. Calculate the numerical aperture of an optical fiber if the acceptance angle is 11.5° .	2.5+2.5=5	CO1
Q2	a. State Faraday's law of electromagnetic induction. b. Calculate the induced emf produced due to a coil of 100 turns with the magnetic flux changing at rate of 5 Wb/s.	2.5+2.5=5	CO2
Q3	Describe the various Bravais lattices.	5	CO3

Q4	Show that an electron cannot exist inside the nucleus of an atom?	5	CO4
Section C (2Qx15M=30 Marks)			
Q 1	Discuss the various radioactive decay processes with suitable examples.	15	CO2
Q2	<p>a. Discuss how quantum theory can explain the phenomenon of atomic spectra. Take the example of hydrogen atom.</p> <p>b. What is the energy and frequency of radiation emitted due to de-excitation of an electron from $n=2$ to $n=1$ state in a hydrogen atom? Which spectral series does this emission correspond to? Calculate the same for a He atom.</p>	10+5=15	CO4
Section D (2Qx10M=20 Marks)			
Q 1	<p>a. Find the Lorentz force of a charge -10C in an electric field of 20 N/C and magnetic field of 5 T moving with a velocity 10m/s. Assume the charge is travelling perpendicular to the magnetic field.</p> <p>b. If the electric field is switched off, what is the distance travelled by the charge within the field? Assume mass of the charge to be 10^{-23} kg.</p>	5+5=10	CO2
Q2	<p>a. An electron is confined in a 1D potential well of length 0.5 nm. Calculate the ground state and next excited state energies of the electron. Also, draw the wavefunction profiles of electrons in these two states and comment on the probability of finding the electron over the entire length of the well.</p> <p>b. Discuss the importance of various quantum numbers.</p>	5+5=10	CO4