

B. TECH
(SEM I) THEORY EXAMINATION 2018-19
ENGINEERING PHYSICS-I

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

- 1. Attempt all questions in brief. 2 x 10 = 20**
- a. How the negative results of Michelson-Morley experiment interpreted?
 - b. At very low velocities, how Lorentz equations reduce to the classical Galilean equations.
 - c. Obtain a relation between group velocity and phase velocity?
 - d. If uncertainty in the position of a particle is equal to de Broglie wavelength, what will be uncertainty in the measurement of velocity?
 - e. Write the characteristics of a wave function.
 - f. What do you mean by diffraction of light?
 - g. Define plane of polarization and plane of vibration.
 - h. Discuss optic axis of doubly refracting crystal.
 - i. Define metastable state.
 - j. Give few important applications of optical fibre.

SECTION B

- 2. Attempt any three of the following: 10 x 3 = 30**
- a. What do you mean by length contraction at relativistic speed? Deduce the necessary expression for it. Show that the circle, $x^2 + y^2 = a^2$ in frame S appears to be an ellipse in frame S' which is moving with Constant velocity relative to S .
 - b. Derive an expression for the wave function and energy of a particle confined in one dimensional potential box of length L using Schrodinger's wave equation. An electron is bound in one dimensional potential box which has width $2.5 \times 10^{-10} \text{m}$. Assuming the height of the box to be infinite, calculate the lowest two permitted energy values of the electron.
 - c. What is resolving power of a grating? A plane transmission grating has 15000 lines per inch. Find the resolving power of the grating and the smallest wavelength difference that can be resolved with a light of wavelength 6000\AA in the second order.
 - d. What do you mean by quarter wave plate? Derive expression for its thickness. A phase retardation plate of quartz has thickness of 0.1436mm for what wave length in visible region ($4500 \text{\AA} - 7800 \text{\AA}$), will it act as quarter wave plate, given μ_E and μ_O are 1.5533 and 1.5443.
 - e. Discuss the different types of optical fibre in detail. The velocity of a light in the core of silica fibre is $2 \times 10^8 \text{ m/s}$ and the critical angle at the core cladding interface is 60° . Determine:
 - i) The refractive index of the core and cladding.
 - ii) The numerical aperture for the fibre.

SECTION C

- 3. Attempt any one part of the following: 10 x 1 = 10**
- a) Show that the relativistic invariance of the law of conservation of momentum leads to the concept of variation of mass with velocity.

b) Deduce Einstein's mass energy relation. If the kinetic energy of a body is twice its rest mass energy, find its velocity.

4. Attempt any one part of the following: 10 x 1 = 10

a) Explain de-Broglie's hypothesis. Describe Davisson-Germer's experiment in detail.

b) State Heisenberg's uncertainty principle. Prove that electron cannot exist inside the nucleus and proton can exist.

5. Attempt any one part of the following: 10 x 1 = 10

a) Explain the formation of Newton's ring? If in a Newton's rings experiment, the air in the interspaces is replaced by a liquid of refractive index (μ) in what proportion would the diameter of the rings changed?

b) Discuss the phenomenon of diffraction at a single slit and show that intensities of successive maxima are $1: 4/9\pi^2: 4/25\pi^2: 4/49\pi^2$.

6. Attempt any one part of the following: 10 x 1 = 10

a) Deduce an expression for time dilation on the basis of Lorentz transformation equation. Show that time dilation is a real effect.

b) Describe the construction of Nicol prism. Explain how it can be used as analyzer and polarizer.

7. Attempt any one part of the following: 10 x 1 = 10

a) Discuss the construction and working of a He-Ne laser. Compare it with Ruby Laser.

b) Explain the principle of Holography and discuss its characteristics and applications?

Physical Constants

Rest mass of electron	m_e	$= 9.1 \times 10^{-31} \text{ kg}$
Rest mass of Proton	m_p	$= 1.67 \times 10^{-27} \text{ kg}$
Speed of light	c	$= 3 \times 10^8 \text{ m/s}$
Planck Constant	h	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	e	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann Constant	k	$= 1.38 \times 10^{-23} \text{ J K}^{-1}$