UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination (ESE), December 2021

Course: Physics I
Semester: I
Program: Int. B-Tech-Biotechnology/Food Technology-MBA   **Time: 03 hrs.**
Course Code: PHYS 1021   **Max. Marks: 100**

Instructions: Attempt all Sections.

SECTION A			
S. No.	MCQs or Fill in the blanks	**30 Marks**	**CO**

1	Characteristics of a LASER are
	   a) Directionality
	   b) High intensity
	   c) Mono-Chromacity
	   d) High degree of coherence
	   e) All of above
		1.5	**CO1**

2	An optical fiber work on the principle of ……………………	**1.5**	**CO1**
3	The V-number value (numerical) for a single mode fiber is…………….	**1.5**	**CO1**
4	For a conservative field, which of the following equations holds good…….. a) $\int E.dl = 0$ b) $\int H.dl = 0$ c) $\int B.dl = 0$ d) $\int D.dl = 0$	**1.5**	**CO3**

5	Dielectric strength of a material depends on
	
	   a) Thickness
	   b) Moisture Content
	   c) Temperature
	   d) All Of The Above
		1.5	**CO2**

6	In He-Ne laser, the ratio of He to Ne gas is…………	**1.5**	**CO1**
7	In term of del operator, 3-dimensional differential form an electrostatic Gauss's law is written as……….	**1.5**	**CO2**

8	Attenuation in an optical fiber is caused by………..
	   a) Scattering
	   b) Absorption
	   c) Both scattering and absorption
	   d) None of these
		1.5	CO1

9	The wavelength associated with a moving particle……..
	   a) depends upon charge associated with it
	   b) does not depends on charge associated with it
	   c) depends upon the medium in which the particle travels
	   d) none of these
		1.5	CO4

10	Wave function associated with a moving material particle is……….of its charge.	1.5	CO4

11	In Ampere's circuital law, what is the purpose of an 'Amperian Path'?
	
	   a) Computation of magnetic field intensity
	   b) Determination of differential element of path length
	   c) Estimation of electric flux density
	   d) Detection of loop in a constant plane
		1.5	CO3

12	For a given medium, the electric flux density (D) is related to the electric field (E) as…….	1.5	CO2

13	Which of the following is not true in case of nanomaterials……….
	   a) Increased ratio of surface area to volume
	   b) Altered surface properties compared to bulk material
	   c) Increase in size compared to bulk material
	   d) Some of the mechanical properties will be altered compared to bulk material
		1.5	CO5

14	The relation between Einstein's coefficients A_{21} and B_{21} is expressed as….	1.5	CO1

15	When the two members of a Qubit pair exist in a single quantum state, it is known as _____.
	   A. Engagement
	   B. Superposition
	   C. Entanglement
	   D. None of the above
		1.5	CO4

16	The elemental volume (dv) in cylindrical coordinate (ρ, ϕ, z) is written as ………	1.5	CO2
17	The unit of dipole moment / unit volume is ………..	1.5	CO2
18	The product of uncertainty between energy and time ………….	1.5	CO4
19	The minimum energy require for pair production is …..…….MeV.	1.5	CO4

20	In terms of Planck's constant (h), rest mass of particle (m) and speed of light X-ray wave (c), the Compton's wavelength is given by the (formula only)…………	**1.5**	**CO4**
	SECTION B the word limit 20 marks 4 questions 5 marks each		
Q	Short Answer Type Question (5 marks each) Scan and Upload 4 questions 5 marks each	**20 Marks**	**CO**
1	Calculate the de Broglie wavelength an electron (mass 9.1×10^{-31} kg) whose kinetic energy is 120 eV.	**5**	**CO4**
2	List any four methods for synthesizing the nanomaterials.	**5**	**CO5**
3	Prove that pair production cannot occurs in empty space.	**5**	**CO4**
4	Find maximum kinetic energy in eV of photoelectrons if the work function of the material 2.33 eV and frequency of radiation is 3.19×10^{19} Hz.	**5**	**CO4**
	SECTION C 30 marks		
Q	**Two case studies 15 marks each subsections**	**30 Marks**	**CO**
1	a) Derive the mathematical expression for continuity equation ($\boldsymbol{\nabla}.\boldsymbol{J} = -\partial\rho/\partial t$). b) Write down integral and differential form of all four Maxwell equations.	**15 (7+8)**	**CO2, CO3**
2	a) Set-up time independent one-dimensional Schrodinger wave equation. b) Using this equation, discuss the solution for a particle trapped in one dimensional potential well (length L) of infinite height. Hence, obtain the normalized wave function	**15 (5+10)**	**CO4, CO4**
	SECTION- D 20 marks		
Q	Long Answer type Questions Scan and Upload (10 marks each) **word limit not more than 400 words**	**20 Marks**	**CO**
1	a) What should be properties of any valid wave function ψ (r, t). b) Derive a relationship between group velocity (Vg) and phase velocity (Vp).	**10 (5+5)**	**CO4, CO4**
2	a) With neat figure, derive an expression for numerical aperture (NA) in a step index optical fiber. b) What is the difference between BITS and QUBITS? Explain the role of quantum computing in bio technology (2+3)	**10 (5+5)**	**CO1, CO5**