Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: PHYSICS I **Semester: I**
Course Code: PHYS1020
Programme: BTech : APE UP, APE Gas, CERP, Mechanical **Max. Marks: 100**
Time: 03 hrs.
Instructions: All questions are compulsory (**Q9** and **Q11** have internal choice)
Total pages: 2

SECTION A

S. No.		Marks	CO
Q1.	Two coherent beams of wavelength 5000 Å reaching a point would individually produce intensities 1.44 and 4.00 units. If they reach there together, the intensity is 0.9 units. Calculate the lowest phase difference between the beams.	**4**	**CO1**
Q2.	Calculate de Broglie wavelength of a relativistic electron moving with 0.2c speed.	**4**	**CO3**
Q3.	Obtain the expectation value of momentum for ground state of a particle in 1-D box.	**4**	**CO3**
Q4.	Explain Bragg's law for X-ray diffraction.	**4**	**CO4**
Q5.	Determine the Miller indices of a plane parallel to the z-axis, which cut intercepts of 2 and 2/3 along x-axis and y-axis respectively.	**4**	**CO4**

SECTION B

Q6.	Describe absorption, spontaneous emission, and stimulated emission and establish a relationship between Einstein A and B coefficients.	**10**	**CO1**
Q7.	Describe step and Graded index optical fibers demonstrating the propagation of light ray in both the types. Prove that the distance between two successive reflections is $\sqrt{\left(\frac{{n_1}^2}{(NA)^2}-1\right)}$, where d is the core diameter, n_1 is the core refractive index and NA is numerical aperture.	**10**	**CO1**
Q8.	What do you understand by Atomic Packing Factor (APF)? Obtain APF for FCC and BCC structures.	**10**	**CO4**
Q9.	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. **OR** Define pair production and show that it cannot occur in free space, also find the minimum energy required for pair production to occur.	**10**	**CO3**

SECTION-C			
Q10.	(a) Write the Differential form of Maxwell's equation in final form and using these equations obtain the electromagnetic wave equation in free space. (b) Find the displacement current density in a region where the electric field is $\boldsymbol{E} = 10\sin(1.0 \times 10^{10}t - 1.57 \times 10^{7}x)\,\boldsymbol{j}$ kV/m (c) Discuss the Uncertainty Principle for microscopic particles and enlist some of its applications	**10** **5** **5**	**CO2** **CO2** **CO3**
Q11.	(a) Give the construction and working of a Solar Cell. (b) A proton and an electron have same de-Broglie wavelength. Which of them moves faster and which possess more kinetic energy? Justify your answer. **OR** (a) 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. (b) Discuss the properties of a well-behaved wave function. 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.	**10** **10** **10** **10**	**CO3** **CO3** **CO3** **CO3**

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