STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.

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

B.Sc. DEGREE EXAMINATION APRIL 2009
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.   Give the electromagnetic spectrum in the order of increasing frequency.

2.   There exists a 1 to 1 correspondence between infrared frequencies and functional groups.

3.   Distinguish between Raman and infrared spectra.

4.   Explain population of states using Boltzmann's distribution.

5.   What is the advantage of Laser over the conventional sources in Raman spectroscopy.

6.   Explain the principle of working of a microwave oven.

7.   Give two advantages of double beam infrared spectrophotometer over single beam.

8.   Explain the term resolving power.

9.   Explain one application of microwave spectroscopy in research.

10.   Give the selection rule for infrared and Raman transitions.

SECTION – B

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

11.   What is Raman effect? How is it different from Stoke's scattering.

12.   State the mutual exclusion principle with an example.

13.   Explain with necessary theory the spectrum of CO_2 and H_2O with regard to infrared and Raman lines.

14. Discuss the effect of isotopic substitution on the microwave spectra.

15. Explain Doppler broadening with regard to width of spectral lines.

16. Draw the block diagram of a typical emission spectrometer.

17. What is a klystron? Explain the working of a reflex klystron.

18. The moment of inertia of a CO molecule is 1.46×10^{-46} Kg m^2. Calculate the energy of the lowest rotational level of the CO molecule in Joules and in electron volt.

SECTION – C

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

19. Assuming the rigid dynamics of a diatomic molecule derive an expression for the energy of the rotational lines. Sketch the allowed transitions of the diatomic molecule. Give the selection rule used.   (15 + 3 + 2)

20. Give the origin of Stoke's and anti Stoke's lines. Why are anti Stoke's lines less intense than the Stoke's lines. How can you increase the intensity of the anti Stokes line.   (10 + 5 + 5)

21. Draw a labeled diagram of a Raman spectrophotometer and explain how a spectra is recorded.   (15 + 5)

22. What is meant by degree of vibration. Arrive at the number of fundamental modes of vibration of linear and non linear polyatomic molecules. In the spectrum of a polyatomic molecule such as Benzene many absorption bands are observed other than the fundamental modes. How do you account for these lines.   (5 + 10 + 5)

✳✳✳✳✳✳