MANIPAL ACADEMY OF HIGHER EDUCATION

Engineering Physics (PHY 1071)
Mid Term Examination

ENGINEERING PHYSICS [PHY 1071]

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

MCQs

Answer all the questions. Section Duration: 20 mins

1) In a photoelectric effect experiment the stopping potential is (0.5)

the electric potential that causes the electron current to vanish	the energy required to remove an electron from the sample	the kinetic energy of the least energetic electron ejected	the potential energy of the most energetic electron ejected

2) What is the maximum kinetic energy (in eV) of a photoelectron when a surface, whose work function is 5.0 eV, is illuminated by photons whose wavelength is 400 nm? (0.5)

3.1 -1.9 1.9 0

3) An optic glass fiber of refractive index 1.50 is to be clad with another glass to ensure total internal reflection that will contain light travelling within 5 degree of the fiber axis. The maximum

index of refraction allowed for the cladding is, (0.5)

Equal to 1.60 | Less than 1.49 | Greater than 1.60 | Greater than or equal to 1.60

4) Which of the following types of signal attenuation or distortion normally does not occur in single mode fibers? (0.5)

Scattering | Absorption | Intermodal dispersion | Material dispersion

5) The energy difference between the two laser levels is 0.117 eV. The frequency of emitted laser light from this laser would be (0.5)

2.83×10^{13} Hz | 1.77×10^{14} Hz | 3.62×10^{14} Hz | 2.34×10^{15} Hz

6) For a particle in its ground state inside a box of length L, the probability density is maximum at (0.5)

x = L/2 | x = 0 | x = L | x = L/4

7) A free electron has a momentum of 5.0×10^{-24} kg m/s. The wavelength (in m) of its wave function is (0.5)

1.3×10^{-8} | 1.3×10^{-10} | 1.3×10^{-12} | 1.3×10^{-6}

8) The ground state energy of an electron in a one-dimensional trap with zero potential energy in the interior and infinite potential energy at the walls is 2.0 eV. If the width of the well is doubled, the ground state energy will be (0.5)

0.5 eV | 1 eV | 2 eV | 4 eV

9) Active region in a semiconductor laser is, (0.5)

n region | intrinsic region | *p* region | conduction region

10) What is the quantum number, n of a particle of mass, m confined to a one-dimensional "box" of length, L when its energy is 2 h^2/mL^2? (0.5)

4 2 8 1

Descriptive

Answer all the questions.

11) With necessary diagram, derive an expression for angle of acceptance and numerical aperture for an optical fibre. (4)

12) How does Einstein's photoelectric equation explain all the experimentally observed features of photoelectric effect. (3)

13) Explain the operation of He-Ne laser with necessary energy level diagrams. (3)

14) The nucleus of an atom is of the order of 2.0×10^{-14} m in diameter. For an electron to be confined to a nucleus its de Broglie wavelength would have to be on this order of magnitude or smaller. What would be the total relativistic energy of the electron? . (3)

15) A step index optical fiber 60 micro meter in core-diameter has a core of refractive index 1.6 and a cladding of index 1.4. Determine (a) the critical angle for core-cladding interface, (b) the acceptance cone half-angle (the maximum entrance angle) **.** (3)

16) An electron has a kinetic energy of 12.0 eV. The electron is incident upon a rectangular barrier of height 20.0 eV and thickness 1.0 nm. By what factor would the electron's probability of tunnelling through the barrier increase assuming that the electron absorbs all the energy of a photon with wavelength 546 nm? . (3)

17)	Sketch the probability density for the first two energy states (n=1 and n=2) for a particle in a potential well of infinite and finite height.	(2)
18)	An electron has a kinetic energy of 3.0 eV. What is the corresponding wavelength of the electron.	(2)
19)	“In quantum model, the energy levels of a harmonic oscillator are quantized”. Justify the statement .	(2)

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