**Tutorial 8: Part‐A\* Physics II, 15B11PH211 (Even 2021)**

**Assignment 5**: With the help of suitable diagrams, explain the principle, construction and working of Ruby laser.

1. Which are the ‘host’ and ‘doping’ materials for a Ruby Laser? Explain the utility of both types of materials. [C02]

The laser medium (ruby) in the ruby laser is made of the host of sapphire (Al2O3) which is doped with small amounts of chromium ions (Cr3+). The ruby has good thermal properties.

Cr is responsible for red color and has a metastable level whose lifetime is

about 0.003 s.

The primary role of the aluminum oxide crystal, aside from hosting the chromium ion, is to absorb the pump energy and to excite the ion through collisions.

1. In a Ruby Laser, atoms are excited from ground state (E1) to short lived excited state (E3) by means of optical pumping (5500Å). Considering a metastable state (E2) below E3, calculate the energy (in eV) of radiationless transition between E3 and E2, if laser transition of 694.3 nm occurs between E2 and E1. Here, consider the energy conservation for the entire process of absorption and emission and ignore any other transition/process except the abovementioned processes. [CO3]

