## NEW SCHEME

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 $\varepsilon = 1.6 \times 10^{-19} C$*
   *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 $1 A^0$, 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)**

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 $1.5 dB/km$. 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 $1.71 A^0$ 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)**

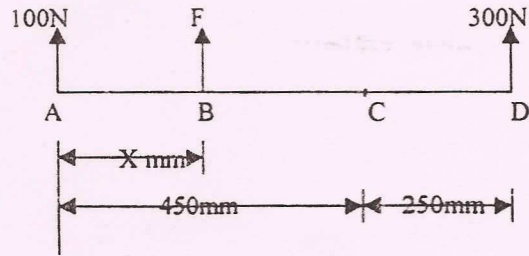   (d) What are composite materials? Give their classifications.  **(5 Marks)**
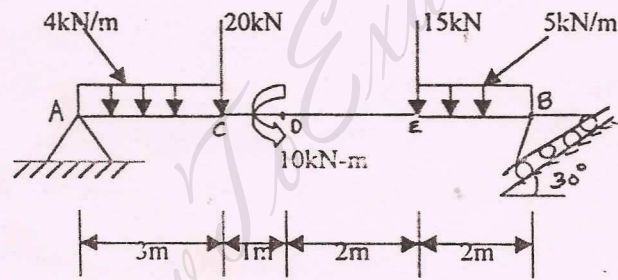
** * **

100N　　　　　F　　　　　　　　300N

A　　　　　B　　　　　C　　　　D

|← X mm →|

|← 450mm →|← 250mm →|

Figure.2

4kN/m　　　　20kN　　　　　15kN　　　5kN/m

A　　　　　　　C　　D　　　　　E　　　　B

10kN-m　　　　　　　　　　30°

|← 3m →|← 1m →|← 2m →|← 2m →|

Figure.3

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