Sub Code: AHT 001 **ROLL NO……..……..**

II SEMESTER EXAMINATION, 2022 – 23

Ist yr B.Tech. – All Branches

Engineering Physics

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any **four** parts of the following. a) Differentiate between Fresnel and Fraunhofer class of diffraction. b) How to covert a circular polarized light into plane polarized light. Discuss with the help of suitable schematic diagram. c) Discuss the phenomenon of hysteresis curve; hence differentiate between soft and hard magnetic materials. d) Write and explain the Einstein's photoelectric effect equation and define stopping potential. e) Differentiate between direct and indirect band gap semiconductors. f) How *n-type* and *p-type* semiconductors are formed from intrinsic semiconductors. What is the position of the Fermi level in intrinsic, *n-type* and *p-type* semiconductors?	5x4=20
Q 2.	Answer any **four** parts of the following. a) What do you mean by specific rotation of an optically active substance? How can this be used to determine the concentration of a sample in a polarimetry experiment? b) Describe absorption, spontaneous emission and stimulated emission and hence define the Einstein coefficients. c) Draw the voltage-characteristics (*V-I*) for a solar cell and photo-diode. d) Discuss the properties of a well defined wave function. e) A silicon diode has a reverse saturation current of *10 nA* and a forward voltage drop of *0.7 V* at room temperature. Calculate the diode current when it is forward-biased with a voltage of *0.8 V* at room temperature, assuming an ideality factor is *1*. f) Two coherent sources of intensity ratio β interfere. Prove that in the interference pattern. $$\frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{2\sqrt{\beta}}{1+\beta}$$	5x4=20
Q 3.	Answer any **two** parts of the following. a) Discuss the formation of Newton's ring by reflected light and derive an expression for the diameter of n^{th} dark ring. b) What is the attenuation coefficient of an optical fiber, and how does it relate to the loss of signal strength in fiber optic communication. An optical signal has lost *85%* of its power after traversing *500 meter* of fiber? What is the loss in *dB per Km* of this fiber? c) Derive the expression for normalized wave function for a particle trapped in one dimensional potential box of length *L*.	10x2= 20

Q 4.	Answer any **two** parts of the following. a) Explain construction and working of Ruby laser with neat and clean diagrams. b) Write Maxwell's equations in differential form. Deduce the equation for the propagation of the plane electromagnetic wave in free space. c) What will be the scattering angle and Compton shift if the scattered photons and recoiled electrons make the same angle ($\theta = \phi$) with the direction of incident wave, and the recoiled electrons have total energy $1/3$ of scattered photons.	10x2= 20
Q 5.	Answer any **two** parts of the following. a) List the main properties of diamagnetic, paramagnetic and ferromagnetic materials. Give an account of Langevin's theory of diamagnetism and show that diamagnetic susceptibility is independent of temperature. b) State and explain Heisenberg uncertainty principle. An electron has a speed of 1.05×10^4 *m/sec* within the accuracy of *0.01%.* Calculate the uncertainty in the position of the electron. c) Describe Hall effect with suitable diagram. Deduce the expression for Hall voltage (V_H) and carrier density (n).	10x2= 20

****

Values of some physical constants:

Planck's constant, $h = 6.6 \times 10^{-34}\, Js$; Velocity of light, $c = 3 \times 10^{8} ms^{-1}$

Mass of electron,$m_e = 9.1 \times 10^{-31} kg$; Mass of proton/neutron $= 1.67 \times 10^{-27} kg$

Charge of electron, $e = 1.6 \times 10^{-19}\, C$ Boltzmann's constant $k = 1.38 \times 10^{-23} J/K$