

EPL 334 , MAJOR TEST

M.Marks 40

Time 2hours

- !- a) In free electron laser , what does free electron here mean ? 1
 b) Output power of He: Ne laser is typically ——— and that of Argon ion laser is ——— 2
 c) The line shape function of Doppler broadening ——— and that of collision broadening is ——— 2
 d) Expression for instantaneous out power for a c.w laser is ——— while that for a pulse laser is ——— 2
 e) Name two techniques usually employed for mode locking of lasers. 2
 f) In excimer laser the active material is ——— and for fibre laser it is ——— 2
 g) Name the serious difficulties associated with the making of x-ray lasers. 2
 h) Draw a labeled schematic and energy level diagram of Ti:Sapphire laser 3

2)) A material of a laser of 15 cm length has a gain factor 0.0005/cm . The reflectance of one of mirrors is 100%. What should be the desirable reflectance of the other mirror.-3

3) A semiconductor laser is made up of a p-n junction. If the band gap of material is 1.316 eV, calculate the beam divergence of the beam. The width of the region is 3μm. 4

4)A student tries to align a laser with a confocal resonator using two mirrors of nominal radius of curvature R= 200mm. Due to manufacturing errors , the radii of curvature of the two mirrors $R_1 = R+r$ and $R_2 = R- r$ with $r=3\text{mm}$. After trying and failing for long time trying to achieve laser action at the confocal distance of 200mm, find the different mirror spacings at which the laser starts working. 4

5) Write the amplitude and sketch the intensity distribution for the following transverse modes associated with laser confocal cavity :

TEM₁₁ , TEM₀₁

4

6) For a mode locked laser, intensity distribution is given by:

$$I(t) = E_0^2 \frac{\sin^2 N \Delta\omega t/2}{\sin^2 \Delta\omega t/2}$$

4

Show how will you calculate the pulse width and the pulse duration of the mode locked pulse.

7) Describe any one of the following lasers giving all the salient features with recent advances: (1) Dye laser (2) Carbon dioxide laser 3) Nd- Yag laser 5

Given $h = 6.62 \times 10^{-34} \text{ J sec}$ $k_B = 1.38 \times 10^{-23} \text{ J/K}$