# University of Mumbai

Curriculum Scheme: Rev2016

All Programs

Examination: FE Semester I

_FH2022

Course Code:FEC102_____ Course Name: _Applied Physics-I_____

Time: 2 hours **Max. Marks: 60**

| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
|---|---|
| 1. | The square of the magnitude of the wave function is called_____ |
| Option A: | current density |
| Option B: | probability density |
| Option C: | zero density |
| Option D: | Volume density |
| | |
| 2. | Fermi energy level is defined as |
| Option A: | is the top most filled energy level at 0 Kelvin temperatures |
| Option B: | is the top most filled energy level at 0 degree Centigrade temperature |
| Option C: | separates valance band and conduction band |
| Option D: | is the top most empty energy level at 0 Kelvin temperatures |
| | |
| 3. | The critical magnetic field for vanadium is 10^5 A/m at 8.58 K & 3 x 10^5 A/m at 0 K. Its critical temperature is |
| Option A: | 10.50 K |
| Option B: | 1.050 K |
| Option C: | 105 K |
| Option D: | 15 K |
| | |
| 4. | For an empty assembly hall of size 20 x 15 x 10 cubic meter with absorption coefficient 0.106. Calculate reverberation time. |
| Option A: | 3.5 sec |
| Option B: | 5.3 sec |
| Option C: | 35 sec |
| Option D: | 35 millisecond |
| | |
| 5. | The inter-planar spacing between the (2 2 1) planes of a cube lattice of edge length 450 pm is: |
| Option A: | 50 pm |
| Option B: | 150 pm |
| Option C: | 300 pm |
| Option D: | 450 pm |

| | |
|---|---|
| 6. | The audible frequency range of human ear is |
| Option A: | 2o Hz to 200 Hz |
| Option B: | 2 Hz to 20 Hz |
| Option C: | 200 Hz to 2000 Hz |
| Option D: | 20 Hz to 20000 Hz |

| **Q2. (16 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
|---|---|
| A | **Answer Two out of Three** **8 marks each** |
| i. | Derive Bragg's law. Calculate the wavelength of X-rays reflected from the faces of a FCC crystal with lattice constant 2.82 Å, if the second order Bragg reflection occurs at a glancing angle of 17.167°. |
| ii. | Derive one dimensional time dependent Schrodinger equation for matter waves. An electron is bound in one dimensional potential well of width 2 Å but of infinite height. Find its energy values in the ground state & first excited state. |
| iii. | State & explain Hall effect. Derive an expression for Hall voltage & Hall coefficient. |

| **Q3. (16 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
|---|---|
| A | **Answer Four out of Six** **4 marks each** |
| i. | An electron has a speed of 400 m/sec with uncertainty of 0.01%. Find the accuracy in its position. |
| ii. | Show that for an intrinsic semiconductor Fermi level lies in the middle of forbidden band. |
| iii. | Find the resistivity of intrinsic Germanium at 300° K. Given density of carrier is 2.5 ×10 ^19 /m^3. Mobility of electron is 0.39 m^2/V-sec.& mobility of holes is 0.19 m^2/V-sec. Charge on electron is 1.6 ×10^19 C. |
| iv | Calculate the number of atoms per unit cell, atomic radius & atomic packing factor for diamond unit cell |
| v | Distinguish between type –I & type-II superconductor. |
| vi | What will be the Young's modulus of quartz if a 5.5 mm thick quartz plate is used to produce an ultrasonic wave of frequency 0.4999 MHz? the density of quartz is 2.65 × 10^3 kg/m^3. |

| **Q4. (16 Marks)** | ***Please delete the instruction shown in front of every sub question*** |
|---|---|
| A | **Answer Four out of Six** **4 marks each** |
| i. | Draw the diagram of magnetostriction oscillator & explain its working as an ultrasound generator. |

| | |
|---|---|
| ii. | Explain the conditions necessary for good acoustical design of an auditorium. |
| iii. | Explain the construction & working of a solar cell |
| iv | What is probability of an electron being thermally excited to the conduction band is Silicon at 27°c.the band gap energy is 1.12 eV. |
| v | A sample of n-type Silicon has a donor density of 10^20 /m^3. It is used in the Hall effect experiment. If the sample of thickness 4.5 mm is kept in a magnetic field of 0.55T with current density of 500 A/m^2. Find i) Hall voltage developed in it ii) Hall coefficient if mobility of electron is 0.17 m^2/V-sec. |
| vi | Using Heisenberg's principle show that electrons cannot exist within the nucleus. |