Shivaji University , Kolhapur

Question Bank For Mar 2022 (Summer) Examination

B.Tech.CBCS Part 1 Semester 1 /2

71811- Engineering Physics

Unit1: Diffraction and polarization

Q.1	Define Grating element and obtain the equation for diffraction grating.
Q.2	What is grating? Explain the use of grating to determine wavelength of different spectral lines in mercury
Q.3	Define resolving power of grating and obtain an expression for it
Q. 4	Define : Anisotropic media ,optical activity , Specific Rotation
Q. 5	What is Huygens's theory of double refraction in uniaxial ?Explain positive and negative crystals
Q.6	Explain the phenomenon of double refraction and distinguish between positive and negative crystals
Q.7	Explain construction and working of Laurent's half shade polarimeter.
Q.8	Distinguish between positive and negative crystal.
Q.9	A diffraction grating used at normal incidence gives a green line of wavelength $5400A^0$ in certain order superimposed on violet line of wavelength $4050A^0$ of next higher order. If the angle of diffraction is 30^0. Calculate the Number of lines on grating.
Q.10	A diffraction grating used at normal incidence gives a line of wavelength $6000A^0$ in certain order superimpose on line of wavelength $4500A^0$ of next higher order. If the angle of diffraction is 30^0. Calculate the Number of lines on grating.
Q.11	Diffraction Grating has 6000 lines per cm. Find the angular separation of two yellow lines of wavelength $5770A^0$ and $5791A^0$ in second order
Q.12	If the grating has 5000 lines/cm and sunlight is used, determine the angular separation of first and second order spectrum of wavelength 6771 A^0.
Q.13	A Grating has 6000 lines per cm on it. Its width is 10 cm. calculate the resolving power in second order and the smallest wavelength that can be resolved in the third order in $6000A^0$.
Q.14	Find the minimum Number of lines in a plane diffraction grating required to just resolve the sodium doublet of wavelength $5890A^0$ and $5896A^0$ in the second order.
Q.15	A tube of sugar solution 20 cm long is placed between crossed Nicols and illuminated with light of wavelength 6000 A.U. If the optical rotation produced is 13^0 and specific rotation is 65^0, determine the strength of the solution.
Q.16	Determine the specific rotation of the given sample of sugar solution if the plane of polarization is turned through 13.2^0. The length of the tube containing 10% sugar solution is 20 cm.
Q.17	Calculate the wavelength of the spectral line , when a parallel beam of sodium light is allowed to incident normally on a plane grating having 4250 lines per cm and second order spectral line is observed to be deviated through 30^0.
Q.18	Calculate the specific rotation if the plane of polarization is turned through 26.4^0, when travel through 20 cm length of 20% sugar solution.

Unit 2: Laser and Fiber optics)

Q.1	Distinguish between spontaneous and stimulated emission.
Q.2	Explain the following terms in brief 1) Population inversion 2) Metastable state 3) Stimulated emission 4) Ground state
Q.3	Describe principle, construction and working of Ruby laser.
Q. 4	What is holography? Explain the construction and reconstruction of hologram. State the features of holography.
Q. 5	Explain the concept(principle of operation) and cross-sectional view of optical fiber .
Q.6	Explain the structure of optical fiber and explain propagation of light through the optical fiber.
Q.7	Describe the basic principle of fiber optics.
Q.8	Draw black diagram of an optical fiber communication system and explain working in it.
Q.9	What are advantages of optical fiber?
Q.10	Explain the term: acceptance angle, acceptance cone, Numerical aperture, fractional refractive index change
Q.11	State and explain characteristics of laser.
Q.12	A Silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.5 and cladding refractive index of 1.47. Determine critical angle, numerical aperture and acceptance angle for optical fiber in air medium.
Q.13	Determine numerical aperture and angle of acceptance for optical fiber. Given that refractive index of core is 1.42 and refractive index of cladding 1.40
Q.14	The numerical aperture of optical fiber is 0.54 and fractional refractive index change is 0.06. Find refractive index of core and refractive index of cladding.
Q.15	Determine the numerical aperture of a step index fiber, when the core refractive index is 1.5 and cladding refractive index is 1.48. Also find the angle of acceptance
Q.16	An optical fiber has a numerical aperture is 0.2 and cladding refractive index of 1.59. Determine acceptance angle for fiber in water which has refractive index1.33
Q.17	Fractional refractive index change is 0.0135 and numerical aperture is 0.2425. Calculate refractive index of core and cladding.

Unit 3: Sound

Q.1	Explain basic requirements for acoustically good hall
Q.2	Define and explain in brief 1) reverberation 2) reverberation time3) absorption Coefficient
Q.3	Explain various factors affecting acoustics of hall with their remedy.
Q. 4	Distinguish between echo and reverberation time.
Q. 5	A classroom has dimension 20,15 and 5m. The reverberation time is 3.5 sec. Calculate the total absorption of its surface and average coefficient of absorption
Q.6	Volume of an auditorium is 6000 m^3. The reverberation time is controlled by 2 sec by fixing sound absorbing material of coefficient of absorption 0.12. Find the surface area of sound absorbing material
Q.7	A hall has volume of 7500 m^3. It is required to have reverberation time of 1.5 sec . what should be the total absorption in the hall

<table>
<tr><td>Q.8</td><td>A hall of 1500 m^3has a seating capacity for 120 persons . Calculate the reverberation time of the hall when 1) hall is empty 2) hall is full
<table>
<tr><td>Surface</td><td>Area</td><td>Coefficient of absorption</td></tr>
<tr><td>Plastered walls</td><td>112 m^2</td><td>0.03</td></tr>
<tr><td>Plastered ceiling</td><td>170 m^2</td><td>0.04</td></tr>
<tr><td>Wooden door</td><td>20 m^2</td><td>0.06</td></tr>
<tr><td>Wooden floor</td><td>130 m^2</td><td>0.06</td></tr>
<tr><td>Cushioned chair</td><td>100 nos.</td><td>1</td></tr>
<tr><td>Audience</td><td>120 nos.</td><td>4.7</td></tr>
</table></td></tr>
<tr><td>Q.9</td><td>The Volume of the hall is 3398.4 m^3 and its total absorption equal to 92.90 O.W.U. Entry of people inside the hall raises the absorption by 185.50 O.W.U. Calculate the change in the reverberation time,</td></tr>
<tr><td>Q.10</td><td>The reverberation time is found to be 1.5 sec for an empty hall and it is found to be 1sec when a curtain cloth of 20 m^2 is suspended at the center of the hall. If the hall dimension are10x8x6 m^3. Calculate the coefficient of absorption of curtain cloth</td></tr>
<tr><td>Q.11</td><td>A Cinema hall has a volume of 8500 m^3 . It is required to have reverberation time 1.6 sec . What is total sound absorption in the hall</td></tr>
<tr><td>Q.12</td><td>A room has a volume of 1000m^3 the total wall area is 200m^2 the total floor area is100m^2 and the total ceiling area is 100m^2. The average sound absorption coefficient for wall is 0.02, ceiling is 0.8 and floor is 0.05. Determine the average absorption coefficient and the reverberation time.</td></tr>
<tr><td>Q.13</td><td>The volume of room is 1500 using following data calculate the reverberation time and average coefficient of absorption of hall
<table>
<tr><td>Surface</td><td>Area</td><td>Coefficient of absorption</td></tr>
<tr><td>wall</td><td>240 m^2</td><td>0.03</td></tr>
<tr><td>ceiling</td><td>100 m^2</td><td>0.8</td></tr>
<tr><td>floor</td><td>100 m^2</td><td>0.06</td></tr>
</table></td></tr>
<tr><td>Q.14</td><td>A classroom has dimension 20,15 and 10 m has average absorption coefficient of absorption 0.1 . Calculate reverberation time of hall</td></tr>
<tr><td>Q.15</td><td>The volume of an auditorium is 9500m^3. The period of reverberation is found to be 1.5 second. Calculate total absorption in the auditorium. If the floor of auditorium is now covered with carpet, where by the total absorption is found to have be increased by 100sabine. Calculate new reverberation time</td></tr>
</table>

Unit4: Crystal Physics

Q.1	Explain the following terms: i) Space lattice, ii) The basis and crystal lattice, iii) Unit cell
Q.2	Define Co-ordination number and find its values for SC, BCC, & FCC Structure.
Q.3	Define atomic radius and find its values for SC, BCC, & FCC Structure.
Q. 4	Define packing factor/packing density and find its values for SC, BCC, & FCC Structure.
Q. 5	Derive the relation between Lattice constant (a) &density(ρ) of the cubic crystal.

Q.6	what are Miller indices? State the procedure to determine Miller indices of a plane & give important features of Miller indices.
Q.7	Explain axis of symmetry and plane of symmetry in a cubic crystal system.
Q.8	State &derive Bragg's Law for X- ray diffraction.
Q.9	A substance with the FCC lattice has density 6200 kg/m^3 and molecular weight 60.2. Calculate the lattice constant a. (Given- Avogadro number N= 6.02×10^{26} /kg mol)
Q.10	Calculate the interplanar spacing for (221) planes in simple cubic lattice, where lattice constant is 4.2 A^0.
Q.11	Draw following planes in cubic crystal system**:-** (100), (010), (001), (011), (101), (110), (111), (112)
Q.12	The first order reflection from the plane of NaCl is obtained at an angle of 20^0 with the incident beam. If the interplanar spacing is 2.5 A^0 , then calculate the wavelength of X-rays used.
Q.13	Copper has FCC structure and the atomic radius is 1.278 A^0 . Calculate its density. Given- Molecular weight of Copper is 63.54
Q.14	NaCl crystals have FCC structure. The density of sodium chloride is 2.18 g/m^3. Calculate the distance between two adjacent atoms. Atomic weight of Sodium = 23 and that of Chlorine is = 35.5.
Q.15	If the lattice constant of one of the Ferrite system is 3.8 A^0, calculate inter planer spacing.
Q.16	Calculate the longest wavelength that can be analyzed by rock salt crystal of inter planer spacing 2.5 A^0 in the first order.

Unit 5: Physics of Nano material

Q.1	Define: Nano-material, Nano technology, Nano science.
Q.2	What is top down and bottom-up approach for production of nano material?
Q.3	Explain Ball milling method of synthesis/production of nano-material.
Q. 4	What is bottom-up approach for production of nano material? Explain colloidal method of production of nano material.
Q. 5	What do you mean by tunneling of electron? with neat diagram explain construction and working of scanning tunneling microscope (STM).
Q.6	With neat diagram explain construction and working of atomic force microscope.
Q.7	Why properties of material changes at nano level? State and explain different properties of nano-material.
Q.8	Write note on applications of nano-material.

Unit 6: Quantum Mechanics

Q.1	What is dual nature of radiation? Derive an expression for de Broglie wavelength in terms of kinetic energy (E) and potential difference (V).
Q.2	what is de Broglie hypothesis? Derive an expression for de-Broglie wavelength associated with an electron.
Q.3	what are matter waves? Mention their properties.
Q. 4	State and explain Heisenberg's uncertainty principle for position and momentum.
Q. 5	State and explain Compton effect. With suitable diagram explain experimental arrangement used to study Compton effect.Write the formula for Compton shift.
Q.6	Problems on: de Broglie wave length formula in terms of kinetic energy/ formula for de Broglie wavelength associated with an electron accelerated through a potential difference V / uncertainty principle/ Compton shift formula.
Q.7	State and explain Compton effect. Write the formula for Compton shift. Explain how Compton shift varies for scattering angle $\Theta = 0^0$, 90^0 and 180^0.
Q.8	Calculate the smallest possible uncertainty in the momentum of an electron for which the uncertainty in its position is 4×10^{-10}m.
Q.9	Calculate the de Broglie wavelength of the earth, taking the mass of the earth to be 6×10^{24}kg. Orbital velocity of the earth 3×10^4m/s.
Q.10	Calculate the de Broglie wavelength associated with an electron accelerated through energy of 2 keV.
Q.11	X-rays of 1 A^0 wavelength are scattered from a carbon block and the scattered radiation is viewed at an angle 90^0 to the incident beam. Find Compton shift $\Delta\lambda$ and kinetic energy imparted to the recoiling electron.
Q.12	A body of mass 1kg is moving with velocity 10 m/s.What will be de Broglie wavelength associated with this body?.
Q.13	Calculate the de Broglie wavelength of an electron having energy 10keV.
Q.14	X-rays of wavelength $2A^0$ are scattered from Carbon block. Calculate -i) the wavelength of scattered X-rays at the angle of 90^0 with the incident beam. ii) kinetic energy imparted to the recoiling electron.
Q.15	An electron has a speed of 1.05 x 10^4 m/s with an accuracy of 0.02%. Calculate the uncertainty in the position of the electron.(Given – mass of an electron = 9 x 10^{-31} kg.)

****