NEW SCHEME

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# First/Second Semester B.E Degree Examination, July/August 2005

## Common to all Branches

# Engineering Physics

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

**Note:** *1. Answer any FIVE full questions.*
*2. All questions carry eqla marks.*
*3. Answers must be specific and precise.*
*4. Draw neat sketches wherever necessary.*

*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* $h = 6.63 \times 10^{-34} J.S$
*Permitivity of vacuum,* $\epsilon_0 = 8.85 \times 10^{-12}\ F/M$
*Avagadro's number,* $N_A = 6.025 \times 10^{26}/Kmole$
*Boltzmann constant,* $K = 1.38 \times 10^{-23} J/K$

**1.** (a) What are matter waves ? Show that the electron accelerated by a potential difference $V$ volts is $\lambda = 1.226/\sqrt{V} nm$ for non- relativistic case.

(b) Explain phase velocity and group velocity. Derive the expression for de Braglie wave length using the concept of group velocity.

(c) The speed of electron is measured to within an uncertainty of $2.2 \times 10^4 m/s$ in one dimension. What is the minimum width required by the electron to be confined in an atom. **(6+10+4 Marks)**

**2.** (a) What is a wave function ? Give its significance. Assuming a particle of mass 'm' is confined in a field free region between impenetrable walls at $x = 0$ and $x = a$, show that the stationary energy levels of the particle are given by $E_n = n^2h^2/8ma^2$

(b) Explain the BCS theory of super conductity.

(c) A quantum particle confined to one-dimensional box of width 'a' is known to be in its first excited state. What is the probability of the particle in central half? **(10+5+5 Marks)**

**3.** (a) How does the electrical resistance of the metal change with impurity and temperature?

(b) Derive the expression for electrical conductivity in metals interms of relaxation time and explain any three draw backs of classical theory of free electrons.

(c) Find the probability with which an energy level $0.2eV$ below fermilevel being occupied at room temperature of $300K$ and $1000K$. **(5+10+5 Marks)**

**4.** (a) Explain the properties of Ferrites and mention its two uses.

(b) Explain with theory how static dielectric constant of a dielectric material is determined and explain its frequency dependance.

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(c) The dielectric constant of $He$ gas at NTP is 1.0000684. Calculate the electronic polarisability of $He$ atoms if the gas contains $2.7 \times 10^{25}$ atoms per $m^3$.

**(5+10+5 Marks)**

**5.** (a) Explain the terms 'stimulated emission and population inversion. Obtain an expression for energy density of photons in terms of Einstein's co-fficients.

(b) Explain the construction and working of Ruby Laser

(c) Write a note on measurement of pollutents in atmosphere using laser.

**(10+6+4 Marks)**

**6.** (a) Explain the origin of characteristic X-rays.

(b) Derive Braggs law.

(c) Explain the principle of light propagation in an optical fibre. Derive the expression for numerical aperture in terms of refractive indices of core and cladding.

(d) Calculate the number of modes that can be propagated inside an optical fibre, given $n_{core} = 1.53$, $n_{clad} = 1.50$, core radians $50\mu m$, $\lambda = 1\mu m$.

$n_{core} = 1.53$, $n_{clad} = 1.50$, core radians $50\mu m$ $\lambda = 1\mu m$ **(5+5+6+4 Marks)**

**7.** (a) Explain the structure of $NaCl$ and calculate the packing fraction for a bcc structure.

(b) Obtain the expression for inter planar distance interms of Miller indices.

(c) Sketch the following planes in a cubic unit cell (101), (121), (010)

**(10+5+5 Marks)**

**8.** (a) Explain the term MEMS. Discuss different materials used for MEMS.

(b) Explain the advatages and disadvantages of composite materials.

(c) Discuss the different types of nano scale systems. **(6+6+8 Marks)**

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