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PHY12/22

First/Second Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. What is population inversion? Explain the necessity of population inversion for lasing. Write the construction and working of He-Ne Laser. **(10 Marks)**

b. Write the principle of holography. With neat sketches explain in brief recording of a hologram and reconstruction of images. **(06 Marks)**

c. A laser operating at 632.8 nm emits 3.182×10^{16} photons per second. Calculate the output power of the laser. If the input power is 100 watt, find the percentage of power converted into coherent light energy. **(04 Marks)**

2 a. Describe the light propagation and modal dispersion in different types of fibres with neat ray diagrams indicating refractive index profile and the core diameter. **(06 Marks)**

b. Using Bohr's atom model explain the origin of characteristics X-rays. Calculate the cut-off wavelength and maximum velocity of electron striking the target in a Coolidge tube operating at 50 KV. **(10 Marks)**

c. A multimode step-index fiber with a core diameter of 80 μm and relative refractive index difference of 1.5% is operating at 0.85 μm. If the core refractive index is 1.48, calculate number of guided modes. **(04 Marks)**

3 a. What are Miller indices? Find the Miller-indices for a crystal plane. Derive the expression for interplanar distance between consecutive planes described by Miller indices (hkl). Draw (1 1 2) and (1 0 1) planes in cubic crystal. **(10 Marks)**

b. Describe crystal structure of NaCl. Derive the expression for lattice constant and calculate the lattice constant of NaCl given i) Molecular weight of NaCl 58.45 and density 2170 kg/m^3. **(10 Marks)**

4 a. Describe carbon nanotubes. How are carbon nanotubes being produced? Write two important properties and two application of these tubes. **(07 Marks)**

b. What is MEMS? Describe it's main components and explain the function. **(06 Marks)**

c. What are composites? Explain their classification, giving examples. **(07 Marks)**

5 a. Using Einstein theory derive expression for the energy density of radiation of thermal equilibrium. **(10 Marks)**

b. Calculate the ratio of i) Einstein coefficient $\left(A_{21}/B_{12}\right)$. ii) Stimulated to spontaneous emission for wavelength 1.39 μm at 300 K. **(06 Marks)**

c. Explain three level and four level laser systems. What are the advantages of four level laser system over three level laser system? **(04 Marks)**

6 a. Explain with block diagram optical fiber communication system. Explain and compare i) information carrying capability ii) signal security of the optical fiber communication system with that of co-axial cable system. **(10 Marks)**

b. Explain crystalline state of matter and obtain the expression for Bragg's law of X-ray diffraction in crystals. **(06 Marks)**

6 c. The results of X-ray spectrometer showed three reflection maxima for glancing angles 8°58', 12°01' and 18°12'. Show that these are successive orders of reflection from the same crystal. **(04 Marks)**

7 a. Define unit cell. Describe the dimond structure giving details about its co-ordination number, atomic radius and number of atoms per unit cell. Calculate the packing fraction of dimond structure. **(12 Marks)**

b. For a tetragonal lattice, a = b = 0.25 nm and c = 0.18 mm. Draw the unit cell. Draw a plane in the unit cell having Miller indices (110) and calculate the interplanar distance. **(08 Marks)**

8 a. Describe a quantum bit. Explain a single q bit. **(06 Marks)**

b. What are composites? Explain the classification and advantages of composite materials. **(08 Marks)**

c. Write notes on nano systems. **(06 Marks)**

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