

Name:	
Enrolment No:	

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

Course: PHYSICS I	Semester: I
Course Code: PHYS1020	
Programme: BTech : APE GAS, Chemical, ADE, Mechatronics, Mechanical, FSE, Civil	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 answers, no upload)

SECTION A

S. No.		Marks	CO
Q1.	A laser beam propagates through an optical fiber of 2.2 km long through TIR. At the entry side 450 mW power is fed. The output power is measured to be 150 mW. Loss coefficient is (a) 4.15 dB/km, (b) 2.17 dB/km, (c) 3.28 dB/km, (d) 1.55 dB/km	5	CO1
Q2.	The area of a hysteresis loop drawn between B and H is 200m ² . Each unit space along the vertical axis represent 0.005 Wb/m ² and each unit space along the horizontal axis represents 10A/m. Determine the hysteresis loss per cycle per m ³ (a) 100 Joule (b) 5 Joule (c) 10 Joule (d) 20 Joule	5	CO2
Q3.	A dielectric material has very electrical resistance of $\rho = 5 \times 10^5$ ohm-m. If dielectric permittivity $\epsilon = 3.7\epsilon_0$ then how much time the dielectric takes to reduce its charge to 1/e time the initial value? (a) 16.4 μ s, (b) 6.55 μ s, (c) 16.4 ns, (d) 6.55 ns	5	CO2
Q4.	Find the expectation value of position of a particle having wavefunction $\Psi = ax$, between, $x = 0$ and 1, $\Psi = 0$ elsewhere. (a) a^2 (b) $\frac{a^2}{2}$ (c) $\frac{a^2}{4}$ (d) $\frac{a^2}{8}$	5	CO3
Q5.	If (3 2 6) are the Miller indices of a plane, the intercepts made by the plane on the three crystallographic axes are (a) (2a, 3b, c) (b) (a, b, c) (c) (a, 2b, 3c) (d) (3a, 3b, 2c)	5	CO4
Q6.	If the applied potential in a X-ray tube is 50 kV, then maximum wavelength of the produced X-rays is (a) 0.2 nm (b) 2 nm (c) 0.2 Å (d) 2 Å	5	CO4

SECTION B			
Q7.	Calculate atomic packing fraction (APF) of BCC crystal.	10	CO4
Q8.	Show that A/B ratio of Einstein co-efficients can be expressed as $\frac{A}{B} = \frac{8\pi h \nu^3}{c^3}$ the symbols have their usual significance	10	CO1
Q9.	Prove that an electromagnetic wave propagating in free space follows \vec{k} , \vec{E} and \vec{B} as mutually perpendicular to each other (you may consider, \vec{E} along X, \vec{B} along Y and propagation along Z directions).	10	CO2
Q10.	Discuss working of a Solar Cell with diagram. Calculate fill factor from the following data points, MPP = 200 mW, open circuit voltage $V_{oc} = 2.5$ volt, short circuit current $I_{sc} = 150$ mA.	5+5	CO3
Q11.	Write down the characteristics of a laser beam. Discuss 3-level and 4-level laser working with level diagram.	2+4+4	CO1
SECTION-C			
Q12.	(a) Discuss photoelectric effect with diagram and various characteristic graphs. (b) Write down the main characteristics of Schrodinger wavefunction. Sketch normalized wavefunction and probability function between 0 to L of a particle in a box problem. OR (a) Deduce the expression for Compton shift, in the form $\Delta\lambda = \lambda' - \lambda = \frac{h}{m_0 c} (1 - \cos\theta)$ where θ is the angle made by scattered photon with incident direction (b) State Heisenberg uncertainty principle. Show that electron can not be a part of nucleus.	10 2+4+4 10 2+8	CO3 CO3 CO3 CO3
Physical constants: $h = 6.63 \times 10^{-34} \text{ J-s}$, $c = 3 \times 10^8 \text{ m/s}$, $k_B = 1.38 \times 10^{-23} \text{ J/K}$, $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$ $\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$, mass of proton = $1.6726 \times 10^{-27} \text{ Kg}$			