STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE : **PH/MO/SP64**

B.Sc. DEGREE EXAMINATION APRIL 2008
BRANCH III - PHYSICS
SIXTH SEMESTER

COURSE : **MAJOR – OPTIONAL**
PAPER : **SPECTROSCOPY**
TIME : **3 HOURS** MAX. MARKS : 100

SECTION – A

ANSWER ALL QUESTIONS: (10 x 3 = 30)

1. Explain with an example the role of resolution of spectral lines and its significance in spectroscopy.

2. Explain the relationship between energy, wave number and frequency of radiation.

3. How are the Mercury spectrum and the Solar spectrum called? Why?

4. What is Rayleigh scattering and Raman scattering?

5. Explain zero point energy.

6. What is Normal vibration?

7. Which of the following molecules exibit a) IR spectra? b) Raman Spectra? Why? H_2, HCI, O_2, CI_2.

8. What is degree of depolarization? How does it vary for a linear molecule and a spherical molecule?

9. Arrange any six of the following types of EM radiation with increasing order of their wavelengths: Gamma rays, UV rays, Visible light, X rays, Microwaves, IR rays and Radio waves.

10. Classify the following types of molecules according to their Moments of inertia relationship: Linear, symmetrical and spherical top molecules.

SECTION – B

ANSWER ANY SIX QUESTIONS: (6 x 5 = 30)

11. What are the applications of Raman spectroscopy?

12. With the help of a diagram explain the Grating Spectrometer.

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13. Compare and contrast Raman spectroscopy and IR spectroscopy.

14. Discuss the effect of isotopic substitution in microwave spectroscopy.

15. Explain in detail what is Stark effect and its importance in microwave spectroscopy.

16. What is Anharmonicity? How is it accounted in Infra Red spectroscopic discussions?

17. Explain what type of molecules are H_2O and CO_2 and hence discuss their vibration modes.

18. The rotational spectrum of CO shows a series of lines placed 3.84235 cm^{-1} apart. Calculate the moment of inertia.

SECTION – C

ANSWER ANY TWO QUESTIONS: (2 x 20 = 40)

19. With the help of the quantum mechanical approach. Discuss the selection rules to observe the IR spectrum of a diatomic molecule behaving as an harmonic oscillator and explain the characteristics of the spectrum observed.

20. With the help of a simple in atomic molecule, explain how both the Raman and the IR spectra are complimentary to each other in determining the shape of the molecule.

21. Discuss in detail the classical theory of Raman effect. Why the classical theory proved to be inadequate to explain Raman lines? How the Quantum mechanical approach of selection rules provided the solution?

22. Discuss the techniques and instrumentation adopted in the IR spectroscopy and highlight its applications.

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