

<b>Tutorial No. : 03</b>			
<b>(Module 3: LASER &amp; Fiber Optics)</b>			
<b>Subject</b>	<b>Physics</b>	<b>Subject Code</b>	<b>UBS1008</b>

- 1) Determine the energy and momentum of a photon of a laser beam of wavelength  $6328\text{\AA}$ .
- 2) Calculate the energy of laser pulse in a ruby laser for  $2.8 \times 10^{19}$   $\text{Cr}^{+3}$  ions. If the laser emits radiation of wavelength  $6943\text{\AA}$ .
- 3) Calculate the population ratio of two states in He-Ne Laser that produces light of wavelength  $6000\text{\AA}$  at 300K.
- 4) Compute the numerical aperture and hence the acceptance angle for an optical fiber given those refractive indices of the core and the cladding are 1.42 and 1.40 respectively.
- 5) An optical fiber has the core refractive index  $n_1=1.36$  and relative difference in index  $\Delta=0.025$ . Find (i) refractive index of cladding (ii) numerical aperture (iii) acceptance angle.
- 6) An optical fiber has a numerical aperture of 0.20 and a cladding refractive index of 1.59. Determine the acceptance angle for the fiber in water which has a refractive index of 1.33.
- 7) An optical fiber has  $n_1 = 1.55$ ,  $n_2 = 1.50$  and core diameter =  $50\mu\text{m}$   
Calculate (i) numerical aperture; (ii) acceptance angle; and (iii) how many reflections per meter are suffered by the guided ray at steepest angle with respect to fiber axis.
- 8) A glass fiber has a core material of refractive index 1.45, cladding material of refractive index 1.40. If it is surrounded by air, compute the critical angle
  - i) at the core cladding boundary
  - ii) cladding air boundary
- 9) The optical power, after propagating through a fiber that is 500 m long is reduced to 25% of its original value. Calculate the fiber loss in dB/km.
- 10) A communication system uses 10 km fiber having a loss of 2.3 dB/km. Compute the output power if the input power is  $400\text{ }\mu\text{W}$ .