Question Bank

Module-I
Modern physics and Quantum physics

1.Using time independent Schrodinger's wave equation, obtain the expression for the normalized wave function for a particle in one dimensional potential well of infinite height.

(July 2014)

2.State Heisenberg's uncertainty principle and write its physical Significance.

(July 2014)

3.A spectral line of wavelength 5461Å has a width of 10^{-4}Å. Evaluate the minimum time spent by the electrons in the upper energy state. (July2014)

4.Explain Wien's law and Rayleigh Jean, law. Mention their drawbacks. (Jan 2014)

5.Define phase and group velocity. Derive the relation between the two. (Jan 2014)

6.Calculate the de-Broglie wavelength for an electron whose speed is 0.01 part of the Speed of light. (Jan 2014)

7.Set up time- independent one-dimensional Schrodinger wave equation. (Jan 2014)

8.Explain Heisenberg's uncertainty principle. Give its physical significance. (Jan 2014)

9.An electron is bound in one dimensional infinite potential well of width 0.12 nm. Find the energy value and de Broglie wavelength in the first excited state (Jan 2014)

10.Explain blackbody radiation spectrum on the basis of planks radiation law

(Dec 2014)

11.Obtain the solution of Schrödinger's time –independent wave equation when appliedto a potential box of infinite height. (Dec-2014)

12.What is Compton Effect? Explain its Physical significance. (Dec 2014)

13.The position and momentum of electron with energy 0.5 Kev are determined .What is minimum percentage uncertainty in its momentum if the uncertainty in the measurement of position is 0.5A. (Dec 2014)

14.What is group velocity and phase velocity in wave motion? Obtain the relation between them. (Dec 2014)

15.Setup time independent Schrödinger wave equation for free particle in one dimension. (Dec 2014)

16.Using Heisenberg uncertainty principle, prove that electron cannot exist in the nucleus. (Dec 2014)

17.Calculate the wavelength associated with an electron having K.E 100ev (Dec 2014)

18.Calculate the energy in ev , for the first excited state of an electron in an infinite potential well of width $2A^{O}$ (June-2015)

19.Write the assumptions of quantum theory of radiation and deduce Ray-Jeans law from Planck's law. (June2015)

20. Give four important properties of matter waves. (June2015)
21.Setup time independent Schrödinger wave equation for free particle in one dimension. (June2015)
22. Calculate the energy in ev , for the first excited state of an electron in an infinite potential well of width $2A^O$
23.State de Broglie hypothesis and Show that the group velocity of the de Broglie waves of a partical is equal velocity of the particle. (june2015).
24.. State and explain Heisenberg uncertainity principle . (June2015).
25. Explain in brief the properties of wave function . If the wave function of a partical in an infinite potential box of width a is Ψ=Bsin(nΠX/a) where X is the position aand n is the quantum number , find B. (June2015)
26.The wavelength of a fast neutron of mass 1.675X10-27 kg is 0.02nm. Calculate the group velocity and phase velocity of its de Broglie waves (June2015).
27. Show that planck 's law duces to Weins law and Rayleigh-Jeans law at lower and higher wavelength (June-2016)
28.Setup time independent Schrodinger wave equation in one dimension (June-2016)
29. A partical of mass $940MeV/c^2$ has kinetic enegy 0.5 KeV. Find its de-Brogle wavelength , c is the velocity of light. (June-2016)
30.Define phase velocity and group velocity. Obtain the relation between them (June-2016)_)
31. Using Heisenbergs uncertainity principle. Prove that electron does not exist in a nucleus. (June-2016)
32.The first existed state energy of an electron in an infinite well is 240 eV . What will be its potential well is doubled. (June-2016)

Module-II

Electrical properties of materials

1.Explain failures of classical free electron theory. (July2014)

2.What are the merits of quantum free electron theory? (Jan 2014)

3.Calculate the Fermi velocity and mean free path for conduction electrons in silver, given that its Fermi energy is 5.5eV and relaxation time for electrons is $3.83x10^{-14}$s. (Jan 2014)
4.Define Fermi energy and Fermi factor. Discuss variation of Fermi factor With temperature. (June-2016) (July2014)

5.What is mean collision time? Using free electron theory in a metal, obtain an expression electrical conductivity in terms of mean collision time. (July2014)

6.State and explain Matthiessen's rule. (July2014)

7.Explain failure of classical free electron theory. (June-2016)(Jan 2014)
8.Explain the probability of occupation of various energy states by electron at T=0K and T> 0K on the basis of Fermi factor (Jan 2014)
9.Describe type –I and type-II Superconductors. (Jan 2014)

10.What are the assumptions made in quantum free electron theory? Explain success of this theory. (Dec 2014)

11.What is Fermi level? Describe the variation of Fermi factor with temperatures. (June-2016)(Dec 2014)

12.Explain the Meissner effect and different types of superconductors. (Jan-2016)

13.What is Superconductivity? Explain the superconductivity on the basis of BCS theory. (Dec 2014)

14.Explain the laws of mass action and derive the conductivity expression of a semiconductor. (Jan-2016)

15.Explain failure of classical free electron theory

16.What is Fermi- Dirac statistics? Explain. (June-2016)(Dec 2014)

17.The Fermi level in silver is 5.5ev. Find the velocity of electrons in silver. (Dec 2014)

18.Show that the Fermi level of an intrinsic semiconductor lies in the middle of the forbidden energy gap. (June2015)

19.Explain the temperature dependence of resisitivity of metal and state Matthiessen´s rule. (June-2016) (June2015)

20.Calculate the probability of an electron occupying an energy level 0.02ev above the Fermi level at 300k. (June2015)

21. Define the drift velocity, mean free path ,mean collision time and relaxation time. (June2015)

22.Describe Maglev vehicle. (June2015)

23. Calculate he concentration a which the acceptor atoms must be added to a germanium sample to p-type semiconductor with conductivity 0.15 per ohm-meter. Given the mobility of holes=0.17m^2/Vs (June2016)

Module-III

Laser and Optical fibers

1.Obtain the expression for energy density of radiation under equilibrium condition in terms of Einstein coefficient. (Jan2014)

2.What is holography? Explain principle of hologram recording using laser. (Jan2013) (July 2014)

3.A pulsed laser with power 1mw lasts for 10 ns. If the number of photons emitted per second is 5 x 10^7 calculate the wavelength of laser. (Jan2014)

4.Explain the terms spontaneous emission and stimulated emission. (Jan 2014)

5.Explain laser welding and cutting process with diagrams. (July2014)

6.Explain the process of spontaneous and stimulated emission. (Jan 2014)

7.Describe the construction and working of semiconductor laser. (Jan 2014)

8.A pulse laser emits pulse of 20ns duration with average power per pulse being 1.5mW. If the number of photons in each pulse is 1.047 X 10^8, find the wave length of photons. (Jan 2014)

10.An optical fiber of 600 mts long has input power of 120 mw which emerges out with power of 90 mw. Find attenuation in the fiber. (Jan2014)

11.Discuss point to point optical fiber communication system and mention its Advantages over the conventional communication systems. (July2014)

12.The angle of acceptance of an optical fibre is 30° when kept in air. Find the angle of acceptance when it is in a medium of R.I=1.33. (July2014)

13.What is attenuation? Explain any two factors contributing to the fibre loss. (July 2014)

14.The angle of acceptance of an optical fibre is 30^0 when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. (Jan 214)

15.Mention the condition for laser action. Explain the working of a semiconductor laser. (Dec 2014)

16.Discuss the various loss factors in optical fiber communication. (Dec 2014)

17.Derive the condition for propagation of light through an optical fiber (Dec 2014)

18.The average power of laser beam of wavelength 6328A is 5mW.Find the number of photons emitted per second by the source. (Dec 2014)

19. What is laser? Give the construction and working of carbon dioxide laser device. (Dec 2014)

20. What are the different types of optical fibers? Explain. (Dec 2014)

21.The attenuation in an optical fiber is 3.6dB/km. What fraction of its initial intensity remains after 3km. (Dec 2014)

22. Derive an expression for the radiant energy density under thermal equilibrium using Einstein's coefficients. (Jan2013)(June 2015)

24.With suitable ray-diagrams, explain the principle construction of a holographic images. (June 2015) (June-2016)

25. Give an account of point to point communication system using optical fibers.

26.The angle of acceptance of an optical fiber kept in air is 30^0. Find the angle of acceptance when the fiber is in a medium of refractive index 4/3. (June 2015)

27.Discuss the requisites and the conditions for a laser system. (June 2015)

28.Define angle of acceptance and numerical aperture. Obtain an expression for the numerical aperture of an optical fiber. (June 2015)

29.Explain measurement of pollutants in atmosphere using laser. (June 2015)

30.A 5w pulsed laser emits light of wavelength 694nm. If the duration of each pulse is 20ns, Calculatethe number of photons emitted per pulse. (June 2015)

31.The refractive indice of the core and cladding of the step index optical fiber are 1.45 and 1.40 respectively and its core diameter is 45micrometer . calculate its fractional index change and numerical aperture (June-2016)

Module- IV

Crystal Structure

1.Derive an expression for inter planar spacing of crystal in terms of miller indices. (June-2016)

2.What is atomic packing factor? Calculate packing factor for sc and bcc structures. (Jan 2013) (July 2014)

3.What are miller indices? Explain the procedure to find miller indices with an example (June-2016)

4.calculate the atomic packing factor for SC, FCC, and BCC lattices. (June-2016)

5.Define (i) coordination number (ii) packing factor. Calculate the atomic packing factor for bcc structure (Jan 2014)

6.The minimum order of Bragg's reflection occurs at angle of 20^0 in the plane (212). Find the wavelength of X- rays if lattice constant is 3.615 Å. (Jan 2014)

7.What are miller indices? Explain how axial intercepts in a crystal plane are converted into miller indices. (Dec 2014)

8.Give the working principle of Liquid crystal display(LCD). (Dec 2014)

9.Find the atomic packing factor of SC, FCC and BCC structures. (Dec 2014)
(1).Simple cubic structure (SC):

10.Determine the interplanar spacing for (110) planes for copper which has FCC structure and atomic radius 0.127nm. (Dec 2014)

11.Obtain an expression for the interplanar distance in cubic crystal in terms of miller indices. (Dec 2014)

14.Sketch and explain the structure of diamond crystal. (Dec2014)
15.Explain how bragg's law verified using Braggs X-ray spectrometer. (July2014) (June-2016)
16.Draw the crystal planes (210) and (101) in a cubic crystal

17.Mention the geometrical configuration of the seven crystal systems. (June2015)
18. Sketch and describe the perovskite structure. (June2015)
19.Derive Bragg's equation. (June2015)
20.The atomic radius of gold is 0.144nm. Determine the interplanar distance for (110) planes assuming that gold belongs to FCC system. (June2015)
21.With the help of vector diagram explain the terms basis vectors, lattice vector, interfacial angles and crystal parameters of a space lattice. (June2015)
22.Derive an expression for interplanar distance in terms of Miller indices. (June2015)
23.Define coordination number and packing factor. Compute the packing factor for BCC crystals. (June2015)
24. In a calcite crystal, second order Bragg's reflections occur from the planes with d-spacing 3Å, at a glancing angle of 24°. Calculate the path difference between X-rays reflected from the two adjacent planes. Also, Calculate the wavelength of the X-rays. (June2015)
25.Monochromatic X-rays of wavelength $0.82A^0$ under the first order Bragg reflection crystal of cubic lattice with lattice constant $3A^0$ at a glancing angle of 7.855^0.Identify possible planes which give rise to this reflection in terms of their Miller indices.

Module -5

Shock waves and Science of nanomaterials

1.Explain carbon nano tubes and its application by giving their physical properties. (Jan 2014)

2.What are shock waves ? Explain the experimental method of producing shock waves and measuring its mach number using Reddy shock tube. (Dec 2014)

3.Give the graphical representation of density of states with equation for 0D,1D,2D and 3D structures. (Dec 2014)

4.What are the properties of Carbon Nanotubes? (Dec 2014)

5.What are the ultrasonic and supersonic waves? Describe in brief how the normal shock relationships are arrived. (Dec 2014)

6.Define mach number ,subsonic waves and supersonic waves. (July2015)

7.What are nano material's? Outline the structure of a carbon nano tube. (July2015)

8.Define shockwaves. Mention its properties. (July2015)

9.What are nanomaterial's? Outline the structure of a carbon nano tube.(July2015)

10.Definemachnumber ,subsonic waves and supersonic waves. (July2015)

11.Explain the Sol-Gel method of preparing nanomaterial's (July2015)

12.In scanning electron microscope, electrons are accelerated by an anode potential difference 60kilo volt. Estimate the wavelength of the electrons in the scanning beam. (July2015)

13.The distance between two pressure sensors in a shock tube is 150mm.the time taken by a shock wave to travel this distance is 0.3ms.If the velocity of sound under the same condition is 340m/s.Find the mach number of the shock wave. (June-2016)

14.Explain structure and application of carbon nanotubes. (June-2016

15.Describe the principle, construction and working of a scanning electron microscope (Jan-2016)

16.Explain the construction working of Reddy shock tube (June-2016)

17.What are the Nanomaterials ? Write a note on sol-gel method of preparing nanomaterials (Jan-2016)