

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

CLASS: IMSc / MSc
BRANCH: PHYSICS

SEMESTER : VIII / II
SESSION : SP/2025

SUBJECT: PH409 ATOMIC AND MOLECULAR SPECTROSCOPY

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.
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Q.1(a)	Calculate the first five energy levels of H atom using Bohr's atomic model.	[5] 1	3
Q.1(b)	Calculate the spectroscopic term value for H atom when electron is in 1s, 2s and 2p orbitals. Draw the corresponding energy levels.	[5] 1	3
Q.2(a)	What is the implication of Born Oppenheimer approximation in molecular spectroscopy?	[5] 2	2
Q.2(b)	Discuss the Fluorescence and Phosphorescence processes in an electronically excited molecule.	[5] 2	5
Q.3(a)	Explain basic elements of practical spectroscopy by drawing a neat diagram.	[5] 3	3
Q.3(b)	What is stimulated emission? How is it different from spontaneous emission?	[5] 3	3
Q.4(a)	How the nuclear Bohr magneton is different than electronic Bohr magneton? Calculate the value of nuclear Bohr magneton.	[5] 4	2
Q.4(b)	Show the effect of nuclear coupling using energy level diagram when (a) coupling is ignored (b) coupling is small compared to chemical shift and (c) coupling is large compared to chemical shift.	[5] 4	3
Q.5(a)	Explain the method to determine e/m of electron in Thomson's method.	[5] 5	2
Q.5(b)	Discuss four mechanisms of molecule ionization in mass spectrometry.	[5] 5	5

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