B. Tech.

(For EC/EE/EN/EI/ET/EX/EL/IE/IC/IN)

(Semester II) Even Semester Theory Examination, 2012-13

ENGINEERING PHYSICS–II(E)

Time : 3 Hours]   *[Total Marks : 80*

Note : Attempt questions from each Section as per instructions.

Section-A

Attempt *all* parts of this question. Write answer of each part in short.. Each part carries 2 marks.   2×8=16

1.   (a)   What do you understand by wave packet?
    (b)   Explain, why electron can not reside inside nucleus?
    (c)   What is Meissner effect?
    (d)   What is dielectric loss?
    (e)   What do you mean by coercivity?
    (f)   What is the importance of Hall effect?
    (g)   What is enthalpy?
    (h)   Define material dispersion.

Section-B

Attempt any *three* parts of this question. Each part carries 8 marks.   8×3=24

2.   (a)   Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to one-twentieth of the velocity of light.
    (b)   The critical fields at 6K and 8K for NbTi alloys are 7.616 and 3.284 MA/m respectively. Calculate the transition temperature and the critical field at 0K.
    (c)   Calculate the electronic polarizability of argon atom at NTP, the dielectric constant of argon is 1.0024 and its atomic density is 2.7×10^{25} atoms/m³.
    (d)   The compressor of an air expansion machine intakes air at 1 atmosphere and releases at 5 atmosphere pressure. Calculate the coefficient of performance of the machine. If the power necessary to derive the machine is 1.5 H.P., find the amount of heat removed per minute. γ for air is 1.4.

(e) A glass clad fiber is made with the core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.005. Calculate (i) the refractive index of cladding, (ii) the critical angle, (iii) the acceptance angle, and (iv) the Numerical Aperture.

Section-C

Attempt *all* questions of this Section. Each question carries 10 marks. $8\times5=40$

3. Attempt any *one* part of the following :

(a) What are phase and group velocity? Establish a relation between them in term of frequency.

(b) A particle is moving along a line between $x=0$ and $x-a$ with zero potential energy. At point for which $x<0$ and $x>a$, the potential energy is infinite. Solving Schrödinger's equation, obtain the energy, eigenvalues and the normalized wave function for the particle.

4. Attempt any *one* part of the following :

(a) What do you mean by superconductivity? Explain the BCS theory of super conductors and give some applications of super conductors.

(b) What are nano materials? Discuss preparation technique and properties of Buckyball.

5. Attempt any *one* part of the following :

(a) Discuss frequency dependence of dielectric constant. What is relaxation time?

(b) What is diamagnetism? Show that susceptibility of diamagnetic material is negative and independent of temperature.

6. Attempt any *one* part of the following :

(a) What is Fermi energy? Show how this energy depends on the density of electron gas.

(b) Explain the theory of Joule-Thomson regenerative cooling. How can you obtain liquid helium by its application?

7. Attempt any *one* part of the following :

(a) Describe the working of a rotatory oil pump for producing low pressure. How are these pressure measured?

(b) What are optical fibers? Describe classification of these fibers with refractive index profile.

Physical Constants :

Speed of light $c = 3.0\times10^{8}$ m/s,   Planck's constant $h = 6.62\times10^{-34}$ J-s

Mass of electron $m = 9.1\times10^{-31}$ kg,   Mass of proton $m_{p}=1.67\times10^{-27}$ kg.

Permeability $\mu_{0}=4\pi\times10^{-7}$ H/m,   Permitivity $\varepsilon_{0}=8.854\times10^{-12}$ F/M.