

Roll No. ....

## OLE-24003

### B. Tech. 1st Semester (Common for All Branches)

Examination – April, 2021

PHYSICS – I

Paper : PHY-101-F

*Time : Three Hours ]*

*[ Maximum Marks : 100*

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*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

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**Note :** Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) Give condition for absent spectra in a diffraction grating.
- (b) Give some application of fibre optics.

- (c) What are the polar and non-polar molecules ?  
Give examples.
- (d) Why high frequency lasers are difficult to construct ?
- (e) Write a short note on population inversion ?
- (f) Give some application of fibre optics.
- (g) How coherent sources are produced ?
- (h) Explain Rayleigh criteria for limit of resolution.
- (i) Discuss inertial and non-inertial frames of reference.
- (j) Write conditions for lasing action.  $2 \times 10 = 20$

### **SECTION – I**

- 2.** (a) Define Explain the formation of interference pattern by Fresnel's bi-prism and derive the expression for the fringe width. How will you measure the wavelength of monochromatic light using bi-prism method ? 15
- (b) A parallel beam of sodium light ( $5890 \times 10^{-10}$  m) is incident on a thin glass plate ( $\mu = 1.5$ ) such that the angle of refraction into the plate is  $60^\circ$ . Calculate the smallest thickness of plate which will make it appear dark by reflection. 5

3. What is a plane transmission grating ? Obtain expression for intensity distribution of Fraunhofer diffraction due to N-slits. Explain effect of increasing N on the diffraction pattern. Plot a graph of intensity variation due to N slits. 20

### SECTION – II

4. (a) What are three level and four level lasers ? Give construction and working of He-Ne laser with necessary diagrams. 15
- (b) Discuss spatial and temporal coherence. 5
5. (a) What is double reflection ? Discuss construction and working of Nicol prism. How it can be used as a polariser and analyser. 15
- (b) Define circularly polarised light. How it can be produced ? 5

### SECTION – III

6. (a) Explain concept of induced polarization for non-polar dielectrics. Obtain an expression for local field in dielectrics and thus find the Clausius-Mossotti relation. 15

- (b) Define electric intensity  $E$ , electric displacement  $D$ , electric polarization  $P$ . Establish relation between them. 5
7. (a) What do you mean by acceptance angle and numerical aperture? Discuss in detail the various modes in fiber optics. 16
- (b) Calculate the numerical aperture and acceptance of optical fiber with  $\mu_{core} = 1.55$ ,  $\mu_{clad} = 1.45$ . 4

#### SECTION – IV

8. On the basis of Lorentz transformation, discuss
- (a) Length contraction and time dilation. 12
- (b) Show that  $x^2 + y^2 + z^2 - c^2t^2$  is invariant under Lorentz transformation. 8
9. Drive the London equations and discuss how its solution explains Meissner effect. 20
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