Sub Code: BAST 104 **ROLL NO……..……..**

I SEMESTER EXAMINATION, 2022 – 23

Ist year, B.Tech

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) Explain phase velocity and group velocity of matter waves. Derive the relation between phase velocity and group velocity b) Discuss Huygen's principles of wave theory. c) Draw I-V characteristics of a p-n junction diode using diode equation. d) In the Young's double slit experiment, the fringe width with λ=589 nm is 0.431 mm, and shift of white central fringe on introducing a mica sheet in one path is 1.724mm, Calculate the thickness of the sheet (μ=1.59). e) Define gradient, divergence and curl with their significance. f) Explain Meissner's effect and hence differentiate between Type I and Type II superconductors.	5x4=20
Q 2.	Answer any **four** parts of the following. a) State and explain the Heisenberg's uncertainty principle. b) Define the resolving power of grating. Explain Rayleigh criterion of resolution. c) A ray of light enters from air to an optical fiber. Calculate critical angle, the fractional refractive index, acceptance angle and numerical aperture. Given $n_{air} = 1$, $n_{clad} = 1.46$ and $n_{core} = 1.49$. d) Define Fermi level in materials. What is the position of the Fermi level in intrinsic, *n-type* and *p-type* semiconductor? e) Describe the polarization in dielectric materials. Derive an expression of electric field due to polarized dielectric. f) State and explain the de Broglie hypothesis of matter waves.	5x4=20
Q 3.	Answer any **two** parts of the following. a) Derive the expression for normalized wave function for a particle trapped in one dimensional potential box of length L b) Discuss the formation of Newton's ring by reflected light and derive an expression for the diameter of n^{th} dark ring. c) Discuss the principle, construction and working of *He-Ne* laser with suitable diagrams.	10x2= 20
Q 4.	Answer any **two** parts of the following. a) Drive the expression for numerical aperture (*NA*) of an optical fiber. Take θ, n_o, n_1 and n_2 are as incident angle; and refractive indices of incident, core and cladding medium respectively. b) Write Maxwell's equations in differential form. Deduce the equation for the propagation of the plane electromagnetic wave in free space. c) Describe Hall effect with suitable diagram. Deduce the expression for Hall voltage (V_H) and carrier density (n).	10x2= 20

Q 5.	Answer any **two** parts of the following. a) Write the conditions for the acceptable de-Broglie wave function and derive the Schrodinger time independent wave equation for a quantum particle staring with simple wave equation. b) Describe absorption, spontaneous emission and stimulated emission and hence define the Einstein coefficients. Obtain the relationship between them. c) Using continuity equation, obtain a relation showing the decay of volume charge density inside a material.	10x2= 20

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