**PVP 14**

Code: ME1T3, EE1T3, EC1T3, AE1T3

# I B.Tech - I Semester – Regular Examinations - January 2015

## ENGINEERING PHYSICS
**(Common for AE, ME, EEE, ECE)**

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1. a) What is the physical significance of wave function 'Ψ'?
   b) State the postulates of de-Broglie hypothesis.
   c) State and explain Bragg's law of X-ray diffraction.
   d) What is the significance of Miller indices?
   e) What are the successes of Classical free electron theory?
   f) What is Fermi level and Fermi energy?
   g) What is polarisation in a dielectric material?
   h) What are donor and acceptor energy levels?
   i) What is a hard magnetic material?
   j) Write the characteristics of laser.
   k) Explain single wall and multi wall in nano materials.

## PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Write down the Schrodinger wave equation for a particle in a one-dimensional box. Solve the equation to obtain energy eigen values. 8 M

b) State and explain Heisenberg's uncertainity principle. 4 M

c) Calculate the de-Broglie wavelength of an electron whose kinetic energy is 10eV. 4 M

3. a) Describe the seven types of crystal systems with their numerical and diagrams. 6 M

b) Explain the powder method of crystal structure analysis. 6 M

c) Monochromatic X-rays of wavelength 1.5A° are incident on a crystal face having an interplanar spacing of 1.6 A°. Find the highest order for which Bragg's reflection maximum can be seen. 4 M

4. a) Discuss the Kronig-Penny model for the motion of an electron in a periodic potential. 8 M

b) Explain the classification of metals, semiconductors and insulators based on band theory. 4 M

c) For a dielectric material $\varepsilon_r$=4.94 and $n^2$=2.69, where 'n' is the refractive index. Calculate the ratio between electronic and ionic polarisabilty for this material. 4 M

5. a) Describe the drift and diffusion currents in a semi conductor and derive their expressions. Deduce Einstein's relation. 8 M

b) Show that the Fermi level is nearer to the conduction band in an n-type semiconductor. 4 M

c) Calculate the position of Fermi level $E_F$ and the conductivity at $300^0$K for germanium crystal containing $5x10^{22}$ arsenic atoms/$mm^3$. Also calculate the conductivity if the mobility of the electron is $0.39m^2v^{-1}s^{-1}$. 4 M

$E_g$=0.3 ev $m_h^* = 0.24\ m_o$ $m_c^*$=0.12 $m_o$

6. a) Describe the construction and working of Ruby laser with necessary energy level diagram. 8 M

b) Explain the light wave propagation through an optical fiber and deduce the expressions for numerical aperture and acceptance angle in it. 6 M

c) The acceptance angle for a certain fiber is 24°. The refractive index of the core is 1.46. Determine the refractive index of cladding. 2 M