(6 pages) Reg. No. : ....

Code No. : 41136 E   Sub. Code : JMPH 5 A

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2018.

Fifth Semester

Physics

Major Elective I — SPECTROSCOPY

(For those who joined in July 2016 and afterwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Very near infrared region ranges from

    (a) 1.2 to 2.5 μ

    (b) 1.5 to 2.5 μ

    (c) 1.2 to 3.5 μ

    (d) none of the above

2. The value of Planck's constant is

    (a) $6.626 \times 10^{34} Js$ (b) $6.126 \times 10^{-34} Js$

    (c) $6.71 \times 10^{19} Js$ (d) $6.626 \times 10^{-34} Js$

3. Which of the following is a non-linear molecule

    (a) CO_2 (b) H_2O

    (c) HCl   (d) O_2

4. The vibration rotation spectra has

    (a) P-branch

    (b) R-branch

    (c) both P and R branch

    (d) None of the above

5. The rotational energy levels of a linear molecule is

    (a) $E_j = J(J+1)$

    (b) $E_j = BJ(J+1)$

    (c) $E_j = \dfrac{B}{J(J+1)}$

    (d) None of the above

6. In linear harmonic oscillator the energy level is

(a) $E_n = \left(n + \dfrac{1}{2}\right) h\gamma$

(b) $E_n = \left(n - \dfrac{1}{2}\right) h\gamma$

(c) $E_n = (n+1) h\gamma$

(d) $E_n = (n-1) h\gamma$

7. In Raman effect Stokes line is given by

(a) $r = \gamma_0$ (b) $\gamma = \gamma_0 - \gamma_m$

(c) $\gamma = \gamma_0 + \gamma_m$ (d) $\gamma = 0$

8. The intensity of Stoke's lines are

(a) greater than the antistokes lines

(b) less than the antistokes lines

(c) equal

(d) none of the above

9. Chief detection of IR rays are

(a) Thermopiles

(b) Bolometer

(c) Radio micrometers

(d) All

10. The number of mirrors used in double beam IR spectrometer is

(a) 1   (b) 2

(c) 3   (d) 4

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is electromagnetic spectrum? Give the properties of it.

Or

(b) Discuss the isotopic effect in Rotational spectra.

12. (a) Derive an expression for the frequency of vibration of a diatomic molecule.

Or

(b) Discuss the vibrators of polyatomic molecules.

13. (a) Discuss the pure rotational Raman Spectra of linear molecules.

Or

(b) Explain the discovery of Raman spectra.

14. (a) Explain Frank-Condon principle.

Or

(b) Explain Fortrat diagram.

15. (a) Describe the single beam IR spectrometer.

Or

(b) Explain the sources of IR Radiations.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Derive an expression for the rotational energy of symmetric and asymmetric top molecules.

Or

(b) Explain the rotational spectra of a rigid diatomic molecule.

17. (a) Derive expression for rotational constant of a diatomic vibrating rotation.

Or

(b) Give the theory of anharmonic oscillator.

18. (a) Explain the structure determination from Raman and Infrared spectroscopy.

Or

(b) Explain the vibrational Raman spectra.

19. (a) Deduce an expression for the dissociation energy of a molecule.

Or

(b) Explain the vibrational rotation of fine structure spectra.

20. (a) Describe the double beam IR spectrometer.

Or

(b) Explain Instrumentation techniques of IR spectroscopy.

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