



SPRING END SEMESTER EXAMINATION-2016

2nd Semester B.Tech & B.Tech Dual Degree

PHYSICS-II

PH-201

(Back-2013 Admitted Batch)

Time: 3 Hours

Full Marks: 60

Answer any SIX questions including Question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. a) Show graphically how the variation of energy density with $[2 \times 10]$ wavelength of black body radiation is changed if the temperature is increased.
- b) What are the laws of Photoelectric effect?
- c) Calculate the value of momentum and energy of an electron in a box of length 1 \AA for $n=2$ state.
- d) Out of the given eigen functions $\Psi(x) = e^x$ and $\Psi(x) = e^{-x}$, which one is an acceptable quantum mechanical wave function?
- e) Calculate the interplanar spacing for (221) plane in an SC lattice whose lattice constant is $4.2 \times 10^{-10} \text{ m}$.
- f) Write any four applications of superconductors.
- g) X-rays of $\lambda = 0.3 \text{ \AA}$ are incident on a crystal with a lattice spacing 0.5 \AA . Find the angle at which second order Bragg's diffraction maximum is observed.

- h) What are the limitations wave function?
- i) Show that phase velocity of de Broglie wave is greater than the velocity of light.
- j) State Heisenberg's uncertainty principle.
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2. What is Compton effect? Derive an expression for Compton shift and show that Compton shift depends only on the angle of scattering and is independent of the wavelength of incident photons. [2+6]
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3. Define phase velocity and group velocity. Give their analytical expressions and find the relation between them. [2+4+2]
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4. Establish time-dependent and time-independent Schrodinger's wave equations in one dimension. [4+4]
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5. What is tunnel effect? Write down the Schrodinger's equation for a particle approaching a one dimensional potential barrier of finite height and width. Show that there is a finite probability of the particle to tunnel through the barrier. [2+6]
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6. i) Calculate the atomic packing fraction and the number of atoms per unit cell in crystals having (a) simple cubic (b) body centered cubic and (c) face centered cubic structures considering the atoms as hard spheres. [6]
- ii) Find the Miller indices of a plane having intercepts of $8a$, $4b$ and $2c$ on the a , b , c axes respectively. [2]

7. i) Derive an expression for electron concentration in an intrinsic semiconductor. [10]
- ii) Calculate the wavelength of the emitted light for the gallium arsenide phosphide having energy band gap of 2eV. [2]
8. i) What is Meissner's effect? Explain the difference between type I type II superconductors using this effect. [6]
- ii) Lead in the superconducting state has critical temperature of 6.2 K at zero magnetic field and a critical field of 0.064 MA m⁻¹ at 0 K. Determine the critical field at 4K. [2]

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