Reg.No.:								

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 3002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – DECEMBER 2019
First Semester
Computer Science and Engineering
U19PH101 – SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS
(Common to Information Technology)
(Regulation 2019)

Time : Three Hours | Maximum : 100 Marks

Answer ALL the questions

PART – A

(10 x 2 = 20 Marks)

1. Interference fringes are formed in a thin air wedge using sodium light of wavelength 5893 A°. When observed normally, 10 fringes are found in a distance of 1 cm. Calculate the angle of the wedge.
2. Determine the refractive index of the material of the cladding of an optical fiber in order for the incoming light with an acceptance angle of 60° to transmit through the fiber. Given the refractive index of the core is 1.55.
3. State Malu's Law.
4. The expression for a polarized electromagnetic wave is given as $\bar{E} = E_0\left[\hat{i}\cos(kz-\omega t) + \hat{j}\sin(kz-\omega t)\right]$ where $\hat{i}$ and $\hat{j}$ are unit vectros in the x and y directions respectively. Identify the direction of propagation (including sign), state of polarization and the amplitude of the wave.
5. Which one of the following statements about the $(\bar{2}4\bar{1})$ and $(2\bar{4}1)$ planes is false
   a. They are perpendicular
   b. They are part of the same set of planes
   c. They are part of the same family of planes
   d. They are parallel

6. Distinguish between the following pair of terms Hexagonal Close Packing (HCP) and Cubic Close Packing (CCP).
7. An electron moves with a constant speed of $v = 1.1\times10^{6}$ m/s along a straight line. If the speed is measured to a precision of 0.1 percent, what is the maximum precision with which the position could be simultaneously measured?
8. If an electron and a proton have the same kinetic energy which has the shorter de Broglie wavelength?
9. LED operates under _____ with light being emitted mainly due to _____ and mainly requires _____
   a) Forward bias, band-to-band recombination, direct band gap
   b) Reverse bias, band-to-band recombination, direct bandgap
   c) Forward bias, Auger recombination, indirect bandgap
   d) Forward bias, S-R-H recombination, direct bandgap
10. Describe what is Franz-keldysh effect and its use in a modulator.

PART – B

(5 x 16 = 80 Marks)

11. a) i. Explain with a neat diagram the principle and working of Michelson Interferometer (10)
    ii. Propose a method to determine the thickness of a transparent mica sheet of refractive index μ using Michelson Interferometer (6)

(OR)

b) Write a short note on anti-reflection coatings. Describe its principle of working and its uses with neat diagrams.

12. a) The intensity distribution in the case of Two-Slit Fraunhofer diffraction pattern is given by $I = 4I_0\frac{\sin^2\beta}{\beta^2}\cos^2\gamma$ Where $\beta = \frac{\pi b\sin\theta}{\lambda}$ and $\gamma = \frac{\pi d\sin\theta}{\lambda}$, b being the slit width and d being the separation between two slits. Consider the case when $b = 8.8\times10^{-3}$ cm and $d = 7.0\times10^{-2}$ cm. How many interference minima will occur between the two diffraction minima on either side of the central maximum?

(OR)

b) State and explain Brewster's law. Using the law determine the refractive index of flint glass in order to achieve complete polarization of reflected light of a ray of light at the water-glass interface(light enters from the side of water to glass) at an angle of incidence 52.2°.

13. a) Calculate the packing factor of a metal crystal for SC, BCC and FCC lattices with the assumption that the atoms are touching each other.

(OR)

b) i. Write a short note on Miller indices. Determine the miller indices of a plane parallel to the b axis and having intercepts 2a and $\frac{3c}{2}$ along x and z axes, respectively. (10)

ii. Calculate the spacing between (212) planes in a cubic system having the lattice constant $a = 0.45\,A^0$. (6)

14. a) State and explain the important postulates of quantum mechanics.

(OR)

b) Write down the Schrodinger equation for a particle in a one dimensional box (Infinitely deep well). Solve the same to obtain its energy Eigen values and Eiean function.

15. a) Write a note on Kerr effect and Pockels effect.

(OR)

b) Describe the principle, construction, working and any three advantages of solar cells.
