Question Bank
Module-I
Modern physics and Quantum physics

1) Calculate the de-Broglie wavelength of particle of mass $0.65MeV/C^2$ has a kinetic energy of 80eV. (Jan2013)

2) Set up Schrodinger time- independent wave equation.(Jan 2013)

3)Using Heisenberg's uncertainty principle and prove that free electron does not exist inside the nucleus (Jan 2013)

4)Derive the expression for group velocity on the basis of superposition of waves. Also obtain the relation between group velocity and phase velocity. (july 2013)

5)) Explain blackbody radiation spectrum on the basis of planks radiation law. (Dec2014)

6)Obtain the solution of Schrödinger's time –independent wave equation when applied to a potential box of infinite height. (Dec2014)

7)What is Compton Effect? Explain its Physical significance. (Dec2014)

8)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. (Dec2014)

9)What is group velocity and phase velocity in wave motion? Obtain the relation between them. (Dec2014)

10)Setup time independent Schrödinger wave equation for free particle in one dimension. (Dec2014)

11)Using Heisenberg uncertainty principle, prove that electron cannot exist in the nucleus. (Dec2014)

12)Calculate the wavelength associated with an electron having K.E 100ev (Dec2014)

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

15)Give four important properties of matter waves. (June2015)

16)Setup time independent Schrödinger wave equation for free particle in one dimension. (June2015)

17) Calculate the energy in ev , for the first excited state of an electron in an infinite potential well of width $2A^O$ (June2015)

18) 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)

19) State and explain Heisenberg uncertainity principle . (June2015).

21)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)

Module-II
Electrical properties of materials

1) Explain failures of classical free electron theory. (jan 2013) (July2014)

2) What are the merits of quantum free electron theory?(Jan 2013)

3) Define Fermi energy and Fermi factor. Discuss variation of Fermi factor With temperature. (July2013) (July2014)

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

5) What is Fermi level? Describe the variation of Fermi factor with temperatures(Dec 2014)

6) Explain the Meissner effect and different types of superconductors. 7) The electron concentration in an n-type semiconductor is $5X10^{17}/\boldsymbol{m}^3$.Neglecting the hole current; calculate the conductivity of the material if the drift velocity of the electrons is 350 m/s in an electric field of 100 V/m. (Dec2014)

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

9) Explain the laws of mass action and derive the conductivity expression of a semiconductor. (Dec 2014)

10) What is Fermi- Dirac statistics? Explain. (Dec 2014)

11) The Fermi level in silver is 5.5ev. Find the velocity of electrons in silver. (Dec 2014)
Given: $E_F = 5.5ev$

12) Obtain an expression for the conductivity of a metal from quantum mechanical considerations. (June2015)

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

14)Explain the temperature dependence of resisitivity of metal and state Matthiessen´s rule. (June2015)

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

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

17) Describe Maglev vehicle. (June2015)

18) 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 (June2015)

19)What is mean collision time? Using free electron theory in a metal, obtain an expression electrical conductivity in terms of mean collision time.(July2013

Module-III

Laser and Optical fibers

1) Obtain the expression for energy density of radiation under equilibrium condition in terms of Einstein coefficient. (Jan2013)

2)What is holography? Explain principle of hologram recording using laser.

(Jan2013)(July 2014)

3)Explain laser welding and cutting process with diagrams.(July2013)

4)Mention the condition for laser action. Explain the working of a semiconductor laser. (Dec2014)

5) Discuss the various loss factors in optical fiber communication. (Dec2014)

6) Derive the condition for propagation of light through an optical fiber (Dec2014)

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

8)What is laser? Give the construction and working of carbon dioxide laser device. (Dec2014)

9) What are the different types of optical fibers? Explain. (Dec2014)

10)The attenuation in an optical fiber is 3.6dB/km. What fraction of its initial intensity remains after 3km. (Dec2014)

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

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

13)Give an account of point to point communication system using optical fibers. (June 2015)

14) 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)

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

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

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

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

Module- IV
Crystal Structure

1) Derive an expression for inter planar spacing of crystal in terms of miller indices. (Jan2013)

2) What is atomic packing factor? Calculate packing factor for sc and bcc structures. (Jan2013)(July2014)

3) What are miller indices? Explain how axial intercepts in a crystal plane are converted into miller indices. (July2013) (Dec2014)

4) What are miller indices? Explain how axial intercepts in a crystal plane are converted into miller indices. (Dec2014)

5) Find the atomic packing factor of SC, FCC and BCC structures. (Dec2014)

6) Determine the interplanar spacing for (110) planes for copper which has FCC structure and atomic radius 0.127nm. (Dec2014)

6)Obtain an expression for the interplanar distance in cubic crystal in terms of miller indices. (Dec2014)

7)Sketch and explain the structure of diamond crystal. (Dec2014)

8)Explain how bragg's law verified using Braggs X-ray spectrometer. (Dec2014)

9)Draw the crystal planes (210) and (101) in a cubic crystal. (Dec2014)

10) Mention the geometrical configuration of the seven crystal systems. (June2015)

12)Derive Bragg's equation. (June2015)

13)The atomic radius of gold is 0.144nm. Determine the interplanar distance for (110) planes assuming that gold belongs to FCC system. (June2015)

14)With the help of vector diagram explain the terms basis vectors, lattice vector, interfacial angles and crystal parameters of a space lattice.(June2015)

15) Derive an expression for interplanar distance in terms of Miller indices. (June2015)

16) Define coordination number and packing factor. Compute the packing factor for BCC crystals. (June2015)

17) 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)

Module -5

Shock waves and Science of nanomaterials

1) What are nano materials? Explain carbon nano tubes and their physical properties. Mention few applications of carbon nano tubes. (June2013)

2) write a note on carbon nano tube. Discuss various quantum structures. (June2013)

3) Describe with simple illustrations, the two methods of preparation of nanomaterials. (July2013)

4) Explainquantum structures. (July2013)

5) What are shock waves ? Explain the experimental method of producing shock waves and measuring its mach number using Reddy shock tube. (Dec2014)

6) Give the graphical representation of density of states with equation for 0D,1D,2D and 3D structures. (Dec2014)

.7) What are the properties of Carbon Nanotubes? (Dec2014)

8) What are the ultrasonic and supersonic waves? Describe in brief how the normal shock relationships are arrived. (Dec2014)

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

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

11)What is scanning electron microscope? Mention its three applications. (July2015)

12)The distance between the two pressure sensors in a shock tube is 100mm.the time taken by shock wave to travel this distance is 200 microsecond. If the velocity of sound under the same conditions is 340m/s ,find the Mach number of the shock wave.

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

14)Discuss the basics of conservation of mass, momentum and energy.(July2015)

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