

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 1107**

Roll No.

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**B.Tech.**

(SEM. I) ODD SEMESTER THEORY

EXAMINATION 2013-14

**ENGINEERING PHYSICS – I**

Time : 3 Hours

Total Marks : 80

**Note** :- Attempt questions from each Section as per instructions.**SECTION – A**

- Attempt all the **eight** parts of this question. Answer each part in short. Each part carries **2** marks : **(8×2=16)**
  - Show that the rest mass of photon is zero.
  - Distinguish between an ordinary photograph and a hologram.
  - Explain the concept of Maxwell's displacement current.
  - Why does an excessively thin film appear black in reflected system ?
  - What do you understand by specific rotation ? Write its unit.
  - What do you understand by population inversion in a laser system ? Give two necessary conditions for lasing action.
  - What are the necessary conditions for destructive interference in an anti-reflection coating ?
  - What are the main components of an optical fiber ?

- Describe the propagation mechanism and communication in step-index multimode fibre with suitable diagrams.

**OR**

What is the significance of reference beam in Holography ?  
Discuss different features of hologram with three applications of holographic plate.

**Physical Constants :**

Speed of light	$c = 3.0 \times 10^8 \text{ m/s}$
Planck's constant	$h = 6.62 \times 10^{-34} \text{ J-s}$
Boltzman's constant	$k = 1.38 \times 10^{-23} \text{ J/K}$
Permeability	$\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$
Permittivity	$\epsilon_0 = 8.854 \times 10^{-12} \text{ F/M}$

**SECTION-B**

2. Attempt any **three** parts of this question. Each part carries **8** marks : (8×3=24)

- (a) A circular lamina moves with its plane parallel to the X-Y plane of a reference frame S at rest. Assuming its motion to be along x-axis (or y), calculate the velocity, at which its surface area would appear to be reduced to half to an observer in frame S at rest.
- (b) If  $\vec{A} = xz^3\hat{i} - x^2yz\hat{j} + 2yz^4\hat{k}$ , find the Curl  $\vec{A}$  at point (2, -1, 0). Is  $\vec{A}$  irrotational ?
- (c) If the population ratio of the two states in gas laser is  $1.80 \times 10^{-35}$ . Calculate the temperature of active system if the wavelength of emitted radiation is 5893 Å.
- (d) Calculate the minimum thickness for an anti-reflection coating of refractive index 1.38 to minimize the reflection of light of wavelength 6000 Å.
- (e) The optical power after propagating through a fibre that is 450 m long is reduced to 35% of its original value. Calculate the fibre loss in dB/km.

**SECTION-C**

**Note** :— Attempt all the **five** questions of this section. Each question carries **8** marks. (8×5=40)

3. Show that a clock moving with velocity  $v$  relative to an observer appears to him to go slow by a factor of  $1/\sqrt{1-\frac{v^2}{c^2}}$  then at rest relative to him. Give an example to show that time dilation is real effect.

**OR**

Deduce relativistic velocity addition theorem. Show that it is consistent with the Einstein's second postulate of special theory of relativity.

4. What are coherent sources of light ? Explain temporal and spatial coherence with suitable examples.

**OR**

What is Rayleigh criterion of resolution ? Deduce an expression for resolving power of plane transmission grating.

5. What are the important features of stimulated emission ? Obtain a relation between transition probabilities of spontaneous and stimulated emissions.

**OR**

What is Double Refraction ? Explain the construction and working of Nicol's Prism.

6. Write Maxwell's equations in differential and integral form. Show that Faraday's law of electromagnetic induction can be expressed as,  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ .

**OR**

Using relevant Maxwell's equation, derive Coulomb's law in electrostatics. Further, show that the equation of continuity is contained in Maxwell's equations.