USN

# First/Second Semester S.E. Degree Examination, Dre21119/Jan.2020
## Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer FIVE full questions, choosing ONE full question from each module.*
2. *Physical constants :* $h = 6.624 \times 10^{-34}$ *JS,* $K = 1.38 \times 10^{-23}$ J/K,
$N_A = 6.022 \times 1.0^{23}$ / mole, $m_e = 9.1 \times 10^{-31}$ *kg.*

### Module-1

1 a. Define phase velocity and group velocity. Derive the relation between them. **(06 Marks)**
b. Derive the expression for Eigen function and energy Eigen values for a particle inside a potential well of infinite height. **(07 Marks)**
c. Explain Heisenberg's uncertainity principle. Mention its physical significance. **(03 Marks)**
d. Find the kinetic energy and group velocity of an electron with De-Broglie wavelength of 0.2 nM. **(04 Marks)**

**OR**

2 a. What are the assumptions of Plank's law of radiation? Derive Wien's law and Rayleigh-Jean's law from Planck's law. **(07 Marks)**
b. Set up one dimensional time independent Schrodinger wave equation. **(06 Marks)**
c. What are matter waves? Give its properties. **(03 Marks)**
d. A spectral line of wavelength 546 nm has a width of $10^{-14}$ m. Evaluate the minimum time spent by the electron in the upper energy state between the excitation and deexcitation processes. **(04 Marks)**

### Module-2

3 a. Explain failure of classical free electron theory. **(06 Marks)**
b. Discuss BCS theory of super conductivity. **(06 Marks)**
c. Explain Meissner effect. **(04 Marks)**
d. Calculate the number of donor atoms which must be added to an intrinsic semiconductor to obtain a conductivity of $2.2 \times 10^{-4}$ mho/m. Given mobility of electrons = $125 \times 10^{-3}$ $m^2/VS$. **(04 Marks)**

**OR**

4 a. Derive the expression for electrical conductivity of an intrinsic semiconductor. **(06 Marks)**
b. Define critical temperature and critical field for superconductivity. Explain temperature dependence of critical field. **(06 Marks)**
c. Define the terms (i) Drift velocity (ii) Thermal velocity (iii) Relaxation time (iv) Mean collision time. **(04 Marks)**
d. Find the temperature at which there is 1% probability that a state with an energy 0.5 eV above Fermi level is occupied. **(04 Marks)**

### Module-3

5 a. What is attenuation in optical fibers? Give the equation for attenuation coefficient. Explain different attenuation mechanisms. **(07 Marks)**
b. Derive an expression for energy density in terms of Einsteien's coefficients. **(06 Marks)**
c. Write a note on modes of propagation and V.number in optical fiber. **(04 Marks)**
d. The average output power of a laser emitting photons of wavelength 632.8 nrn is 5 mW. Calculate the number of photons emitted per second by the laser beam. **(03 Marks)**

**OR**

6 a. Describe the construction and working of a semiconductor diode laser. **(06 Marks)**
b. Explain different types of optical fibers with suitable diagrams. **(06 Marks)**
c. Mention the properties of laser light. **(04 Marks)**
d. The attenuation of light in an optical fiber is 2.2 dB/km. If the input power is 100 MW. Calculate the output power after 2 km and 6 km. **(04 Marks)**

**Module-4**

7 a. Define packing factor. Obtain packing factor for simple cubic, bcc and kc structures. **(07 Marks)**
b. What is Bragg's law? Describe how Bragg's spectrometer is used to determine the wavelength of X rays. **(06 Marks)**
c. Define altotrophy and polymorphism. **(03 Marks)**
d. Draw the following planes in a cubic unit cell:
(i) 100 (ii) (101) (iii) (111) (iv) (132) **(04 Marks)**

**OR**

8 a. What are Miller indices? Explain the procedure to find Miller indices of a plane with ar example. **(06 Marks)**
b. Derive an expression for interplanar distance for a set of parallel planes having Miller indices (hK1). **(06 Marks)**
C. Discuss Perovskite structure. **(04 Marks)**
d. A monochromatic X ray beam of wavelength 0.7 A undergoes first order Bragg reflection from (302) plane of a cubic crystal at a glancing angle of 35 $^{0}$. Calculate the lattice constant. **(04 Marks)**

**Module-5**

9 a. Define: (i) Mach number (ii) Subsonic wave (iii) Supersonic wave (iv) Hypersonic wave (iv) Mach angle. **(05 Marks)**
b. Give an account of Rankine-Hugoniot equations and mention the conservation laws. **(06 Marks)**
c. Discuss Ball milling method of synthesis of nanoparticles. **(05 Marks)**
d. What are carbon nanotubes? Mention their properties. **(04 Marks)**

**OR**

10 a. Describe the construction and working of Reddy tube. **(07 Marks)**
b. Describe the principle, construction and working of scanning electron microscope. Mention its applications. **(08 Marks)**
C Describe arc discharge method of obtaining CNTs with the help of a diagram. **(05 Marks)**