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NEW SCHEME

PHY12/22

USN | | | | | | | | | | |

First/Second Semester B.E Degree Examination, July/August 2004

Common to all Branches

Engineering Physics

Time: 3 hrs.] [Max.Marks : 100

Note: *1. Answer any FIVE questions out of eight.*
2. Each question carries equal marks.
3. Values of Constants :
Electron mass $m = 9.11 \times 10^{-31} kg$
Electron charge $e = 1.6 \times 10^{-19} C$
Velocity of light $c = 3 \times 10^{8} m/s$;
Planck's constant $h = 6.63 \times 10^{-34} J.S$
Avagadro's number, $N_A = 6.025 \times 10^{26} / Kmole$

1. (a) Explain the duality of matter waves from the inferences drawn from Photo-electric effect and Davison Germer experiment. **(5 Marks)**

(b) Explain phase velocity and group velocity. Deduce the relation between them on the basis of superposition of waves. **(10 Marks)**

(c) The position and momentum of 1 kev electron are simultaneously determined and if its position is located within $1A^0$, what is the percentage of uncertainty in its momentum? **(5 Marks)**

2. (a) What are Eigen values and Eigen functions of a de-Broglie wave? Find Eigen values and Eigen functions for a particle in 1-dimensional potential well of infinite height. **(10 Marks)**

(b) Calculate the wave length associated with electrons whose speed is 0.01 of the speed of light. **(7 Marks)**

(c) Distinguish between Type I and Type II superconductors. Discuss briefly the BCS theory of superconductivity. **(3 Marks)**

3. (a) Explain the terms drift velocity, relaxation time and mean free path for free electrons. **(5 Marks)**

(b) Explain density of states. Derive an expression for number of allowed states for a unit volume of solid. **(10 Marks)**

(c) Show that the occupation probability at $E = E_F + \Delta E$ is equal to the non-occupation probability at $E = E_F - \Delta E$. **(5 Marks)**

4. (a) What is polarization and dielectric loss in dielectric materials? Explain the dependence of polarizability and dielectric loss on frequency. **(8 Marks)**

(b) A parallel plate capacitor has an area of $7.45 \times 10^{-4} m^2$ and the plates are separated by a distance of $2.45 \times 10^{-3} m$. across which a potential of 10V is applied. If a material with dielectric constant 6 is introduced between the plates, determine the capacitance, the charge stored on each plate, the dielectric displacement D and polarization. **(5 Marks)**

(c) Explain the properties and applications of ferrites. **(7 Marks)**

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5. (a) Explain the terms spontaneous emission, stimulated emission and population inversion. Explain the construction and working of Ruby Laser. (10 Marks)

(b) Discuss the applications of lasers. (6 Marks)

(c) Find the ratio of population of two energy levels out of which one corresponds to meta stable state, if the wavelength of light emitted at 330K is 632.8nm. (4 Marks)

6. (a) Explain fiber-optic communication. Describe point to point communication system using optical fibers with the help of a Block diagram. (8 Marks)

(b) Explain attenuation of an optical fibre. A fibre with an input power of $9.0\mu W$ has a loss of $1.5dB/km$. If the fibre is 3000m long, what is the output power? (5 Marks)

(c) Explain the phenomena of production of continuous and characteristic X-ray spectrum. Derive the expression for Bragg's law. (7 Marks)

7. (a) What are Miller indices? Derive an expression for the interplanar spacing of planes in terms of Miller indices in a cubic structure. (10 Marks)

(b) Draw the following planes in a cubic unit cell (011), (102), (132) and (112). (5 Marks)

(c) In an X-ray diffraction study, a radiation of wavelength $1.71A^0$ was directed at a cubic crystalline sample. It was found that the first two Bragg reflections occur at angles of 30^0 and $35^017'$ respectively. Determine whether the crystal is BCC or FCC structure. (5 Marks)

8. (a) Explain density of states for various quantum structures. (5 Marks)

(b) Explain nano tubes and its applications by giving their physical properties. (5 Marks)

(c) Explain smart materials with two examples. (5 Marks)

(d) What are composite materials? Give their classifications. (5 Marks)

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