

Roll No.

Total Pages : 05

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Dec. 2025

B.Tech. (ECE/ENC/EE(IoT)/EL) (First Semester)

Physics (Waves and Optics)

(PHU-153-V/BSC-101C)

Time : 3 Hours]

[Maximum Marks : 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) A plane transmission grating has 32000 lines per inch over a length of 10 inch. Find the resolving power of the grating in second order.

1.5

(b) What is meant by population inversion ?

How is it achieved ? 1.5

(c) When a movable mirror of Michelson

Interferometer is shifted through 0.059 nm,
a shift of 200 fringes is observed. Determine
the wavelength in angstrom. 1.5

(d) What do you understand by laser
action ? 1.5

(e) What is mirage effect ? 1.5

(f) Find the intensity of a laser beam of
150 mW power and having a diameter of
1.5 m assuming the intensity to be uniform.

1.5

(g) What is Rayleigh's limit of resolution ? 1.5

(h) What is meant by Evanescent waves ? 1.5

(i) Define nodes and antinodes. 1.5

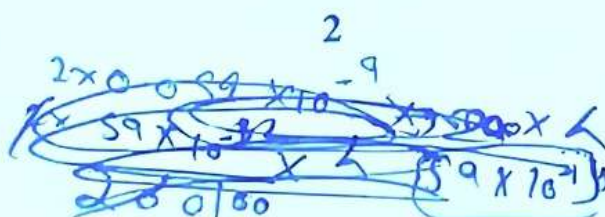
(j) Explain relation between group velocity and
phase velocity in dispersive medium. 1.5

Part B

2. (a) Derive the expression for velocity of
transverse waves along a stretched string. 5

(b) What are Fresnel equations ? Mathematically
explain how the Fresnel's equation describe
the reflection and transmission of
electromagnetic waves at the interface. 10

3. (a) A particle executes SHM for period 16s. 2s
after it passes the center of oscillation its
velocity is found to be 4 m/s. Find the
amplitude. 5



- (b) What is driven harmonic oscillator ? Derive differential equation for the forced harmonic oscillator and discuss condition for resonance amplitude. 10
4. (a) What is impedance matching and why is it required ? If two strings of characteristic Z_1 and Z_3 need to be joined through another string of impedance Z_2 for minimum loss, prove that $Z_2 = \sqrt{Z_1 Z_3}$. 12
- (b) Find the ray transfer matrix for refraction at a spherical boundary. 3
5. (a) A parallel beam of monochromatic light is allowed to be incident normally on the plane transmission grating having 5000 lines/cm and the second order spectral line is found to be diffracted through 30° . Calculate the wavelength of the light. 5

- (b) What is diffraction grating ? Explain the spectra formed by it and also show that intensity is not uniformly distributed over all maxima. 10

6. (a) Discuss with suitable diagram the principle, construction and working of Solid-State Laser. 8

- (b) Explain three-level and four-level laser schemes. 4

- (c) Calculate the coherence length for a laser beam for which the bandwidth ($\Delta\nu$) is 3000Hz. 3

- Write short notes on the following : 3×5=15

- (a) Newton's ring
- (b) LCR electrical oscillator
- (c) Fermat's principle and its applications.

