NUMERICALS

1. He-Ne laser produces light of wavelength 6328 A at room temperature.

a)The frequency of the emitted radiation is
b)The energy difference between two energy levels emitting this radiation in Joule

2. A medium in thermal equilibrium at temperature 300K has two energy levels with a wavelength separation of 1 micrometer .Find the ratio of population densities of upper and lower laser level.

3. A laser emits light of wavelength 3.39 micrometer. The output power is 30Watt.

a)The frequency of emitted radiation is
b)What will be energy emitted in 10 min?

4. A laser system is capable of lasing at several infrared wavelengths where the most prominent wavelength is 3.1235 mm. (Given, k= 8.6x 10-5eV/K or 1.38 X 10(power-23) J/K)

a) What would be the difference (in J) between upper and lower levels for this wavelength?

b)The relative population of these states at 27^0 C is

5. A 5W pulsed laser emits light of wavelength 694nm .If the duration of each pulse is 20ns .Calculate the number of photons emitted per pulse.

6. What would be the difference (in eV) between upper and lower levels for wavelength 6328A ?
a) The relative population of these states at 27^0 C is
b) The ratio of rates of stimulated emission and spontaneous emission at temperature 300 K is

7. In Ruby laser, total number of Cr^{3+}ions is 3x10(power[19). The laser emits radiation of wavelength 6940 Å

a. The frequency of the emitted radiation is[**4.32×10^{14} Hz]**

b. The energy of one emitted photon in terms of eV is given by[1.78 eV]

c. The energy of one pulse generated by the laser action is[8.58 J]

8.A glass clad fiber is made with core glass of refractive index 1.39 and the cladding is doped to give a fractional refractive index difference of 0.001.
a. The refractive index of cladding will be

b. The critical angle for TIR will be given as

c. The acceptance angle of the cable is

9. A step index fiber is made with a core of index 1.52 and diameter 29 micrometer and n2 is 1.51 it is operated at wavelength 1.3 micrometer . Find V number and no of modes it will support.

10.The numerical aperture of an optical fiber is 0.5 and core refractive index is 1.54 . Find refractive index of cladding.

11. Numerical aperture of fiber is 0.5 and core refractive index is 1.48 . Find cladding refractive index and acceptance angle.

12. Internal critical angle in core at core-cladding interface of a step index fiber is 78.6°. The refractive index of cladding is 1.45.

a. The maximum acceptance angle is

b. The fractional refractive index of the cable is

13.An optical fiber has core diameter of 6 micrometer and core refractive index is 1.45 . The critical angle is 87 degree .Calculate

a) Refractive index of cladding

b) Acceptance angle

c) No of modes propagating through fiber when wavelength is 1micrometer.

14.Find the core radius necessary for single mode operation at 850nm in step index fiber with n1 = 1.480 and n2 = 1.47.What is numerical aperture and maximum acceptance angle of this fiber.

15.The wavelength of emission is 7000A and the coefficient of spontaneous emission is 10^8 /s . Find the coefficient of stimulated emission

16. A He-Ne gas laser is emitting a laser beam with an average power of 4.5 mW. Find the number of photons emiited per second by the laser. The wavelength of the emitted radiation is 6328A.

17. Find the ratio of population of two energy levels in a medium at thermal equilibrium, if the wavelength of the emitted radiation at 291k is 6928A.

18. The ratio of population of two energy levels out of which one corresponds to metastable state is 1.059*10^-30 .Find the wavelength of light emitted at 330k.