MANIPAL ACADEMY of HIGHER EDUCATION
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Question Paper - Report

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Question Paper

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MANIPAL ACADEMY OF HIGHER EDUCATION

Answer all questions

APPLIED PHYSICS FOR ENGINEERS [PHY 1072]

Marks: 30 **Duration: 90 mins.**

MCQs

Answer all the questions. Section Duration: 20 mins

1) What is the quantum number n of a particle of mass 'm' confined to one dimensional box of length "L" when its energy is $2h^2/mL^2$ (1)

4 1 8 2

2) What is the maximum change in the wavelength of Compton scattered radiation? (1)

4.85 pm 2.43 pm 1.22 pm 9.70 pm

3) What is the minimum uncertainty in velocity of an electron if uncertainty in its position is 50 pm? (1)

Zero 1.16×10^6 m/s 1.05×10^{-24} m/s 5.27×10^{-35} m/s

4) Choose the wrong statement from the following. (1)

A single mode step index optical fibre consists of a core having a uniform refractive index.

A multi mode step index optical fibre consists of a core having a uniform refractive index.

Diameter of core is more for single mode step index optical fibre as compared to that of multi mode step index optical fibre.

Material dispersion in optical fiber is due to wavelength dependence of refractive index of the core.

5) Which part of laser system is responsible for directionality of laser? (1)

Lasing medium	Pumping system	Cavity resonator	Electrical power supply

Descriptive

Answer all the questions.

6)	(a) An electron is confined in an infinite potential well of width 0.2 nm. Find the speed of the electron in the n =1 state. (b) A quantum simple harmonic oscillator consists of an electron bound by a restoring force proportional to its position relative to a certain equilibrium point. The proportionality constant is 8.99 N/m. What is the longest wavelength of light that can excite the oscillator?	(4)
7)	Explain the following terms with reference to lasers: (a) spontaneous emission (b) stimulated emission. Give an example each.	(3)
8)	A step-index optical fiber has a core refractive index =1.48 and a cladding refractive index =1.46. The core radius of the fiber is 4 μm and the operating wavelength is 1550 nm. Calculate the following: a) The critical angle for total internal reflection at the core-cladding interface. b) The numerical aperture (NA) of the fiber. c) The maximum acceptance angle in air.	(3)
9)	How Davison and Germer experiment validated the de Broglie hypothesis? Explain.	(3)
10)	When a photosensitive metal is illuminated by light of certain wavelength, the stopping potential required to stop the ejected photoelectrons was found to be 1.1 V. If the incident wavelength is half the threshold wavelength of the metal, find (a) threshold frequency, (b) work function of the metal and also (c) the maximum velocity of the ejected electrons.	(3)
11)	Show that the wave function of a particle trapped in a finite potential well decays exponentially with distance outside the well.	(3)
12)	Define skip distance and derive an expression for it.	(2)
13)	Calculate the ratio of Einstein's coefficients for a system at 300 K in which radiations of wavelength 1.39 μm are emitted.	(2)
14)	The radius of our Sun is 6.96 x 10^8 m, and its total power output is 3.85 x 10^{26} W. Assuming that the Sun's surface emits as a black body, calculate its surface temperature.	(2)

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