

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086
(For candidates admitted from the academic year 2025 – 2026)

B.Sc. DEGREE EXAMINATION APRIL 2026
BRANCH III – PHYSICS
SECOND SEMESTER

COURSE : CORE

PAPER : SPECTROSCOPY AND SOUND

SUBJECT CODE : 25PH/MC/SS23

TIME : 3 HOURS

MAX. MARKS: 100

Q. No.	SECTION A	CO	KL
	Answer ALL questions (4 x 3 = 12 marks)		
1.	List the different regions of the electromagnetic spectrum with the wavelength.	1	1
2.	State Beer-Lambert's law.	1	1
3.	What are ultrasonic waves?	1	1
4.	List any three conditions for good acoustics in an auditorium.	1	1
Q. No.	SECTION B	CO	KL
	Answer ALL questions (6 x 3 = 18 marks)		
5.	What are the different types of energies that molecules possess?	2	2
6.	Define the terms i) Transmittance ii) Absorbance	2	2
7.	Explain the difference between fluorescence and phosphorescence.	2	2
8.	Write brief notes on the magnetic properties of nuclei.	2	2
9.	How are stationary waves formed?	2	2
10.	What are the uses of the Lissajous figures?	2	2
Q. No.	SECTION C	CO	KL
	Answer any FOUR questions (4 x 5 = 20 marks)		
11.	Give an account of absorption, spontaneous emission and stimulated emission.	3	3
12.	Classify the different spectroscopic methods based on transitions between energy levels.	3	3
13.	Explain the relaxation processes in NMR.	3	3
14.	Derive the equation of a simple harmonic wave.	3	3
15.	Elucidate the production of ultrasonic waves using a piezoelectric generator.	3	3
Q. No.	SECTION D	CO	KL
	Answer any TWO questions (2 x 15 = 30 marks)		
16.	Explain in detail the spectral line broadening mechanism and its types.	4	4
17.	Describe the principle and instrumentation of a single beam UV spectrophotometer.	4	4

18.	Discuss briefly the theory of NMR and explain the working of the NMR spectrometer.	4	4
19.	Define reverberation time and derive Sabine's formula for reverberation time.	4	4
Q. No.	SECTION E Answer any FOUR questions (4 x 5 = 20 marks)	CO	KL
20.	The wavelength of the radiation absorbed during a particular transition is $10\mu\text{m}$. Express this in frequency (Hz), wavenumber (cm^{-1}), calculate the change in energy during the transition. If the change in energy were twice as large what would the wavelength of the corresponding radiation be?	5	5
21.	Calculate the difference in energies of protons oriented with and against a magnetic field of strength 1.5T. What is the frequency of radiation that has photons with this energy? Given that the nuclear g-factor = 5.5857	5	5
22.	A molecule makes a transition between the ground state and an excited state having a lifetime of 10^{-3}s . Calculate the uncertainty in the excited state energy level and the width of the associated spectral line.	5	5
23.	A sample has been made with an unknown concentration. The absorbance was 0.037, the pathlength 0.5 cm and the molar absorption coefficient is $493 \text{ M}^{-1}\text{cm}^{-1}$. Find the concentration of the sample.	5	5
24.	A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45 Hz. The mass of the wire = $3.5 \times 10^{-2} \text{ kg}$ and the linear mass density = $4 \times 10^{-2} \text{ kgm}^{-1}$ calculate the a) speed of the transverse wave b) tension in the string.	5	5
25.	The velocity of a simple harmonic wave is 30 cm/s. At time $t = 0$ the displacement of the particle is given by $y = 4 \sin 2\pi \left(\frac{x}{100}\right)$. Find the equation for displacement of the particle at $t = 2 \text{ s}$.	5	5
