EPM755 Optical Communications

Tutorial Answer Sheet 2

1. Calculate the mode spacing $\delta\lambda$
   Number of modes = (6nm/$\delta\lambda$)+1

   $\delta\lambda = \lambda^2/2Ln$

   The minimum photon energy = the bandgap, $E_g = 1.29 \times 10^{-19}$J

   Hence the maximum possible emission wavelength = hc/1.29 x 10^{-19}J = 1.542μm
   The peak wavelength is less than that defined by E_g but to a good approximation the axial mode spacing $\delta\lambda = (1.541)^2/2 \times 300 \times 4$μm
   = 9.9 x 10^{-4}μm = 0.99nm

   Hence, the number of operating modes is 7.

2. The total spread of output wavelengths = (n-1)$\delta\lambda$ where n = the number of axial modes and $\delta\lambda$ = the axial mode spacing.

   The maximum output wavelength = hc/1.3 x 10^{-19}
   = 1.53μm

   Hence, to a good approximation the axial mode spacing $\delta\lambda = (1.53)^2/2 \times 315 \times 4.2$μm
   = 0.885nm

   Hence, the worst case linewidth = (7-1) x 0.885nm
   = 5.31nm

   and the worst case coherence length = $\lambda^2/\Delta\lambda$
   = $(1.53 \times 10^{-6})^2/5.31 \times 10^{-9}$m
   = 0.441mm