COEP Technological University
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2023-24 FYBTECH Engineering Physics (Test I)

20/20

MIS NO.	: 612307082	Semester	: II
Name	: ISHAN SAGANE	Division	: 7
		Marks	: Max marks 20
Time	: 40 Min.	Date	: 15th Feb, 2024

Note :

1) **Question 1 to 8 carry 1mark each and Question 9 to 14 carry 2marks each.**
2) **All questions are compulsory.**
3) **Tick your answers with blue or black pen.(Pencil and whitener not allowed)**
4) **ZERO marks will be given in case of cancellation or multiple ticks.**

1) If a wave function $\psi(x)$ for a particle moving along the x axis is "normalized" then:

(a) $\int |\psi|^2 dt = 1$ (b) $\int |\psi|^2 dx = 1$ (c) $|\psi|^2 = 1$ (d) $\partial\psi/\partial x = 1$

$\lambda = \frac{h}{\sqrt{2meV}}$

2) If a particle is accelerated through potential V, then its De Broglie wavelength is inversely proportional to

a) Square root of V b) V c) Square of V d) 2V

3) The ground state energy of particle confined in infinite potential well is

a) $E_1=\pi^2\hbar^2/8ma^2$ b) $E_1=\pi^2\hbar^2/2ma^2$ c) $E_1= 0$ d) $E_1= \hbar^2/8ma^2$

4) If v is the velocity of particle and c is velocity of light then the velocity of matter waves u is given by

a) c / v b) v/c^2 c) c^2/v d) None of these

5) Forbidden bands in Semiconductor exist for the value of K(Wave vector) in E-K curve is

a) nΠ/a b) nΠ/a cos2θ c) Π/2a d) 2Π/K

$n\lambda = 2d\sin\theta$

$k = \frac{n\pi}{a}$

$k = \frac{2\pi}{\lambda}$

$= \frac{2\pi}{2a}$

6) The momentum operator is

a) $\hat{p} = -i\hbar\frac{\partial}{\partial x}$

b) $\hat{p} = i\hbar\frac{\partial}{\partial x}$

c) $\hat{p} = -i\hbar\frac{\partial}{\partial t}$

d) $\hat{p} = i\hbar\frac{\partial}{\partial t}$

1

7) The Fermi dirac probability distribution function f(E) = ½ Where $T > 0^0K$, indicates...

a) $E_f = E_g/2$, b) $E = E_f$, c) $E_f = E_v$, d) $E_C = E_V$

1

8) Which of the following is not the condition on well behaved wave function?

a) single valued b) differentiable c) continuous d) infinite

1

9) The de Broglie wavelength of neutron whose kinetic energy is 3.2×10^{-19} J is _____.

Given: mass of neutron = 1.676×10^{-27}kg, h= 6.625×10^{-34} J-s

2 a) 0.202 Å b) 0.118 Å c) 0.404 Å d) 0.286 Å

10) The eigen function for energy operator is $e^{-i\omega t}$ then the corresponding eigen value is

2 a) $\hbar\omega$ b) $h\omega$ c) ωk d) $\hbar k$

11) A particle is limited to move on x-axis has the normalised wave function given by

$\Psi(x) = ax$ for $0 \le x \le 1$

$= 0$ at all other points

What is the probability that particle is found between x = 0.45 and x = 0.6 ?

2 a) $0.041\ a^2$ b) $0.378\ a^2$ c) $0.025\ a^2$ d) a^3

$\lambda = \frac{h}{\sqrt{2mKE}}$

$\frac{6.625 \times 10^{-34}}{\sqrt{2 \times 1.676 \times 10^{-27} \times 3.2 \times 10^{-19}}}$

$a^2 \int_{0.45}^{0.6} x^2 dx$

$a^2 \left[\frac{x^3}{3}\right]_{0.45}^{0.6}$

$\frac{a^2}{3}\left[0.6^3 - 0.45^3\right]$

$\hbar \frac{de^{i\omega t}}{dt}$

$\hbar \times i\omega$

12) An electron is trapped in a rigid box of width 1 Å. The momentum in lowest level is (Given h = 6.63×10^{-34} Js)

a) 1.315×10^{-26} kg m/s

b) 6.615×10^{-24} kg m/s

c) 9.915×10^{-24} kg m/s

d) 3.315×10^{-24} kg m/s

2

13) At what temperature we can expect a 10% probability the electrons in silver have an energy which is 1% above the Fermi energy (E_f = 5.5eV for silver) (Given k = 8.62×10^{-5} eV/k)

a) 310 K

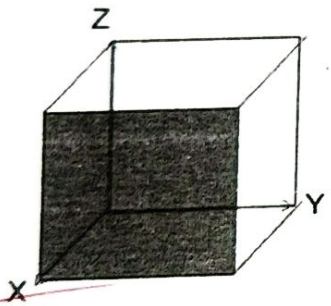
b) 290K

c) 190K

d) 2990K

2

14) The miller indices for the shaded plane of unit cube as shown in figure are.....



2

a) (010)

b) (202)

c) (1∞ ∞)

d) (100)

Rough Work

$E = \frac{h}{q}$ $E = \frac{hc}{d}$ $E = PC$

$\frac{10}{100} = \frac{1}{1+e^{\left(\frac{5.5}{100}\right)/8.62\times10^{-5}t}}$

$1 + e^{\frac{5.5\times10^{-2}}{8.62\times10^{-5}t}} = 10$

$e^{\frac{5.5\times10^{3}}{8.62\times t}} = 9$

$\frac{5.5\times10^{3}}{8.62\times t} = \ln 9$

$t = \frac{5.5\times10^{3}}{8.62\times \ln 9}$

$E = \frac{h}{2}$ $P = \frac{h}{d}$

$P = \frac{h}{2a}$

$E = \frac{hc}{d}$

$P = \frac{}{}$

$= \frac{6.63\times10^{-34}}{2\times10^{-10}}$