BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.Sc. / I.M.Sc. **SEMESTER : III/IX**
BRANCH: PHYSICS **SESSION : MO/2025**

SUBJECT: PH503 LASER PHYSICS AND APPLICATIONS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Explain the mechanism of natural broadening in atomic lines.	[5]	1	2
Q.1(b)	List the differences between spontaneous and stimulated emission.	[5]	1	2
Q.2(a)	Discuss usual types of resonator cavity.	[5]	2	5
Q.2(b)	The output of a He–Ne laser (λ= 6328 Å) can be assumed to be Gaussian with plane phase front. For w_0 = 1 mm and w_0 = 0.2 mm, estimate the beam diameter at z = 20 m.	[5]	2	5
Q.3(a)	Discuss the principle of Q-switching and how it can be achieved using acousto-optic modulator.	[5]	3	2
Q.3(b)	A Rh6G dye laser operating over it entire gain bandwidth (570-640 nm) with the cavity mirror separated by 2m. The RI of the dye solution is 1.4. Estimate the mode-locked pulse width Δt_p and the pulse separation Δt_{sep}. Consider the central wavelength as the laser wavelength.	[5]	3	5
Q.4(a)	Discuss the principle of operation and construction of Dye laser.	[5]	4	6
Q.4(b)	Discuss the lasing mechanism in He-Ne laser with the help of neatly drawn energy level diagram.	[5]	4	5
Q.5(a)	Discuss the application of laser in isotope separation methods.	[5]	5	5
Q.5(b)	Discuss construction and reconstruction of a transmission hologram using appropriate mathematical formulation	[5]	5	5

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