



Class Number: Slot: D1+TG1 Exam Duration: 1.5 hrs Maximum Marks: 50

Answer All questions

1.	a) A two level laser is not practically possible. Justify. b) What are the advantages of four level laser over three level laser ? (2+3)
2.	Consider the two level system in the photosphere of sun (6000 K). What are the relative population of N_1/N_0 at 6000 Å and 150 GHz where N_0 is the ground state and N_1 is the first excited state ?
3.	The lifetime of $3^2P_{1/2} \rightarrow 3^2S_{1/2}$ transition of sodium atom at 5896 Å is 16.4 ns. Compute Einstein's coefficients A and B corresponding to this transition.
4.	Explain the principle and working of CO ₂ laser. Use energy level diagrams to support the explanation.
5.	The intensity of the sun light on earth is 1.3 kW/m ² . 1. Evaluate the power within an area of 1 cm ² . 2. Estimate the intensity if the radiation incident on an area of 10 cm ² is focused to a surface of 100 micrometer in diameter.
6.	1. Write a vector function (Not a constant) which has zero divergence and zero curl everywhere. 2. Find the gradient of $f(x,y,z) = e^x \sin(y) \ln(z)$
7.	The velocity of a particle is always equal to the group velocity of the packet. Justify
8.	Write the expression for E and B as a function of position and time for an EM wave propagating in the z direction. Frequency of the EM wave is 60.0 Hz and $E_0 = 2.00$ V/m. Assume that E is pointing in x-direction
9.	Equation of continuity is contained in Maxwell's equation. Justify the validity of this statement.
10.	What are the various modes in a rectangular waveguide for microwave propagation? How are they different?